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ORIGINAL ARTICLE

The impact of information technology on developing leadership skills of sports coaches: A field study of football coaches in Algeria

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ABSTRACT

This study investigates how IT impacts the leadership abilities of football coaches in Algeria. Employing a descriptive-analytical method, it surveyed 58 coaches using a structured questionnaire to evaluate IT adoption and leadership competencies, results show a strong positive link between IT use and improved leadership skills, especially in communication and motivation, driven by reliance on smart devices and digital training, however, skills like planning, decision-making, and problem-solving showed only moderate proficiency, highlighting areas for growth, the findings suggest IT can transform sports leadership and recommend enhanced digital training and infrastructure limitations, including limited effects from sports software and communication networks, call for further research to refine IT integration in coaching.

Keywords: Technology, Innovation, Information technology, Leadership skills, Sports coaching, Coaching effectiveness, Digital training, Smart devices.

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INTRODUCTION

Today the rushing development of information technology (IT) has almost entirely engulfed every part of life, even, and perhaps especially, those parts that rely most on the human senses like physical sports (Reyaz et al., 2023), once a field refreshed almost totally by practices implemented in real time, the world of sports has come to utilize technical tools more and more, that has impacted not only the world of sports as we know it but also the private (and often secretive) world of sports training, now it seems there is almost inexorable progress toward employing information technology and computing to uplift not just the performance of the average athlete but that of coaches as well, this study looks carefully at how IT can be employed to enhance the training of a coach who specializes in either the technical aspects of their chosen sport or in leading their athletes (Suyudi, 2023).

The tools of information technology have emerged as an indispensable resource for modern sports in various dimensions of athletic performance, team management, and coaching practices IT is permeating today's sports world and the office of the coach is now as much an IT centre as it is a strategy centre (Ma, 2024), this integration provides an opportunity to pay closer attention to the not so visible edges athletes, and teams can gain and also to look more closely at the procurement and actualization of IT resources and services that sometimes occupy the not so visible portion of the coach's job description, from performance enhancement to good, open communication with all team members, the way IT is creeping into every corner of the coaching office can no longer be slighted as unwelcome in modern sports, whether we like it or not, the increasing number of IT tools in our resource toolbox is now coupled to the expectation of good usage by instructors. (Balaguer et al., 2012).

The job of a sports coach is not merely that of a technical instructor who tells athletes what to do and how to do it, that would be a one dimensional role and one that does not merit the professional stature that coaching holds (Kasper, 2019), coaching is indeed a multifaceted leadership role and a demanding one at that coaches set the strategic agenda, they foster team coherence and motivate athletes, moreover they handle many resources effectively, in their pursuit of winning coaches are outstanding administrators (Isaacson, 2021), they do more than manage just people however, they have to attend to lots of technical details and make evidence based decisions related to the training process and the selection and use of team formation, they analyse performance data and then set up the next training cycle, they have to maintain a competitive edge without losing sight of the ultimate goal, this brief description of what coaches do not how they do it points to the fact that coaching demands decision-making, and adapt, and interpersonal skills.. (Adie et al., 2012).

The era of technology driven practices has dawned on sports coaching and it is now fundamentally transforming how coaches do their jobs (Albuquerque et al., 2021), video analysis is one of the most significant tools behind this development indeed coaches in elite sports have almost universally adopted the practice of using video to aid in their decision-making and to enhance the overall coaching experience, this practice has existed in one form or another since the late 1950s, but its modern incarnation, highlighted by the use of IT (showing specific clips to individuals or groups), enables picture perfect precision in tactical instruction not previously possible, whether showing an individual athlete how to position better/dribble, pass, shoot (Mohammed et al., 2024), doing the same with a quarterback on how to improve pass placement or instructing a defender in football on how better to position himself, video analysis (and its associated practices) is arguably the most powerful single tool available to the modern tactical coach.

While the sports industry is rapidly becoming digitized, the need to develop coaches' leadership skills has become more critical, the era of traditional coaching which often depended on and favoured the experiential

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knowledge and intuition of coaches is becoming an anachronism in our current context (Diakogeorgiouet al., 2021), where data technology and innovation are the driving forces of competitive success, if for no other reason than this, it is incumbent upon us as an industry to ensure that our coaches are technologically literate and have the strategic foresight to lead in the high pressure, dynamic environments that are the new norm in sports take for instance, the effective use of IT tools which requires a cadre of skills that lie at the intersection of data analysis, problem-solving and decision making skills that are utterly integral to effective leadership. (Nae, 2024)

It is also worth considering how technological incorporation in the practices of coaching has shifted the coach-athlete relationship dynamics (Fiedler, 1967), this new context requires good old fashioned communication, as well as some enhancement in the motivational skills that are necessary to maintain, despite the current corpus of study regarding the utilization of information technology in sports, much of this attention falls upon its impact not just on the performance of athletes but also on the practices of technical coaching however there is little research that focuses on the role of IT in developing the leadership skills of coaches, evolving from this point is the idea that the use of IT in sports has broader implications for leadership development a premise that remains underexplored mainly in the literature furthermore there is research that examines how specific IT tools like video analysis, innovative applications, and performance management systems can enhance not just your run of the mill administrative but also your strategic and interpersonal leadership competencies as a coach.

The ongoing research gap in this crucial area of sports science is the lack of a current and comprehensive body of knowledge purporting the growing presence of information technology as a key ingredient to developing effective coaching leaders across all levels of the athletic context from youth to professional stages, this study hopes to initiate a change in that regard by surveying current IT applications used in educational contexts of coaching in hopes of better discerning trends that are occurring in that area from there it will apply the theoretical the structure of Kouzes and Posner's leadership (LPI) in order to target some of those current technologies as having the potential to act as conduits of the development of leadership competencies among coaches, coaches who are then to mentor the athletes under their care (Kouzes et Posner, 2006)

Main research problem

To what extent does the use of information technology influence the enhancement and development of leadership competencies among sports coaches?

Sub-Questions

- What is the proficiency level of sports coaches in using information and communication technology (ICT) in their work?
- To what degree do sports coaches possess leadership skills that enable them to perform their tasks effectively?
- Is there a correlational relationship between the adoption of information technology and the development of leadership skills among these coaches?

Research hypotheses

Main hypothesis

There is a noticeable positive impact of using information technology on the growth and development of leadership skills among sports coaches.

Sub-hypotheses

- Sports coaches exhibit a high level of interaction with and use of information technology in their training context.
- The leadership skills of coaches are characterized by a moderate level that reflects their current capabilities.
- There is a strong positive relationship between relying on information technology and the advancement of leadership skills among coaches.

Theoretical framework of the study

Information Technology (IT) is the utilization of technology specifically computers software and networks to store retrieve and process data (Laudon et Laudon, 2004), Key concepts include data management for access and security and networking for communication and sharing of devices among computing systems, cloud computing provides scalable storage and processing power on the internet, while cyber security safeguards digital assets from unauthorized access and threats, artificial intelligence (AI) refers to the creation of computer systems able to execute tasks typically necessitating human(Russell et Norvig, 2016), taken together these ideas emphasize the catalysing power of IT in innovation, efficiency, and connectivity (Ben Khedim et Layadi, 2024).

Leadership is the skill of guiding others to achieve a common objective collaboratively (Sinek, 2014), the main ideas are transformational leadership which creates team oriented behaviour situational leadership which adapts to the group's needs and servant leadership, which prioritizes the growth and well-being of team members, then there is sports leadership which seems self-explanatory until you realize that it could mean guiding not only athletes but also the teams of coaches and other staff, there is also coaching leadership which combines sports mentorship with skill development, all these types of leadership, especially when taken together imply that intelligence or at least savvy is important especially if emotional bonds are part of the deal (Covey, 2020; Dweck, 2006; Al Khajeh, 2018), Bass and Riggio highlight a largely neglected facet of sport—the convergence of information technology and coaching practice. They contend that effective leadership in this domain can be captured by four fundamental dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Bass & Riggio, 2006).

Sport Leadership Groups refer to a specific set of leaders within a team who either engage in shared leadership or facilitate the decision making process of a designated team leader (Cotterill et al., 2019), shared leadership can take various forms characterized by different scopes and methods of participation, ranging from a concentrated focus on a single team captain to the inclusion of all team members in leadership roles, contemporary viewpoints suggest that neither extreme is optimal It is improbable that every team member possesses the requisite skills and motivation to lead (Seibert et al., 2003), effectively Furthermore if all team members assume leadership responsibilities the task of coordinating their communications can become burdensome, heightening the chances of confusion and miscommunication (Hardy et al., 2007), as Gockel et al noted, "*Sharing the burden of leadership may seem advantageous, but too many cooks can spoil the broth*" (Gockel et Werth, 2011), Conversely minimal shared leadership structures involving only two individuals e.g. (the coach and the team captain) fail to address the challenges associated with overburdened leadership roles (Turner, 2002; Horst, 2016), in such cases individuals may assume more responsibilities than they have the time, energy or expertise to handle leading to role conflict and significant stress (Fransen et al., 2014), Kotter in his book outlined that leadership dimensions involve creating urgency, building a strong team, formulating and communicating a clear vision, empowering action, achieving short term wins, consolidating changes, and institutionalizing a new culture (Kotter, 2012), Yukl classified leadership behaviours into categories: task-oriented planning, monitoring, relationship oriented ,coaching, conflict

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resolution, and change oriented ,innovation, crisis management (Yukl, 2012), leadership styles are categorized into six distinct approaches coercive, authoritative, follow-up, democratic, pacesetting and coaching (Goleman, 2017), fundamental techniques of effective leadership encompass inspiring a collective vision, questioning established systems, empowering people to take action, fostering motivation, and exemplifying desired behaviours (Kouzes et Posner, 2006).

The inclusion of (IT) in sports coaching improves the leadership capability of coaches, with the use of data analytics and performance tracking tools, coaches can have more intelligent conversations and provide data driven answers that advance training practice and performance, it supports improved communication and collaboration with tools such as video conferences and messaging for timely feedback from coaches to build the team's interconnectedness, moreover internet resources for learning make it possible for coaches to continuously develop themselves professionally so that they can remain up to date with the best practices in the field, individualized coaching and data informed coaching becomes in the hands of the athletes and it strengthens the relationship between coach and athlete Last IT facilitates situational awareness that is applied dynamically in game situations by the coaches. In general, IT is a valuable aid in the development of practical leadership skills in sports coaches.

MATERIAL AND METHODS

Study limitations

- Objective Limitations: The study was limited to examining the impact of using information technology on the development of leadership skills among sports coaches.
- Spatial Limitations: The study was conducted in Algeria.
- Time Constraints: The study was undertaken from March 5, 2025, to April 25, 2025.
- Human Limitations: The study was confined to football coaches.

Study methodology

Approach

The study adopts a descriptive-analytical approach to examine the relationship between variables.

Sample

Population and Sample: The target Sample includes sports coaches in football, with a random sample of 58 coaches selected randomly.

Analyse data

Perform descriptive statistical operations (frequencies, means, standard deviations), reliability tests (Cronbach's Alpha), correlation analysis (Pearson's coefficient), and inferential tests (T-Test, ANOVA) using SPSS V 22 software to see how they relate to and differ from one another.

Instruments

A structured questionnaire was developed to evaluate the use of information technology and leadership skills. The instrument employs a three-point Likert scale (High, Medium, Low) with closed-ended response options, the information-technology construct comprises five dimensions Smart Devices, Sports Software, Access to Information, Networks and Communication, and Digital Training captured by items 1-24, the leadership construct likewise encompasses five dimensions Planning and Direction, Decision-Making, Communication, Motivation, and Problem-Solving captured by items 25-48.

Reliability of the study instrument

To gauge how trustworthy our data collection method was, we calculated an indicator known as Cronbach's Alpha. When our programmer performed the calculations, she came up with an answer of 0.89, this value not only far exceeds the minimum acceptable level of 0.65 but also suggests a very high degree of internal consistency among the items we put on our questionnaire. It is likely that the answers provided by our sample are a good indication of the real-world conditions that we are trying to understand.

RESULTS AND DISCUSSION

Table 1. Descriptive statistics and ranking of the dimensions of the first variable (information technology) based on sample responses.

Dimensions of the first variable Information Technology	SMA	SD	Percentage	Sample Direction	Ranking
Smart Devices	2.39	0.71	79.67	High	1
Sports Software	2.17	0.76	72.33	Medium	4
Access to Information	2.18	0.78	72.67	Medium	3
Networks and Communication	1.96	0.78	65.33	Medium	5
Digital Training	2.37	0.73	79	High	2

The research indicates that sports coaches rely heavily on Smart Devices (79.67%) and Digital Training (79%), with the tools they use most being computers and online certifications Meanwhile they show only moderate adoption of Sports Software (72.33%), Access to Information (72.67%), and Networks and Communication (65.33%). In those areas, they show no real inclination to use the tools more effectively, as a result they have some serious shortcomings that stem from a lack of resources and training that could help them become more digitally proficient, if these digital natives are going to serve as coaches for the next generation they will need to build better digital habits for themselves.

Table 2. Descriptive statistics and ranking of the dimensions of the second variable (leadership skills) based on sample responses.

Dimensions of the second variable Leadership Skills	SMA	SD	Percentage	Sample Direction	Ranking
Planning and Direction	2.11	0.51	70.33	Medium	5
Decision-Making	2.30	0.47	76.66	Medium	3
Effective Communication	2.79	0.71	93	High	1
Motivation	2.66	0.49	88.66	High	2
Problem-Solving	2.29	0.55	76.33	Medium	4

Table 3. Correlation relationships between dimensions of information and communication technology and leadership skills (Pearson's correlation coefficient).

	Indicators Dimensions	Smart Devices	Sports Software	Access to Information	Networks and Communication	Digital Training	Information Technology (Overall)
Leadership Skills	Pearson Correlation Coefficient	0.601	0.505	0.526	0.655	0.481	0.623
	Significance Level	.00	.00	.00	.00	.01	.00
	Sample Size	58	58	58	58	58	58

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The findings of the study show that sports coaches are altogether very proficient in the communication skills that lead to effective performance, of the study participants, 93 percent rated their communication skills (in the context of what it means to be an effective coach) as good or very good In this same vein 89 percent of participants rated their motivational skills as good or very good, on a daily basis sports coaches are required to perform two critical roles: to be a communicator and to be a motivator these two parties of the coaching circus are necessary for the effective functioning of the team.

The relationship between the information technology dimensions and leadership skills

Examined dimensions exhibit statistically significant positive relationships with leadership skills, as all significance values are below the conventional threshold of .05.

The relationship between information technology (overall) and leadership skills

In the table, we see that the Pearson correlation coefficient equals 0.623, meaning there is a strong positive linear relationship between IT and leadership skills. This relationship is statistically significant, as the sig level is 0.00, which is well below the necessary cutoff of 0.05.

The strong correlations especially with "*Networks and Communication*," "*Smart Devices*," and "*Information Technology*" highlight the digital age's contribution to raising leadership to a new level, the findings point to the integrated use of communication, smart devices, and information technology as the primary enhancers of effective communication, motivation, planning, and decision-making within the contemporary leadership model, as agreed upon by numerous researchers (Yanti et al., 2023; Ausat et al., 2022; Ichsan et al., 2021).

The moderate correlations with "*Sports Software*," "*Access to Information*," and "*Digital Training*" suggest that these three dimensions do make a positive contribution to effective leadership but that there may be spots in the evenness of that contribution (e.g., some leaders using these tools effectively and others not) caused either by lack of training, lack of awareness, or lack of sufficient instructional resources (Kane et al., 2019; Weill et Broadbent, 1998).

These results suggest that increased integration and effective utilization of technological tools especially smart devices and comprehensive IT infrastructure can play a significant role in developing leadership potential.

Table 4. Results of multiple linear regression analysis testing the impact of information technology dimensions on leadership skills

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	A	Std. Error	Beta		
(Constant)	17.102	6.107	---	2.421	.010
Smart Devices (X_1)	1.016	0.324	0.632	1.922	.003
Sports Software (X_2)	0.218	0.841	0.041	0.320	.799
Access to Information (X_3)	1.322	0.344	0.521	2.753	.007
Networks and Communication (X_4)	0.344	0.522	0.112	0.710	.482
Digital Training (X_5)	1.193	0.483	0.061	0.306	.004

Smart devices (X_1)

The findings presented show that Smart Devices have a positive and statistically significant impact on the dependent variable, with a standardized coefficient of β = 0.632 (*p* = .003), these results emphasize the

critical role of smart devices as the most significant effective in the model, intimating that harnessing smart devices dramatically improves the dependent variable, holding all other variables constant, we can interpret the unstandardized coefficient (B = 1.016) as indicating that a 1-unit increase in the use of smart devices corresponds to a 1.016-unit increase in the dependent variable.

Many researchers have found that mobile technologies like smartphones and tablets greatly improve how coaches analyse performance and make decisions in real-time, this matches my finding that smart devices are the most impactful, as many studies show these devices help coaches get immediate feedback, which leads to better strategies and leadership results, similar to your observed effect size (β = 0.632). Additionally, Mencarini and others discovered that using smart devices in training helps coaches make decisions based on data, improving their leadership skills by giving them tools to monitor and adjust athlete performance on the spot (Luczak et al., 2020; Baca et al., 2009; Bideau et al., 2009; Rajasekaran et al., 2024; Mahdi, 2019), Similarly, Mencarini et al. found that the integration of smart devices in training environments fosters data-driven decision-making, enhancing leadership competencies by providing coaches with tools to monitor and adjust athlete performance dynamically (Mencarini et al., 2019; Grady, 2023).

Sports software (X_2)

Meanwhile, Sports Software shows a very small and not statistically significant relationship with the dependent variable, with a standardized coefficient of β = 0.041 (p = .799), the effect of Sports Software on the dependent variable is very small, even for one unit changes in the Sports role accounting for just a 0.218 unit increase (unstandardized coefficient, B = 0.218) for each unit increase in Sports Software and it is not significantly different from zero α = .05.

We see that while Sports Software e.g. (performance analysis tools) holds potential to enhance coaching practices, its impact is often diminished by barriers such as insufficient training, lack of user friendly interfaces and resistance to technological change among coaches (Martin et al., 2017; Sampaio et al., 2019; Cacioppe, 1998; Megheirkouni et Mejheirkouni, 2020; Murthy et al., 2024), additionally, many researchers have reached the conclusion that the effectiveness of sports software in improving coaching outcomes is contingent upon coaches' technological literacy and organizational support factors that if absent result in minimal impact, the effects of the authentic sports leadership training program are effective for both coaches and players (Garcia et al., 2021; Sánchez et al., 2024; Changgui et Chao, 2024; Suyudi, 2023; Chen, 2014).

Access to information (X_3)

Access to Information stands out as a statistically significant determinant of the dependent variable (β = 0.521, p = .007), this outcome makes it the second most influential dimension in the model and shows a strong positive relationship access to information indicates that an increase of one unit in Access to Information, will increase the dependent variable by 1.322 units (B = 1.322) when the other variables are constant.

The significant positive effect of Access to Information on the dependent variable is well supported by prior research, which underscores the critical role of information availability in enhancing leadership and performance outcomes in sports, Kroll and many other researchers mention that it has been argued that access to digital databases, online resources, and performance analytics is a cornerstone of modern sports coaching, enabling evidence based decision making and strategic planning, which are integral to leadership development (Kroll, 2015; Venugopal, 2023; Passfield et Hopker, 2017; Cope et al., 2024; Hickman et Akdere, 2018; Krishna et Khan, 2024), Mears and many other researchers mention that coaches who

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leverage accessible information systems exhibit enhanced problem-solving and communication skills, key components of leadership (Mears, 2019).

Networks and communication (X_4)

This analysis shows that Networks and Communication doesn't have a significant statistical relationship with the dependent variable as evidenced by the standardized coefficient β = 0.112 (*p* = .482), as regards its unstandardized coefficient (B = 0.344), we may conclude that networks and communication has a small effect, since one additional unit in networks and communication translates into a 0.344 unit increase in the dependent variable that it has not statistically significant (α = .05).

That although digital communication platforms (team management apps, virtual collaboration tools…) can improve cohesion and leadership within a team, their effectiveness is blunted due to suboptimal usage, failure to embed in practice, or cultural pushback from coaching staff (Cotterill et Fransen, 2016; Davis et al., 2019; Swart et al., 2022; Cherubini, 2019; Cranmer et Myers, 2015; Pawar et Dhumal, 2024; Majumdarr et al., 2024), Similarly, although networking technologies in sports and studies in sport networks grew because of their potential according to influence and encourage support from the local national network and help if the organization by organization is not supportive along the network, no impact as in your findings. (Liao, 2017; Avolio et al., 2014).

Digital training (X_5)

Digital Training is identified as a statistically significant influencer of the dependent variable, albeit with a relatively modest effect size as indicated by a standardized coefficient of β = 0.061 (*p* = .004), the unstandardized coefficient (B = 1.193) demonstrates that a one unit increase in Digital Training is associated with a 1.193-unit increase in the dependent variable, holding other variables constant while, this effect is statistically significant, its smaller standardized coefficient compared to smart devices and access to information suggests a less pronounced influence.

The significant impact of Digital Training on the dependent variable is supported by prior research that highlights the value of digital training platforms while acknowledging their role compared to hardware and information access, numerous researchers have determined that digital training tools, such as online certifications and e-learning modules, contribute to coaches' skill development by providing structured learning and motivate them (Honchar, 2024; Parra et Fernández, 2023; Langdon et al., 2023; Leeder et al., 2023; Sivulca et al., 2024), Prior research has consistently shown that while digital training enhances coaches' technical and leadership competencies, its effectiveness is contingent upon integration with other technological components, such as smart devices and information systems, especially with the spread of artificial intelligence (Tan et O'Connor, 2022; Bennett et Szedlak, 2024; Sperlich et al., 2023).

The multiple linear regression analysis yielded the following equation:

$$Y = 17{,}102 + 1{,}016X_1 + 0{,}218X_2 + 1{,}322X_3 + 0{,}344X_4 + 1{,}193X_5 + e$$

The graphical representation (Figure 1) visualizes the relative magnitudes of the regression coefficients, clearly illustrating the predominant effects of Smart Devices (X_1), Access to Information (X_3), and Digital Training (X_5), while also showing the comparatively smaller contributions of Sports Software (X_2) and Networks and Communication (X_4). The error bars indicate the precision of these estimates, with smaller standard errors for the significant predictors suggesting more reliable coefficient estimates.

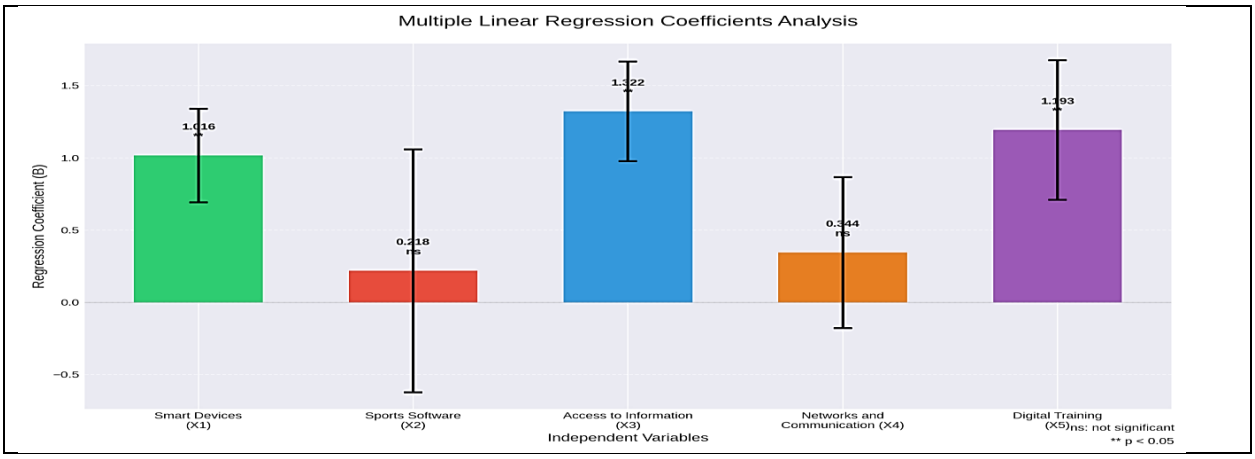

Figure 1. Relative Impact of Information Technology Components on Leadership Skills Development among Sports Coaches "*SPSS V 22*".

CONCLUSION

Results indicated that the coaches show a high reliance on smart gadgets and digital training resources in their coaching events by contrast, their level of use of sports software, information and communications networks was moderate in terms of leadership competencies, the highest strength of the coaches was their effective communication and motivation, and their planning and team direction, decision-making, and problem-solving skills were found to be at a moderate level.

Additional examination revealed a strong positive correlation between the use of IT and the improvement of leadership smart devices and communication networks were the most influential devices on the list, furthermore the research found that smart devices were positively significant to the cultivation of leadership, followed by information access and digital training, sports software, and communication networks seemed to have a lower influence.

These results show a clear contribution of information technologies particularly smart devices and digital training, to the development of leadership capacities in football coaches, It is highlighted that the relatively low dependence on sports software and communication networks for coaching may be areas to target for further integration to maximize coaching efficacy, the strength of communication and motivation of the coaches indicates the importance of technology to leverage these skills with other leadership areas of moderate proficiency that suggest an opportunity for focused professional development provided through technological tools.

Recommendations

- -Institutions and policymakers should prioritize the integration and provision of smart devices and ensure access to information for sports coaches, as these factors have the most significant positive impact on leadership skills development.
- Training programs for coaches should emphasize digital training modules, focusing on practical applications and the use of technology to enhance leadership competencies.
- Investment in digital infrastructure should be directed primarily toward improving hardware availability and information accessibility, rather than solely focusing on software solutions or network expansion, as the latter showed limited statistical significance in this context.

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- Further research is recommended to explore the underlying reasons why sports software and network communication did not significantly influence leadership skills, potentially considering qualitative approaches or broader samples.

AUTHOR CONTRIBUTIONS

This study was conducted by researchers from the Institute of Science and Technology of Physical and Sports Activities, Mohamed Cherif Messaadia University, souk ahras, Algeria, namely:
Benkhedim Oussama authored the original draft of the manuscript laying out the initial structure of the research, he designed the research methodology, creating a solid approach for investigation, additionally he managed the data collection process, organizing essential information, and performed the data analysis, deriving key findings, he also finalized the manuscript, ensuring the research was comprehensively documented. Layadi Issam conceptualized the research establishing its foundational framework and objectives, he reviewed and edited the manuscript to uphold its academic quality and clarity, and furthermore he supervised the research process, providing guidance at every stage, his efforts also extended to collecting references and sources, enhancing the study's theoretical basis, and he contributed significantly to the analysis and interpretation of data, delivering critical insights.

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No potential conflict of interest was reported by the authors.

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