The Extent of Jordanian Football Coaches' Knowledge of the Use of Artificial Intelligence and Nanotechnology in Developing the Game of Football

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ABSTRACT:

The study aimed to identify the degree of awareness and knowledge among Jordanian football coaches on the importance of artificial intelligence and nanotechnology and their possible use in the development of the game, development of the coaches themselves and development of their teams through modern scientific technologies. Ten elite football coaches in Jordan formed the study sample. Through the telephone method, the survey methods were used during which the questions were posed to the coaches.

The study found that the coaches were significantly weak in their knowledge of these technologies and their present ability to use them. Statistical analysis revealed a vast chasm between the knowledge owned by the coaches regarding the use of artificial intelligence and nanotechnology and the positive developments achieved by these scientific fields in serving football in general.

As part of the training courses conducted for the coaches, further, it has been recommended to teach AI and nano along with adding a related course to bachelor's programs for students in faculties of physical education.

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Keywords: Artificial intelligence, nanotechnology, football coaching, Jordanian football coaches, sports technology

Introduction:

There has been great technological advancement, and the areas of artificial intelligence (AI) and nanotechnology are of particular interest (Zhou et al., 2026). These new technologies have been incorporated in many walks of life, including in the developing game of football (Wang et al., 2025). For this study, the terms AI and nanotechnology are described as follows: AI can be understood as an intelligent computer system capable of responding and behaving like a human but performing these functions with more speed and precision, while nanotechnology is the manipulation of matter by using atoms and molecules and engineering levels at the nanoscale, which interfaces with various areas of science (Goudarzi, 2025). There has been optimism for the introduction of AI and nanotechnology in the game of football in areas related to athletics training, injury recovery, fatigue control, skill analysis, machine learning, opinion detection, decision support systems, prediction analytics, and injury prevention (Li et al., 2026).

In Jordan, coaching levels are continually changing (Sarama, 2026). The transfer of knowledge regarding the training and education of football coaches in Jordan is governed by the Jordan Football Association (Khwaileh et al., 2025). The AFC Coaching Convention recognizes national coaching education programs at three levels—Assistant Coach; Head Coach; and Head Coach for the Licensed Youth and Professional Football Academies (Ajlouni et al., 2023). Currently, the knowledge of Jordanian coaches concerning technology has not yet been investigated (Hammad et al., 2024). Given this context, the study sought to assess the extent of Jordanian football coaches' knowledge of AI and nanotechnology in developing the game of football (Benkhedim and Layadi, 2025).

2. Theoretical Framework

The topic is examined through concepts of technology adoption, knowledge, and attitude. Rogers' factor of relative advantage contributes to success and acceptance in technology adoption within organizations (Al Atout, 2025). Individual and collective constructs of knowledge, attitude, and literacy are particularly relevant in the context of sport, where engagement with elite practice is often mediated through education (Beiderbeck et al., 2023). Such frameworks are useful in exploring the extent of Jordanian coaches' knowledge of Artificial Intelligence and Nanotechnology, as Jordan's geographic, economic, and cultural context presents an environment in which inclusion– or otherwise– of these technologies may significantly advance the availability of local resources or increase the competitiveness of athletes on the global stage (Al-Titi, 2026). Within football, the culturally salient ideas of coaching, practice design, and supporting technology come to the fore (Zuhair and Amrieh, 2025).

Knowledge is the shared cognitive understanding among a community of practitioners and may be structured to inform action, but such efforts may be of limited effectiveness unless the audience's existing knowledge base is capable of meeting the requirements of that knowledge resource (Wood et al., 2023). The coaches' willingness to learn, with the conceptual receptiveness and ability to acquire that knowledge, become particularly significant in that context (Williams and Hodges, 2023). Attitude, the degree of effectiveness with which a particular actor engages with an object or concept, plays a major role, mediating the process of learning for individuals (Nyfoudi et al., 2023).

3. AI in Football: Concepts, Applications, and Implications

An AI system is a computer that simulates human behavior and can perform tasks normally carried

out by humans as a result of their intelligence (Li et al., 2023). Various branches of AI include machine learning, where systems learn to model data and to improve performance based on experience; pattern recognition, where patterns in data are identified and labelled; and decision-support systems, which provide information, recommendations, alerts, and predictions to human decision-makers (Fuchs et al., 2023).

In football, AI is being applied in player data analysis to study player movements and behaviors; sports analytics to examine team and player performance and other dimensions of the game; virtual agents to optimize strategies and tactics; health prediction to prevent diseases; and injury prediction to foresee the risk of injury for either an individual or a football squad (Choustoulakis and Pastelakos, 2024). The key elements of an artificial intelligence system in football are training data, AI technology, AI analytics, AI prediction, and AI ethical issue (Smerdov et al., 2023). There are two types of ethics: the use of AI technology to share data and the privacy of data sharing (Teixeira et al., 2025). Issues of inequality are likely to arise, linked to the financial capacity of football clubs, and possibly even act as a limitation on competition in the football business (Dang, 2025). AI can predict match results through statistics and algorithms, thereby helping media and betting companies, and also assist coaches in training and making tactical decisions for winning (Marquina et al., 2023).

4. Nanotechnology in Sports Science: Potential and Boundaries

The term nanotechnology refers to the manipulation and utilization of matter at the atomic or molecular level (Liu and Guo, 2022). Although major breakthroughs are still emerging, areas such as nanomaterials, nanometrology, nanosensors, and nanomedicine enjoy well-established applications, and researchers are progressively exploring their relevance to modern sports science (Kong and Ren, 2022). Examples include more resilient energy-efficient materials for sporting goods, nanosensor networks for measuring biomechanical factors during training and competition, and the use of nanocarriers for the enhanced delivery of stimulants and other agents (Huang et al., 2025). While these attributes may help improve proactive health and wellbeing measures and enhance metrological capacities, there are still unanswered questions regarding the feasibility and safety of large-scale implementations (Singh and Kaur, 2023).

5. Contextualising Jordanian Football: Coaching Practices and Innovation

The availability of qualified Jordanian trainers is insufficient. No Jordanian coaches are supervising the national football academy, and both the A and B license qualifications are only partially recognized internationally (Al-Momani, 2022). Jordanian clubs primarily employ foreign coaches (AL-Momani, 2025). Nonetheless, Jordanian trainers are increasingly using modern football knowledge and technology, while the Jordan Football Association is establishing a national strategy to enhance the coaching profession (Obeidat et al., 2025).

AI and nanotechnology in coaching education could thus provide critical advantages to Jordanian trainers and teams (De Vos et al, 2026). However, opportunities for incorporating emerging technology into the coaching syllabus remain limited (Chiazor et al., 2025). Exploration of the subject among Jordanian football trainers is therefore both warranted and timely (Grierson et al., 2024).

Potential changes in coaching education should consider expanding knowledge of AI and nanotechnology within the syllabus to accommodate emerging technology at all levels of knowledge and experience (Abdulnabi et al., 2025). In addition, because Jordanian trainers work in an Arab society, cultural and organizational environments should also be assessed to provide a comprehensive understanding of current factors affecting trainers' dispositions toward AI and nanotechnology (Díaz-Marcos and Mendoza Gonzálvez, 2025). The knowledge–attitude relationship in technology adoption in sports supports this orientation (Almaiah et al., 2022).

6. Study Significance

The continuous technological and digital explosion across all fields, together with the introduction of nanotechnology into the field of sports—whether in sports games or in athletes themselves—has created a need for broader scientific studies and research. Nanotechnology may contribute to monitoring physiological changes during training, assisting in the treatment of injuries or diseases, and using biologically produced immune cells to increase the efficiency and effectiveness of these products on athletes' immune systems.

From this perspective, research has begun to focus on innovating and developing sports equipment, devices, tools, and modern physiological instruments that are precise and small in size. These technologies may be capable of entering the athlete's body to record large amounts of data during training, rest, or competition. In addition, nanotechnology patches placed on the skin surface can be used to monitor different physiological changes from inside and outside the body by connecting them directly to computers for analysis and processing.

Given the researcher's interest and academic work in this field, as a specialist in sports and a football coach, and in order to contribute to the development of football in Jordan in particular and the Arab world in general, the researcher decided to conduct this study.

Through this study, the researcher seeks to obtain results that may motivate those working in this field to become familiar with the latest sciences that support the development of football. The study also aims to encourage coaches to build their training programs based on results provided through the use of artificial intelligence, in addition to using sports devices, tools, and clothing manufactured with nanotechnology. Such technologies may support players' health and enable them to continue performing and contributing creatively and effectively on the field.

7. Problem Statement

The problem of the study emerged from a survey conducted by the researcher with students from the Faculty of Sport Sciences and several football coaches in Jordan. The survey showed a very significant weakness in their knowledge of artificial intelligence in general, and consequently a lack of awareness of any technologies based on artificial intelligence and nanotechnology that could serve and develop the game.

In light of the clear gap between the level of Jordanian teams in particular, and Arab teams in general, compared with foreign teams in international events such as World Cup tournaments, the Olympic Games, continental championships, and major leagues, it becomes evident that the issue is not limited to skills, training, or talent alone. Rather, scientific advancement and the use of artificial intelligence and nanotechnology by coaches and their assistants play an important role in discovering athletic competencies and optimizing their use.

The use of tools and devices capable of rapid development requires benefiting from the experiences of others and adopting such technologies to develop Arab football. This includes player selection, player development, equipment use, treatment, correction of errors, and refereeing. Such developments may help our teams keep pace with international teams in different competitions.

8. Study Objectives

1. The study aimed to identify the extent to which Jordanian coaches who hold first-level and professional continental football coaching certificates are aware of and familiar with artificial intelligence and nanotechnology.

2. The study aimed to identify the extent to which these coaches use artificial intelligence and nanotechnology in training, as well as in the tools and equipment used during training sessions and matches.

9. Research Questions

1. To what extent do Jordanian coaches possess information about artificial intelligence

and nanotechnology that may help them develop the teams they work with?

2. Are there statistically significant differences at the significance level of $\alpha \leq 0.05$ in Jordanian coaches' knowledge of these technologies?

10. Methods

The researchers used the descriptive analytical method through telephone interviews with the coaches, during which questions were asked to collect data. This method was considered suitable for the nature of the study, as it allowed the researcher to obtain realistic responses from the coaches and to identify their level of knowledge regarding the study topic.

10.1. Study Population

The study population consisted of football coaching course lecturers and Jordanian football coaches who had obtained Asian Football Confederation coaching certificates at the first level and professional level.

10.2. Study Sample

The study sample consisted of accredited lecturers at the Asian continental level and Jordanian coaches who had obtained Asian coaching certificates at the first level and professional level.

10.3. Study Procedures

The researcher prepared a set of questions for this study after reviewing several previous studies. These questions were presented to a number of professors at Jordanian universities for validation. The reviewers provided some comments, and the necessary modifications were made until the questions appeared in their final form. The coaches were then contacted, and they expressed their willingness to participate and answer the questions. They responded to the researcher's questions and formed the sample of the study.

10.4. Statistical Analysis

The data gathered from the telephone interviews were examined through the application of descriptive statistical procedures, which were in accordance with the study questions and the small sample size. Because the interview questions were formulated from closed-ended questions having two responses only either "YES" or "NO", the researcher calculated the frequency and percentages. Frequencies were used to indicate the actual number of coaches that answered positively and negatively, while percentages were used to clarify how they were distributed relative to the total sample of ten. Utilizing this method, the researcher identified the general level of awareness, knowledge, and attitudes of Jordanian football coaches towards the use of artificial intelligence and nanotechnology in football. Each question's results were presented in a series of tables to compare the responses more easily along with areas of weakness or acceptance. The findings of the statistical analysis showed that the coaches had very little knowledge regarding the practical implementation of artificial intelligence and nanotechnology in football coaching although they are supportive in including them in the syllabus.

11. Results

11.1. Analysis of the First Question

The first question stated: **"Do you have any information about artificial intelligence and nanotechnology?"**

The response percentages for this question are summarized in table (1). The table presents the number and percentages of frequencies of football coaches who gave information on artificial intelligence and nanotechnology. By looking at the percentage of the response "Yes" only a small proportion of the interviewed coaches, 2 out of 10 coaches (20.0%) had some information about artificial intelligence and nanotechnology. In contrast, the majority of the coaches i.e. 8 out of 10 coaches (80.0%) reported no such information.

The clear weakness in the level of awareness of Jordanian football coaches with respect to artificial intelligence and nanotechnology despite the growing importance of these technologies in developing training methods, performance

analysis, injury prevention, and modern football conditions.

Table 1. Frequencies and Percentages of Football Coaches' Responses to the First Question.

Question 1	Yes	%	No	%
Do you have any information about artificial intelligence and nanotechnology?	2	20.0	8	80.0

11.2. Analysis of the Second Question

When football coaches were asked about their knowledge of the uses of nanotechnology in football, their responses were summarized in table (2). The table presents the percentages of football coaches who had knowledge of the uses of nanotechnology in football. By reviewing the percentage of "Yes" responses, it is clear that only a small proportion of the interviewed coaches, 20.0%**,** had knowledge of the uses of nanotechnology in football. In contrast, the majority of the coaches, 80.0%**,** reported that they did not have such knowledge.

Table 2. Frequencies and Percentages of Football Coaches' Responses to the Second Question: Uses of Nanotechnology in Football

Question 2	Yes	%	No	%
Do you know about the uses of nanotechnology in football?	2	20.0	8	80.0

11.3. Analysis of the Third Question

When football coaches were asked about their knowledge of using nanotechnology to develop the physical attributes of football players through modifying training programs based on the results produced by this technology, their responses were summarized in table (3). The table illustrates the frequencies and percentages of football coaches in relation to their knowledge of the uses of nanotechnology in developing the players' physical characteristics. An analysis of the percentage of results received as "Yes", it is clear that only a small percentage of the interviewed coaches, 2 out of 10 coaches (20.0%) were aware of the uses of nanotechnology in enhancing the physical attributes of football players. On the other hand, 8 out of 10 coaches (80.0%) stated that they did not aware about the application.

Table 3. Frequencies and Percentages of Football Coaches' Responses to the Third Question: The Use of Nanotechnology in Developing the Physical Attributes of Football Players

Question 3	Yes	%	No	%
Do you have information about using nanotechnology to develop the physical attributes of football players by modifying training programs based on the results produced by this technology?	2	20.0	8	80.0

11.4. Analysis of the Fourth Question

The following question was also directed to the coaches: "Can you mention the names of devices manufactured using nanotechnology that are used in football or by any party involved in the game?"

The results showed that none of the interviewed football coaches was able to mention the name of one or more devices manufactured using nanotechnology that are used in football or by any of the parties involved in the game.

This finding indicates a complete lack of practical knowledge among the interviewed coaches regarding nanotechnology-based devices and

tools that may be applied in football. It also reinforces the results of the previous questions, which showed a generally weak level of awareness of nanotechnology and its possible role in developing training, performance monitoring, equipment, injury prevention, and player care (Table 4).

Table 4: Frequencies and Percentages of Football Coaches' Responses to the Fourth Question: Mentioning the Names of Devices Manufactured Using Nanotechnology and Used in Football

Question 4	Yes	%	No	%
Can you mention the names of devices manufactured using nanotechnology that are used in football or by any party involved in the game?	0	0.0	10	100.0

11.5. Analysis of the Fifth Question

The following question was also directed to the coaches: "Do you know anything about the uses of artificial intelligence in manufacturing sports devices used in football?"

As shown in table (5), the frequencies and percentages of the coaches' responses to this question are presented. The table depicts the percentage and frequency of the football coaches who are aware of the applications of AI in the manufacturing of sports devices used in football. It is noted from the percentage of "Yes" responses that 4 out of 10 coaches (40.0%) knew about the use of artificial intelligence in the manufacturing of sports devices used in football.

On the other hand, 6 of 10 coaches (60.0%) said they do not know these uses. As such, we see that while some coaches know ways to use artificial intelligence in sports equipment, the majority still do not have enough knowledge.

Table 5. Frequencies and Percentages of Football Coaches' Responses to the Fifth Question: Knowledge of the Uses of Artificial Intelligence in Manufacturing Sports Devices Used in Football

Question 5	Yes	%	No	%
Do you know anything about the uses of artificial intelligence in manufacturing sports devices used in football?	4	40.0	6	60.0

11.6. Analysis of the Sixth Question

The football coaches were also asked the following question: "Do you have information about the use of nanotechnology in manufacturing sportswear and tools used by parties involved in the game?"

Table (6) illustrates the frequency and percentage of football coaches who had knowledge about the use of nanotechnology to manufacture sportswear and tools of the parties involved in football. An examination of the percentages of 'yes' responses shows that only a very small proportion of the interviewed coaches, 1 coach out of 10 (10.0%) had such information.

On the other hand, 9 out of 10 coaches (90.0%) did not have information regarding the use of nanotechnology in the manufacturing of sportswear and football-related tools. The result shows that Jordanian football coaches have a very weak awareness of the practical uses of nanotechnology in sports clothing and equipment.

Table 6. Frequencies and Percentages of Football Coaches' Responses to the Sixth Question: Knowledge of the Use of Nanotechnology in Manufacturing Sportswear and Tools Used by Parties Involved in Football

Question 6	Yes	%	No	%
Do you have information about the use of nanotechnology in manufacturing sportswear and tools used by parties involved in football?	1	10.0	9	90.0

11.7. Analysis of the Seventh Question

The football coaches were also asked the following question: "Do you know about the use of artificial intelligence in football pitch surfaces, balls, shoes, and safety equipment used in football?"

Table (7) shows the frequencies and percentages of the responses of football coaches regarding their knowledge of the use of artificial intelligence in football pitch surfaces, balls, shoes, and safety equipment. A review of the percentage of "Yes" responses indicate that 6 out of 10 coaches (60.0%) reported that they have knowledge of these applications.

On the other hand, four in ten coaches (40.0%) claimed that they did not know about AI use on the surface of the football pitch, ball, shoes and safety equipment. This means that although the football coaches have some awareness of nanotechnology and how it can help the game, they seem to be more familiar artificial intelligence related applications that can help different functions within football. Nonetheless, the occurrence of 40.0% with no knowledge shows that the contemporary education and training of modern football technologies is still needed.

Table 7. Frequencies and Percentages of Football Coaches' Responses to the Seventh Question: Knowledge of the Use of Artificial Intelligence in Football Pitch Surfaces, Balls, Shoes, and Safety Equipment

Question 7	Yes	%	No	%
Do you know about the use of artificial intelligence in football pitch surfaces, balls, shoes, and safety equipment used in football?	6	60.0	4	40.0

11.8. Analysis of the Eighth Question

The football coaches were also asked the following question: "Do you think it is currently appropriate to include artificial intelligence and nanotechnology in the curricula of football coaching courses?"

Table (8) shows the frequencies and percentages of the coaches' responses to this question. The results showed that a very high percentage of the interviewed coaches (9 out of 10 coaches, 90.0%) supported the inclusion of artificial intelligence and nanotechnology in football coaching course curricula. Conversely, just one coach (10.0%) was opposed to their inclusion at this time.

Table 8. Frequencies and Percentages of Football Coaches' Responses to the Eighth Question: The Appropriateness of Including Artificial Intelligence and Nanotechnology in Football Coaching Course Curricula

Question 8	Yes	%	No	%
Do you think it is currently appropriate to include artificial intelligence and nanotechnology in the curricula of football coaching courses?	9	90.0	1	10.0

11.9. Analysis of the Ninth Question

The football coaches were also asked the following question: "Do you believe that the use of artificial intelligence and nanotechnology will develop the level of Jordanian football?"

The following table shows the frequencies and percentages of the coaches' responses to this question. According to the findings, 50% of the coaches, or in other words, 5 coaches out of the 10 under study, believe that both of the following can develop the level of Jordanian football artificial intelligence, and nanotechnology. On the other hand, 50.0% of the other 5 coaches believed that the use of these technologies would not develop Jordanian football.

Table 9. Frequencies and Percentages of Football Coaches' Responses to Question 9

Question 9	Yes	%	No	%
Do you believe that the use of artificial intelligence and nanotechnology will develop the level of Jordanian football?	5	50.0	5	50.0

11.10. Analysis of the Tenth Question

The football coaches were also asked the following question: "Based on your field experience in coaching, do you believe that the current scientific level of Jordanian coaches qualifies them to benefit from artificial intelligence and nanotechnology?"

Table (10) shows the frequencies and percentages of the coaches' responses to this question. The presented frequencies and percentages of football coaches who believed that the current scientific level of Jordanian coaches qualifies them to benefit from artificial intelligence and nanotechnology. The findings revealed that all coaches interviewed, 10 out of 10, (100.0%), believed that the Jordanian coaches are scientifically qualified to utilize these technologies.

Table 10. Frequencies and Percentages of Football Coaches' Responses to the Tenth Question: Coaches' Scientific Qualification to Benefit from Artificial Intelligence and Nanotechnology

Question 10	Yes	%	No	%
Based on your field experience in coaching, do you believe that the current scientific level of Jordanian coaches qualifies them to benefit from artificial intelligence and nanotechnology?	10	100%	0	0%

11.11 Analysis of the Eleventh Question

The football coaches were also asked the following question: "Will the inclusion of artificial intelligence and nanotechnology become an obstacle preventing some individuals from enrolling in coaching courses that qualify them to work in this field?"

The following table shows the frequencies and percentages of the coaches' responses to this question. The results showed that the percentage of coaches who answered "Yes" was low, reaching only 20.0%**.** In contrast, the majority of coaches, 80.0%**,** answered "No."

Table 11. Frequencies and Percentages of Football Coaches' Responses to Question 11: Whether the Inclusion of Artificial Intelligence and Nanotechnology Would Be an Obstacle to Enrollment in Coaching Courses

Question 11	Yes	%	No	%
Will the inclusion of artificial intelligence and nanotechnology become an obstacle preventing some individuals from enrolling in coaching courses that qualify them to work in this field?	2	20.0	8	80.0

12. Discussion

The extent of Jordanian football coaches' knowledge of AI and nanotechnology and their perceived application in the development of football were explored. Coaches interviewed generally lacked knowledge about the sports-fitness tools, particularly in connection with nanotechnology. A mere twenty percent of the coaches have information on AI and nanotechnology in general, and such percentage also reported knowledge on nanotechnology applications in football and on development of players' physical attributes. What's more, none of the coaches could cite examples of a football device manufactured using nanotechnology while only 10% said they had heard of nanotechnology in sportswear and tools for football. Fundamentally, nanotechnology is not common at the practical coaching level in football in Jordan, as the finding shows.

This restricted level of awareness is pertinent because more sport science literature is featuring technology as a central part of contemporary coaching, monitoring performance, preventing injuries, tactical analysis, and athlete development. In sport AI is now applied for increasing performance, optimizing movement, monitoring health, supporting coaching, sports medicine, rehabilitation, and talent identification (Zhou et al., 2025). Likewise, recent football specific evidence show that AI-based models can support tactical analysis, collective behavior mapping, player movement interpretation, performance prediction, and in-path support for real-time decision making (Teixeira et al., 2025) As such, the poor knowledge stated by Jordanian coaches may be viewed as a gap between local coaching preparation and international football science direction.

Outcomes pertaining to AI were, in general, somewhat more positive than those related to nanotech. As an illustration, there were 40% coaches who stated their knowledge of manufacturing sports devices using AI. 60% were aware of AI applications in football pitch surface, ball, shoes, and safety equipment. It indicates that coaches are more aware of AI compared to nanotechnology. This is due to the presence of AI in video analysis, performance dashboards, wearable devices, match analysis and tactical software. Officials cannot see nanotechnology as it is embedded within clothing, footwear, sensors, fabrics, coatings, and protective equipment. Unless they are qualified, coaches do not spot nanotechnology. The most recent literature on nanotechnology supports this interpretation. The recent applications in sports regarding functional textiles, wearable sensors, thermal regulation, padding, and performance-supporting materials. Not directly visible coaching tools (Li and Peng, 2024).

One of the main findings of the study was the gap between limited knowledge and high acceptance. While most coaches had no detailed information about A.I and nanotechnology, 90% were in favor of their inclusion in football coaching course. It indicates that the obstacles to overcome technological education may not be from the resistance of the stakeholders. Instead, the issue seems to stem from a lack of systematic exposure and formal training, along with limited implementation of modern technologies in coaching education. Recent studies indicate that technology adoption in sport is influenced not just by availability but also usability, cost, technical complexity, accessibility, and the ability of end-users to meaningfully interpret outputs. Gabrišová et al. (2025).

The reality that there are 50% of coaches who provide the opinion that the Jordanian football could be developed through the use of AI and Nanotech and the other 50% who disagree reflects uncertainty surrounding the value that these two in technological factors offer. Limited exposure to applied sport technologies may explain the split perception. Although the coaches may support the theory of learning about AI and nanotechnology, they might still not be sure whether they will benefit Jordanian football unless they are demonstrated, exhibited or affordable local products. Research on technology use in coaching has been conducted. As it is discovered, coaches do not just 'adopt' technologies automatically. They integrate them into their work when they fit real coaching needs.

These needs include practice planning, performance monitoring, injury management, and coach–athlete communication (Brewer et al., 2025).

The tenth question contradicts itself too worth mentioning. Jordanian coaches' current scientific level qualifies all coaches to benefit from AI and nanotechnology, according to their latest responses, despite earlier responses that showed weak knowledge and limited practical awareness. This contradiction may arise from professionals looking to protect themselves, a norm to fit with society or the coaches want to check their professional claims. From a methodological point of view, it implies that future studies should not depend only on self-reported yes/no questions. Using objective knowledge tests, scenario-based questions, practical demonstrations, and structured interviews produces a more accurate assessment of coaches' technology literacy.

The research result also has implications for football coaching education in Jordan. The focus does not have to be to bombard the coaches with advanced technical theory. Rather, AI and nanotechnology must be introduced gradually and practically. Training modules for AI may cover the basics of data-driven coaching, video analysis, tactical pattern recognition, player-load monitoring, injury-risk indicators, and ethical management of player data. Football-specific AI studies indicate that AI can aid coaches in tactical planning and set-piece analysis, suggesting similar trends. As for instance, Tactic AI was developed with Liverpool FC experts, who used predictive and generative AI to support tactical decisions concerning corner kicks, and in many cases expert evaluators preferred the suggested setups to existing tactics (Wang et al., 2024.

Studies and practices in nanotechnology should be aware of applied rather than materials science. Coaches must have an appreciation of how sportswear, protective equipment, smart textiles, sensor-based monitoring, footwear, balls materials, recovery supporting products etc. may be produced with the help of Nanotechnology. Underpinning knowledge can help coaches make informed decisions about equipment selection, physiological data interpretation, or working with scientists, physiotherapists and equipment suppliers. Nonetheless, education should also involve limitations, safety, costs, validation, and ethical issues. Just because something is "nano" or "smart" does not mean it works. The coach must be trained to assess the science, not the advertising.

The findings of the study also showed that Jordanian football development requires a multidisciplinary model. Only coaches cannot implement AI and nanotechnology on their own. Football federations, universities, sport science departments, clubs and technology experts must work together to develop brief courses, applied workshops, demonstration labs and coaching manuals. Bachelor's programs in physical education will also be useful with the addition of AI as well as nanotechnology if related to football practicals. It would equip future technicians with the ability to decipher technological feedback and engage with analysts.

13. Study limitations

The study, however, has limitations. Having only ten elite coaches limits the generalizability of the sample. The telephone interview method was useful for collecting direct responses but using yes or no questions may not capture depth of understanding. The research further failed to differentiate between varied degrees of AI literacy, digital literacy and coaching expertise including age, education and club resources. Future research should involve a larger sample of different competitive level coaches, use a mixed-method approach, and incorporate objective knowledge assessment. Comparative studies between Jordanian, Arab and international coaches may identify specific educational gaps and best practices.

14. Conclusion

To sum up, this study reveals quite a lot about the awareness of Jordanian football coaches about AI and nanotech. The results indicate a weak knowledge of threats particularly on nanotechnology that is also has a strong support for integration in coaching education. This

combination should be interpreted positively: neither do the coaches have sufficient knowledge yet but they seem more than willing to learn. For this reason, the primary recommendation is to channel this openness into a structured educational effort, encompassing updated coaching curricula, applied workshops, university courses and collaboration between football institutions and sport technology experts.

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