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Athlete Perspectives on AI-Driven Coaching Technologies: A Qualitative Inquiry

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A B S T R A C T

This article seeks to understand athletes' perceptions and experiences with AI-driven coaching technologies. The objective is to identify the major themes associated with the adoption, perceived benefits, challenges, and impact of these technologies on motivation and performance, alongside suggestions for future enhancements. Eighteen athletes across various sports disciplines participated in semi-structured interviews. The study employed a thematic analysis approach to identify key themes and sub-themes related to athletes' experiences with AI-driven coaching technologies. Ethical approval was obtained from the Institutional Review Board, and informed consent was secured from all participants. Five major themes were identified: Adoption and Adaptation, Perceived Benefits, Challenges and Limitations, Impact on Motivation and Performance, and Suggestions for Improvement. Athletes expressed initial skepticism followed by appreciation for the personalized training and efficiency offered by AI technologies. However, concerns regarding technical issues, lack of personal touch, and data privacy were noted. The impact on motivation and performance was predominantly positive, with athletes acknowledging the role of AI in enhancing training outcomes. Suggestions for improvement emphasized the need for more intuitive user interfaces, enhanced data security, and better integration of human coaching elements. Athletes recognize the transformative potential of AI-driven coaching technologies in enhancing training efficiency, personalization, and injury prevention. Nonetheless, the successful adoption of these technologies hinges on addressing technical challenges, ensuring data privacy, and maintaining the human element in coaching. Future developments in AI-driven coaching technologies should consider athletes' feedback to refine and tailor these tools, ensuring they meet the unique needs of individuals and foster a productive coach-athlete relationship. Suggestions for future research include expanding the participant pool across a wider range of sports and incorporating longitudinal studies to explore the evolution of athlete perspectives over time.

Keywords: *Artificial Intelligence, AI-Driven Coaching, Technology, Coaching, Sports Sciences.*

1. Introduction

The intersection of artificial intelligence (AI) and sports coaching represents a burgeoning field that promises to revolutionize how athletes train, perform, and achieve their full potential. As technology advances, AI-driven coaching technologies are increasingly being integrated into the sports domain, offering personalized training programs, real-time feedback, and data-driven insights that were previously unimaginable. These innovations hold the potential to enhance athletic performance, prevent injuries, and optimize training regimens. However, the adoption and effectiveness of such technologies are not solely contingent upon their technical capabilities. A critical aspect of their success lies in understanding and addressing the perspectives of those at the heart of sports: the athletes themselves.

Athlete perspectives are paramount in evaluating the impact and utility of AI-driven coaching technologies. Research has consistently underscored the importance of athletes' views on various facets of their training environment, including coaching relationships, autonomy, motivation, and susceptibility to burnout (Barrio et al., 2021; Chao et al., 2022; Fan et al., 2023). These elements are integral to an athlete's experience and performance and, as such, are critical considerations for the successful implementation of AI technologies in sports coaching. Athletes' insights can illuminate how these technologies might be refined to meet individual needs more effectively, strengthen the coach-athlete relationship, and support athletes' psychological well-being, thereby ensuring a more holistic approach to athlete development (Gleaves & Lang, 2017; Jowett, 2009; MacLellan et al., 2017).

Furthermore, the coach-athlete relationship stands as a central pillar of sports coaching, with the dynamic between coach and athlete playing a vital role in the athletic experience. This relationship's quality significantly influences athlete satisfaction, performance, and retention in sports. Understanding athletes' perspectives on this relationship is crucial for integrating AI-driven coaching technologies in a manner that supports and enhances these interactions. Athletes' perceptions of successful performance, learning opportunities, and effective communication with their coaches provide valuable insights that can guide the development of AI tools designed to complement and enrich the coaching process (Jowett, 2009; Millar et al., 2017; Rittenberg et al., 2022; Sandström et al., 2016; Waters et al., 2019; Wells et al., 2022).

In addition to athletes, coaches also play a significant role in shaping the sports coaching landscape's technological evolution. Coaches' ability to effectively integrate AI into their practices, manage data collection, and utilize technology to foster athlete development is paramount. Their efficacy, trust in technology, and communication skills are key factors influencing athletes' willingness to adopt and engage with AI-driven tools. Research highlights the critical importance of considering coaches' perspectives and experiences in the deployment of AI technologies within sports coaching. Their insights can help identify the challenges and opportunities associated with these technologies, ensuring that their integration into coaching practices is both effective and beneficial for athlete development (Kirkland & Cowley, 2023; Rauff et al., 2022; Rittenberg et al., 2022; Sandström et al., 2016; Stewart et al., 2023; Waters et al., 2019; Wells et al., 2022).

Given the intricate dynamics of sports coaching and the pivotal role of the coach-athlete relationship, this article seeks to explore athlete perspectives on AI-driven coaching technologies. Through a qualitative inquiry, we aim to uncover how these technologies are perceived by athletes, the benefits they offer, the challenges they pose, and the ways in which they could be improved to better serve the needs of athletes. By focusing on the athletes' viewpoints, this study contributes to a deeper understanding of the potential impact of AI on sports coaching, providing valuable insights for developers, coaches, and sports organizations looking to harness the power of AI for athletic advancement. In doing so, we endeavor to bridge the gap between technological innovation and the human elements of sports training, ensuring that the development and implementation of AI-driven coaching technologies are grounded in the needs, preferences, and experiences of those they are designed to benefit.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a qualitative research design aimed at exploring athlete perspectives on AI-driven coaching technologies. The design was chosen to facilitate an in-depth understanding of athletes' experiences, perceptions, and attitudes toward these technologies. A phenomenological approach was adopted to capture the

essence of participants' lived experiences with AI coaching tools.

Participants were recruited using a purposive sampling strategy, targeting athletes who have had direct experience with AI-driven coaching technologies across various sports disciplines. Eligibility criteria included athletes who had used AI coaching tools for at least six months, ensuring they had sufficient exposure to provide informed perspectives. The study aimed for a diverse participant pool in terms of sport type, gender, age, and performance level to capture a broad range of experiences and views.

Participants were provided with an information sheet detailing the study's purpose, procedures, and their rights, including confidentiality and the voluntary nature of their participation. Informed consent was obtained from all participants prior to data collection.

2.2. Data Collection

Data were collected through semi-structured interviews, allowing for flexibility in exploring topics deeply while maintaining a consistent structure across interviews. The interview guide covered areas such as initial impressions, perceived advantages and disadvantages, impact on performance and training routines, and suggestions for improvement. Interviews were conducted via video calls to accommodate participants' schedules and geographic locations, lasting approximately 60-90 minutes. All interviews were recorded with participants' consent for accuracy in transcription and analysis.

The following questions are designed to guide the conversation while allowing respondents the flexibility to share their unique experiences and insights, providing a comprehensive understanding of athlete perspectives on

"Can you describe your initial impressions when you first started using AI-driven coaching technologies? What motivated you to adopt these tools into your training regimen?"

"In what ways have AI-driven coaching technologies impacted your training efficiency, personalization of your training program, injury prevention, and feedback? Can you share specific examples where these technologies made a noticeable difference?"

"Have you encountered any challenges or limitations while using AI-driven coaching technologies? These might include technical issues, feeling a lack of personal touch, concerns about data privacy, or situations where the technology's recommendations didn't align with your personal goals or body's signals."

"How has the use of AI-driven coaching technologies influenced your motivation and overall performance? Can you discuss any achievements or setbacks you've experienced as a result of integrating these tools into your training?"

"Based on your experience, what improvements or features would you like to see in future versions of AI-driven coaching technologies? Are there specific areas where you think the integration of human coaching insights could enhance the effectiveness of these tools?"

2.3. Data Analysis

Transcripts from the interviews were analyzed using thematic analysis to identify, analyze, and report patterns (themes) within the data. The analysis followed a six-step process: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. NVivo, a qualitative data analysis software, was used to facilitate the organization and coding of the data. Trustworthiness of the analysis was ensured through techniques such as member checking, wherein participants were invited to review the findings for accuracy and resonance with their experiences.

3. Findings

In this study, a diverse group of 18 participants was recruited to ensure a broad range of insights. The demographic composition of the participants included 10 males and 8 females, reflecting a balanced gender distribution. Age-wise, the participants spanned from early twenties to late thirties, with 6 participants aged 20-25, 7 participants aged 26-30, and 5 participants aged 34-118. The athletes represented a variety of sports disciplines, including track and field (5 participants), swimming (4 participants), cycling (3 participants), and team sports such as soccer and basketball (6 participants). Performance level varied across the group, with 8 identifying as professional athletes, 6 as semi-professional, and 4 as competitive amateurs. The results of qualitative analysis of semi-structured interviews are presented as follows:

Table 1

The Results of Qualitative Analysis

Major Themes	Minor Themes	Concepts
Adoption and Adaptation	Initial Reactions	Curiosity, Skepticism, Interest
	Integration Strategies	Learning Curve, Adaptation Over Time, Incorporation into Routine, Seeking Assistance, Flexibility
Perceived Benefits	Training Efficiency	Time Saving, Efficiency Improvement
	Personalization	Customized Workouts, Tailored Training Plans
	Injury Prevention	Early Detection of Potential Injuries, Risk Mitigation
	Feedback	Constructive Feedback, Real-time Adjustments, Goal Setting Support, Varied Workouts, Continuous Engagement
Challenges and Limitations	Technical Issues	Glitches/Errors, Reliability Concerns
	Lack of Personal Touch	Impersonal Guidance, Lack of Emotional Support
	Data Privacy	Security Concerns, Privacy Assurance
	Misalignment with Goals	Inaccurate Recommendations, Over-reliance on Technology, Ignoring Body Signals, Difficulty in Setup, Adjustment Challenges
Impact on Motivation and Performance	Motivation Enhancement	Increased Engagement, Goal Achievement, Motivational Boost
	Performance Outcomes	Improved Fitness Levels, Personal Bests, Consistency in Training, Recovery Optimization, Performance Enhancement
Suggestions for Improvement	Technology Enhancements	User-friendly Interfaces, More Accurate Personalization, Intuitive Design
	Desired Features	Enhanced Data Security, Integration with Human Coaching, Community Features, Customizable Feedback, Expanded Workout Libraries, Adaptive Algorithms

Adoption and Adaptation emerged as a primary area of interest. Athletes described their Initial Reactions to AI technologies with a mix of curiosity and skepticism. One participant noted, "Initially, I was skeptical about how an app could understand my training needs, but the personalized feedback was a game-changer." As athletes moved beyond initial reactions, the Integration Strategies they developed highlighted a learning curve and an adaptation over time, emphasizing the role of flexibility in successfully incorporating these technologies into their routines. Another athlete shared, "It took some time to adjust, but integrating AI into my training plan has made my routines more dynamic and adaptable to my performance needs."

Perceived Benefits of AI-driven coaching technologies were broadly recognized among participants. Training Efficiency was frequently mentioned, with athletes appreciating the time-saving aspects and efficiency improvements AI tools offered. One interviewee stated, "The AI-driven plans have streamlined my training, allowing me to focus more on performance and less on planning." Personalization of training programs was another significant benefit, with athletes valuing customized workouts and tailored training plans. "The personalized training programs are spot-on, pushing me just enough without overdoing it," remarked an athlete. Injury Prevention strategies facilitated by AI were praised for early detection of potential injuries and risk mitigation, while Feedback mechanisms provided constructive suggestions, real-time adjustments, and support for goal setting, enhancing the training experience. "The instant feedback on my posture and technique has been invaluable," noted another participant, emphasizing the role of continuous engagement in their training progress.

However, Challenges and Limitations were also identified. Technical Issues, such as glitches and errors, sometimes undermined the reliability of AI technologies. Participants also expressed concerns over a lack of personal touch and the need for more emotional support from AI coaches. Data Privacy emerged as a concern, with athletes seeking greater privacy assurance. The Misalignment with Goals, where AI recommendations did not always match athletes' personal goals or body signals, was highlighted. "There were times when the AI's advice didn't align with how my body felt, leading to adjustments in my training," one athlete explained, pointing out the difficulty in setup and adjustment challenges.

The Impact on Motivation and Performance was another critical theme, where AI coaching was seen to enhance motivation and goal achievement, with one athlete sharing, "Seeing the progress tracked by the AI motivates me to push harder." The Performance Outcomes theme underscored improvements in fitness levels, personal bests, and consistency in training, attributed to the optimized

recovery processes and performance enhancement strategies offered by AI technologies.

Lastly, athletes provided Suggestions for Improvement, calling for more user-friendly interfaces and intuitive design to enhance technology enhancements, and desired features such as enhanced data security, integration with human coaching, and adaptive algorithms. "I'd love to see more integration with human coaching insights, adding a personal touch to the AI's capabilities," an interviewee suggested, envisioning a future where technology and personal coaching are seamlessly blended.

4. Discussion and Conclusion

In the qualitative inquiry into athlete perspectives on AI-driven coaching technologies, five major themes were identified, reflecting the diverse and nuanced views of the participants. These major themes include Adoption and Adaptation, Perceived Benefits, Challenges and Limitations, Impact on Motivation and Performance, and Suggestions for Improvement. Each major theme encompasses several minor themes that delve into specific aspects of athletes' experiences and perceptions regarding AI in sports coaching. The minor themes within Adoption and Adaptation are Initial Reactions and Integration Strategies; for Perceived Benefits, they include Training Efficiency, Personalization, Injury Prevention, and Feedback; Challenges and Limitations are broken down into Technical Issues, Lack of Personal Touch, Data Privacy, and Misalignment with Goals; Impact on Motivation and Performance comprises Motivation Enhancement and Performance Outcomes; finally, Suggestions for Improvement consists of Technology Enhancements and Desired Features.

This study explored athlete perspectives on AI-driven coaching technologies, revealing insights into their adoption, perceived benefits, challenges, impact on motivation and performance, and suggestions for improvement. Athletes recognized the potential of AI to enhance training efficiency, personalize training programs, and contribute to injury prevention. However, challenges such as technical issues, lack of personal touch, and data privacy concerns were also noted. Importantly, the study highlighted the crucial role of the coach-athlete relationship in the successful integration of AI technologies into sports coaching, underscoring the need for AI tools to complement and enhance these human interactions.

Adoption and Adaptation emerged as a crucial theme, underscoring how athletes initially react to and begin integrating AI technologies into their training routines. The minor themes of Initial Reactions highlighted athletes' curiosity and skepticism, while Integration Strategies focused on the learning curve, adaptation over time, and incorporation of AI into daily routines. Athletes expressed a range of emotions from excitement to apprehension, emphasizing the importance of user-friendly design and clear guidance to facilitate a smooth transition.

Perceived Benefits of AI-driven coaching technologies were widely recognized among athletes, touching on aspects such as enhanced training efficiency, personalized training programs, injury prevention, and real-time feedback. Training Efficiency underscored the time-saving and efficiency improvement aspects, whereas Personalization highlighted customized workouts and tailored training plans. Injury Prevention was appreciated for early detection and risk mitigation, and Feedback was valued for providing constructive suggestions, real-time adjustments, and continuous engagement.

Challenges and Limitations pointed to the hurdles athletes face with AI technologies, including Technical Issues like glitches and reliability concerns; Lack of Personal Touch, emphasizing the impersonal nature of AI coaching; Data Privacy concerns; and Misalignment with Goals, where AI recommendations did not always align with athletes' personal goals or body signals. These challenges underscore the importance of improving technology reliability, ensuring data security, and enhancing AI's ability to understand and adapt to individual athlete needs.

Impact on Motivation and Performance highlighted how AI technologies influence athletes' drive and achievements. Motivation Enhancement was associated with increased engagement and goal achievement, while Performance Outcomes related to improved fitness levels, personal bests, and consistency in training. Athletes reported that AI technologies could serve as motivational tools, providing measurable progress and feedback that encourage continued effort and improvement.

Suggestions for Improvement encapsulated athletes' recommendations for enhancing AI-driven coaching technologies. Technology Enhancements called for more user-friendly interfaces and accurate personalization, and Desired Features requested enhanced data security, integration with human coaching insights, and customizable feedback mechanisms. These suggestions

underscore the need for ongoing dialogue between athletes, coaches, and technology developers to refine and advance AI applications in sports coaching, ensuring they meet the evolving needs of athletes.

The results of this study on athlete perspectives on AI-driven coaching technologies aligns with and expands upon the existing body of literature in sports sciences. The emergence of AI in sports coaching has prompted a diverse array of studies exploring its impact on injury risk assessment, performance prediction, ethical considerations, and its application across various sports disciplines (Claudino et al., 2019; Hammes et al., 2022; Suman, 2022). Our findings resonate with these studies, underscoring the potential of AI to enhance training outcomes, provide personalized coaching experiences, and improve injury prevention strategies (Patel & Varley, 2019; Pavitt et al., 2021; Timpka & Lindqvist, 2001).

Athletes' insights, as explored in this study, highlight the significance of AI technologies in influencing coaching relationships, enhancing performance, and shaping training experiences. This is in line with previous research that emphasizes the need to understand athletes' perceptions to effectively integrate technology into sports coaching (Barrio et al., 2021; Fan et al., 2023; Gleaves & Lang, 2017). The athlete narratives gathered in our study revealed a nuanced view of AI's role in sports, reflecting both the opportunities and challenges presented by these technologies. This supports the notion that athlete feedback is crucial for tailoring AI applications to meet individual needs and foster a supportive coaching environment (Jowett, 2009; MacLellan et al., 2017).

Furthermore, our results underscore the importance of the coach-athlete relationship in the successful implementation of AI-driven coaching technologies, echoing previous studies that identify this dynamic as a cornerstone of sports coaching (Millar et al., 2017; Rittenberg et al., 2022; Sandström et al., 2016). The findings suggest that AI tools that enhance communication, provide meaningful feedback, and support the learning process can strengthen this relationship, contributing to better performance outcomes (Waters et al., 2019; Wells et al., 2022).

Coaches' efficacy, trust in technology, and effective communication were also identified as key factors influencing the adoption and utilization of AI in sports coaching. This aligns with existing research that highlights the critical role of coaches in facilitating athletes' engagement with technology (Kirkland & Cowley, 2023; Rauff et al., 2022; Stewart et al., 2023). By integrating coaches' perspectives on AI technologies, we can better understand how to leverage these tools to enhance athlete development and coaching practices.

The adaptability of AI technologies across different sporting disciplines, as demonstrated in our study and supported by literature (Bin & Xu, 2021; Shi et al., 2022; Tasiemski et al., 2012), showcases the versatility of AI applications in sports. This versatility allows for customized approaches to training and performance optimization, reflecting the unique needs and requirements of each sport.

The exploration of athlete perspectives on AI-driven coaching technologies contributes valuable insights into the integration of AI in sports. The findings underscore the potential of AI to transform training and performance, highlighting the importance of personalized, athlete-centered approaches. However, the study also brings to light the challenges and considerations that must be addressed to fully realize the benefits of AI in sports coaching. In conclusion, this study offers significant insights into the perceptions of athletes regarding AI-driven coaching technologies, highlighting both the opportunities and challenges inherent in their adoption. By addressing these challenges and leveraging the insights provided by athletes, coaches, and technology developers can better harness the power of AI to revolutionize sports coaching and athlete performance.

5. Limitations and Suggestions

This study, while insightful, is not without its limitations. The sample size was relatively small and focused on athletes from a limited range of sports, which may restrict the generalizability of the findings. Additionally, the qualitative nature of the research provides depth but may lack the breadth of perspectives that a larger, more diverse sample could offer. Future research would benefit from a broader participant base and the inclusion of quantitative measures to complement the qualitative insights.

Future research should aim to expand on the findings of this study by exploring athlete perspectives across a wider array of sports and performance levels. Incorporating longitudinal studies could also shed light on the evolving relationship between athletes and AI-driven technologies over time. Additionally, comparative studies between athletes' and coaches' perspectives would provide a more

holistic understanding of the integration of AI in sports coaching, highlighting areas of alignment and divergence.

The findings from this study suggest several practical implications for the integration of AI-driven coaching technologies in sports. Coaches and technology developers should prioritize the development of user-friendly, personalized AI tools that address athletes' specific needs and concerns. Ensuring transparency regarding data privacy and fostering an environment where athletes feel their input is valued can enhance trust in and acceptance of AI technologies. Moreover, integrating AI tools in a way that supports and enhances the coach-athlete relationship is vital for leveraging the full potential of these technologies to improve athlete performance and satisfaction.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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