A Phenomenological Exploration of the Impact of Using New Technologies and Artificial Intelligence on the Development of Sports for Veterans and the Disabled

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Abstract

Purpose: With the rapid advancement of new technologies and artificial intelligence (AI), the accessibility and performance of sports for veterans and individuals with disabilities are undergoing transformative changes. This study aims to phenomenological explore the influence of these innovations on the development of adaptive sports.

Method: A qualitative approach with a descriptive phenomenological method was employed. Participants included 15 experts in the fields of sports for veterans and the disabled, as well as technology and AI. Purposeful sampling was used, and data were collected through semi-structured interviews with open-ended questions. Thematic analysis was conducted using Mixed (version 2020). The reliability of the findings was ensured through inter-coder agreement between two coders.

Results: Data analysis resulted in the identification of 81 interview codes, organized into four main themes and eight sub-themes. The effects of AI and new technologies on the development of adaptive sports were categorized as follows: (1) Sports Technology (Technology and Equipment Development; Data Analysis and Management), (2) Health and Welfare of Veteran and Disabled Athletes (Improving Training Methods; Health Promotion and Prevention), (3) Individual Empowerment (Personal Growth and Development of Self-Efficacy Skills; Motivation and Social Support), and (4) Management and Strategy (Sports Management; Development Strategies).

Conclusion: The findings highlight the significant and multidimensional role of AI and emerging technologies in enhancing training, health, empowerment, and management within adaptive sports. These advancements present valuable opportunities for expanding participation, improving performance, and fostering inclusion for veterans and individuals with disabilities.

Keywords: artificial intelligence, new technologies, sports development, veterans and disabled.

Introduction

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines designed to perform tasks that typically require human cognition, such as learning, reasoning, problem-solving, and decision-making (Korteling et al. 2021). AI systems use algorithms, data analysis, and machine learning techniques to improve their performance over time. It can be applied to various fields, including healthcare, education, sports, and robotics. By processing large datasets and identifying patterns, AI enables automation, enhances decision-making, and optimizes outcomes. In sports, AI has significant potential to improve performance, injury prevention, and athlete management by analyzing real-time data and providing actionable insights (Mateus et al. 2024). New technologies refer to emerging tools, systems, or innovations that significantly enhance or transform existing processes across various fields (Alaghbari et al. 2024). These include, but are not limited to, advancements in robotics, wearable devices, the Internet of Things (IoT), virtual and augmented reality (VR/AR), 3D printing, and smart materials (Rane et al. 2023). In the context of sports, new technologies offer improved equipment, real-time monitoring systems, data analytics platforms, and rehabilitation tools tailored to individual athletes' needs. They not only increase efficiency and performance but also promote inclusivity and accessibility, particularly for veterans and individuals with disabilities by removing physical and environmental barriers (Willingham et al. 2024).

Sport is recognized as one of the main tools for promoting physical, mental and social health. This importance is doubled for groups such as disabled people who face specific physical and social challenges (Linu & Balasubramanian, 2020). Disability is a deprivation and disadvantage of a person that is the result of an impairment and inability and prevents them from fulfilling the role that is intended for the person according to age, gender, social, cultural and natural conditions (Cassidy & Albanesi, 2023). According to the United Nations report, people with physical disabilities participate less in society, have lower incomes, worse housing conditions and less education, and are less likely to have a job compared to the general population (Yilmaz et al., 2020). Sports development refers to the systematic process of increasing participation, improving performance, and enhancing the infrastructure and support systems for sports at all levels. It includes creating opportunities for individuals of all ages, abilities, and backgrounds to access and benefit from sports. This involves talent identification, coach education, community engagement, and promoting inclusion. In the context of veterans and disabled individuals, sports development emphasizes equal access, customized programs, and the integration of adaptive technologies to enhance physical, mental, and social well-being through structured sporting opportunities. Sport not only provides a basis for improving the physical and mental capabilities of these individuals, but also, as an important social factor, plays a key role in increasing self-confidence, social empowerment, and improving their quality of life. However, physical limitations and inadequate facilities have made it difficult for these individuals to access equal sports opportunities (Mercado-Aguirre & Contreras-Ortiz, 2017).

Sports activities have been considered as one of the key tools in the rehabilitation and improvement of the quality of life of veterans and disabled people. These activities not only help improve physical functions, but also have positive effects on the mental, social and even economic health of disabled people (Vakili Tanha et al., 2019). Sports activities for veterans and disabled people can create significant improvements in physical health. From a biomechanical perspective, exercise leads to muscle strengthening, increased

cardiovascular endurance, improved balance and reduced injuries caused by immobility. Research shows that regular exercise can help improve movement and reduce pain caused by physical limitations. For example, strength and resistance training can improve muscle function and reduce muscle weakness in people with physical disabilities (Brittain et al., 2024).

With the advancement of new technologies and the emergence of artificial intelligence, new perspectives have emerged to overcome these limitations. In the last decade, the introduction and increasing development of technology in the sports industry has grown significantly. Recent advances in technology have created new types of equipment that can bring a huge transformation in the sports of veterans and people with disabilities (Khadem Pir et al., 2023). Technologies such as biomechanical data analysis, smart equipment design, and personalization of training programs are among the possibilities that can transform the sports experience for veterans and people with disabilities. On the other hand, these technologies can help identify the specific needs of each individual, improve training techniques, and reduce the likelihood of injury (Rum et al., 2021). Artificial intelligence-based smart prosthetics enhance athletic performance by dynamically adapting to users' gait and movement patterns through real-time biomechanical data analysis (Srivastava et al., 2024). These systems utilize biosensors and machine learning algorithms to optimize range of motion and movement efficiency. Similarly, AI-integrated sports wheelchairs analyze force distribution and trajectory in various directions to recommend optimal movement paths, thereby improving balance, speed, and reducing injury risks particularly in sports such as wheelchair basketball and para-cycling (Sankar et al., 2024).

Globally, the use of advanced technologies in sports, especially in the field of disabled sports, is rapidly expanding. Examples of this development include smart prosthetics, advanced sports wheelchairs, and AI-based training programs that have had a significant impact on increasing the participation of these individuals in sports activities (Zheng, 2016). AI can help in medical equipment to provide more accurate health and treatment recommendations for veterans and disabled athletes. For example, using data collected on the physical performance of disabled athletes, treatment improvements and medical recommendations can be improved (Harris et al., 2022). On the other hand, AI can provide improved performance of veterans and disabled athletes by using advanced algorithms and new technologies. For example, using intelligent systems, players can be accurately identified and information about their performance in the game can be collected. This information can help coaches improve the way they train and practice players (Nahavandi et al., 2022).

AI can automatically and accurately analyze performance data of athletes with disabilities and veterans. This data can include information such as speed, strength, balance, and motor function. By analyzing this data, coaches and doctors can identify performance patterns and problems and provide appropriate training and treatment programs (Ling et al., 2019). Intelligent algorithms can generate automated and customized responses for each individual and recommend a specific training program based on that individual's needs. This helps athletes maximize their abilities and improve their performance (Cheng & Wang, 2021). Overall, AI can play an important role in improving the performance of athletes with disabilities and enhancing their quality of life. This powerful technology can bring great improvements to the field of sports for veterans and disabled people. This is despite the fact that in many countries, including Iran, there is still a significant gap in the utilization of these facilities (Vakili Tanha et al., 2019).

Among the researchers conducted in this field,

Wang and Shu (2024) stated that the increasing advancement of Internet of Things (IoT) technology and the evolution of deep learning algorithms have brought about transformative changes in the communication strategy for disseminating information about disabled sports. Wang (2023) pointed out that artificial intelligence is not only used in business, entertainment, and academia, but also in sports training to raise the level of competition among athletes. Artificial neural networks are the brains of modern artificial intelligence. In this research, they were investigated in predicting sports training load to improve sports performance, creating scientifically efficient training programs, and increasing the accuracy of training load prediction. The results showed that the methods proposed in this paper can effectively improve the accuracy and efficiency of sports training, predict sports training load, and the effectiveness of athletes' training, and consequently increase the level of sports competition.

In a study by Wang (2023), AI algorithms can automatically adjust exercise training programs based on individual differences and learner feedback, which can overcome the limitations of traditional assessment methods. Alqahtani et al., (2021) stated that more than one billion people with disabilities and older adults with mobility impairments currently require assistive technology devices, and only 10% of this population has regular access to them. It is clear that user needs and preferences vary between regions within countries. Rum et al (2021) conducted a systematic review of the use of wearable sensors in sports for people with disabilities. They identified and discussed four main target applications of sports-related wearable sensors for people with disabilities, including athlete classification, injury prevention, performance characterization for training optimization, and equipment customization.

In a study by Guo & Li (2021), examining the role of artificial intelligence in physical education based on the application of functional exercise training, they found that the artificial intelligence-based functional exercise test is consistent with the basic meaning of the physical fitness test and helps increase students' awareness of physical exercise. The intelligent remote multimedia physical education system based on artificial intelligence makes the physical education process flexible, free from time and place restrictions, and can adopt different educational strategies to implement personalized education according to the different situations of students.

In a study by Senjam et al., (2020) in their study on assistive technology for visually impaired students in schools for the blind in Delhi, they found that awareness about haptic and voice-based technology was good among students. The results of this study showed that most students use haptic technology regardless of their visual status and teachers need to be trained in the use of various assistive technologies for reading, writing, mathematics, science, sports, mobility and daily activities. In a study by Kang and Kang (2019), in their study, virtual reality technology for the disabled is effective as a training content for sports experience and rehabilitation. Effective VR sports for the disabled should be applied differently according to the type and severity of disability instead of using the latest technology unconditionally; And if virtual reality technology is combined with artificial intelligence (AI) in the future, it will create new changes in the field of physical education for the disabled and non-disabled sports, and in addition, it will help improve the sports skills of elite athletes with disabilities.

While technological innovation particularly in the form of artificial intelligence and emerging smart systems has increasingly shaped the landscape of modern sports, persons with disabilities and war-injured veterans continue to face systemic exclusion from its benefits.

Existing research has largely focused on the capabilities of new technologies in able-bodied contexts, often neglecting to explore how such innovations translate within the distinct physical, psychological, and infrastructural realities of disabled and veteran athletes. The core issue is not merely access to technology, but a lack of adaptive, context-sensitive systems that align with the lived experiences and needs of these populations. Despite their potential, technologies remain underutilized or misaligned due to insufficient user-centered design and limited empirical understanding of their impact on marginalized groups.

This study is necessary to address this critical gap by prioritizing the phenomenological insights of experts and stakeholders engaged with disabled and veteran sports. By focusing on how these technologies are perceived, integrated, and experienced in real-world sporting contexts, the research aims to inform inclusive strategies for development. The urgency lies in ensuring that future innovations are not only technically advanced but also ethically and socially responsive capable of fostering meaningful participation, empowerment, and health outcomes for all athletes, regardless of physical condition or military background.

Materials and Methods

This research is applied in terms of purpose and has been conducted with a qualitative approach and descriptive phenomenological method. Phenomenology, in particular, was chosen as it enables the researcher to uncover the essence and structure of participants' experiences without imposing external theoretical frameworks. This approach is well-suited to contexts where individuals interact with emerging technologies in diverse, context-dependent ways. It facilitates the identification of themes, meanings, and patterns that may not be observable through numerical analysis. Moreover, the lack of sufficient prior research in this specialized area necessitates an exploratory approach that can generate new conceptual insights and inform future empirical studies. Thus, the qualitative method was essential for capturing the depth, complexity, and contextual richness required by the research question. The aim of the research is to investigate the effects of using new technologies and artificial intelligence on the development of veterans and disabled sports. The research participants were experts in the field of technology and veterans and disabled sports, such as technology and artificial intelligence experts, sports management professors familiar with disabled sports, disabled athletes, managers and experts in veterans and disabled sports. The sampling method is theoretical, which is a theoretical sampling in a targeted manner and individuals are consciously selected and by referring to them, the most important and deepest information is collected using a semi-structured interview tool, and the criterion is the achievement of theoretical saturation. Theoretical saturation is achieved when new data from the interview do not provide new theoretical insights for the researcher; therefore, theoretical sampling continued until theoretical sufficiency was reached, which ultimately resulted in 15 semi-structured interviews. The inclusion criteria were clearly provided to the volunteers so that only those with relevant lived experience were selected. The data were first coded and then categorized based on main and subthemes, which was based on the Colaizzi method (1978), which specifically focuses on revealing the meanings hidden in the experiences of individuals. The researcher's goal in this approach is to understand the meanings of experiences in the same way that individuals have experienced them. For this reason, the Colaizzi method was chosen as the most appropriate analysis tool for this study.

Semi-structured interviews with open-ended questions were used to collect data. The duration of each interview varied between 20

and 45 minutes, and the interviews continued until non-repetitive concepts were extracted from them. Data analysis was carried out using Colaizzi's descriptive phenomenological method, which provides a structured process for extracting and organizing the essential meanings of participants' lived experiences. The analysis followed the seven standard steps of Colaizzi's approach: (1) reading all participants' descriptions to obtain a general sense of the data; (2) extracting significant statements relevant to the phenomenon; (3) formulating meanings from these statements; (4) organizing the formulated meanings into clusters of themes; (5) integrating the results into an exhaustive description of the phenomenon; (6) identifying the fundamental structure of the phenomenon; and (7) returning the findings to participants for validation and feedback. To increase the validity of this study, after analyzing the data and extracting the results, the findings were sent to the participants to collect their comments and feedback on the accuracy and consistency of the results with their experiences. This method was carried out to ensure the correctness of the data interpretation and their compliance with the real experiences of the people. To increase accuracy, data collected from interviews were compared with other sources such as previous literature or observational data. This method helped the researcher to look at the topic from different angles and reduce possible bias. Efforts were made to select participants from different social, cultural, and educational backgrounds to reflect diversity in experiences and perspectives. This diversity helps to enhance the comprehensiveness of the findings. Findings and analyses were shared with several researchers specializing in the field of sports technology to obtain their opinions on the validity of coding and interpretation of the data. All stages of the research, including sampling methods, instrument design, data collection, and analysis, were recorded in a clear and precise manner. This transparency allows other researchers to evaluate the results or reproduce the research. The researcher was aware of the influence of his/her own assumptions, personal experiences, and possible biases throughout the study and tried to control for these factors in the data analysis. The reliability of the study was examined using the intra-subject agreement method between two coders. In order to comply with ethical principles, the objectives and necessity of the research were explained to the participants before the interview began. All participants participated in the research with full consent and were given the opportunity to withdraw from the research at any stage, although none of the participants withdrew. The interviews were conducted in a quiet environment without interference from others.

Results

The findings presented in Table 1 are based on the lived experiences of experts in the field and emphasize how technological advancements have contributed to improving the quality of sports for veterans and disabled individuals. Smart prosthetics, advanced motion sensors, wearable technologies, and the integration of artificial intelligence in judging systems and training software represent notable innovations. These technologies enhance not only athletic performance but also safety, autonomy, and access to customized training. The findings in this table clearly demonstrate the transformative impact of sports technologies on both individual performance and systemic development.

Table 1. Sports Technology

Main theme	Subtheme	Interview	concepts
		Using advanced motion sensors (e.g., wearable sensors that track movement for performance improvement)	P2, P3, P5, P6, P7, P8, P10

Sports technology	Technology and equipment development	Designing smart sports prostheses for athletes with physical disabilities	P1, P14
		Developing intelligent sports equipment tailored to physical needs	P3, P5, P15
		Designing smart sportswear that adapts to body condition and movement	P7, P11, P12
		Providing online sports consulting services through digital platforms	P5, P9,
		Building smart rehabilitation devices for improved recovery and training	P1, P7
		Designing AI-based training software for athletes with disabilities (AI: systems that adapt based on individual progress)	P5, P7, P13
		Using wearable technologies to monitor and enhance physical performance	P5, P7, P14
		Applying power transmission technologies (such as exoskeletons) to support movement	P10, P13
		Using artificial intelligence to assist in judging sports competitions	P2, P3, P5
	Data analysis and management	Using blockchain technologies for secure and transparent data management of athletes	P3, P3, P7
		Using big data to analyze training performance (large-scale datasets to identify trends and outcomes)	P6, P8, P17
		Analyzing biomechanical data (data from body movement) to assess athletic techniques	P2, P13, P15
		Using machine learning (computers learning from patterns in data) to find success models in training	P3, P4, P5, P7, P8, P10
		Analyzing sports competition statistics to improve team and individual strategies	P5, P10, P13, P15
		Identifying physical weaknesses by analyzing personalized performance data	P10, P11, P13
		Optimizing training programs using both environmental and personal data	P3, P15
		Preventing sports injuries by predictive data analysis	P2, P8
		Evaluating rehabilitation program effectiveness using data analytics	P1, P4, P5
		Designing performance databases for long-term health and fitness monitoring	P1, P3, P5, P6, P7, P8, P10
		Identifying and addressing environmental barriers using location-based data	P1, P12
		Analyzing historical trends in disability sports to plan for future needs	P7, P15

Health and Welfare of Veteran and Disabled Athletes Table 2 reveals how technology is

effectively applied in improving training methods, enhancing physical and psychological health, and preventing sports-related injuries. Insights derived from expert interviews show the importance of technologies such as virtual and augmented reality, real-time feedback systems, AI-based nutrition planning, and biometric data analysis for sleep and cardiovascular monitoring. These tools contribute significantly to creating personalized, adaptive, and preventive health programs. The results presented in this table underscore the role of intelligent systems in optimizing well-being and sustaining the long-term athletic involvement of veterans and disabled athletes.

Table 2. Health and Welfare of Veteran and Disabled Athletes

Main theme	Subtheme	Interview	concepts
Health and welfare of veteran and disabled athletes	Improving training methods	Identifying physical needs of athletes with disabilities	P7, P11
		Creating personalized workout algorithms to match ability levels	P7, P10
		Simulating sports environments using virtual platforms	P7, P11, P12
		Assessing performance of athletes online in real time	P5, P9
		Providing instant feedback during training using smart systems	P1, P7
		Adjusting exercises based on environmental conditions	P5, P7, P13
		29. Reducing fatigue with intelligent workout scheduling	P5, P7, P15
		Analyzing complex physical movements for improved training	P3, P11
		Lowering training costs by using accessible technologies	P2, P4
		Using augmented reality (AR) for immersive workout experiences	P9, P15
		Designing virtual reality (VR) training programs for skill development	P6, P7, P8, P10
		Developing decision support systems to guide athletes and coaches	P1, P14
		Offering easy access to training programs through digital platforms	P3, P5, P7
		Increasing training precision with artificial intelligence	P7, P11, P14
	Health promotion and prevention	Monitoring cardiovascular health using smart devices	P5, P9, P15
		Personalizing nutrition plans with AI-based dietary recommendations	P1, P7
		Analyzing medication effects on performance and recovery	P5, P7, P13
		Tracking sleep quality to support rest and recovery	P5, P7, P14
		Preventing performance decline with predictive analysis tools	P10, P13

	Analyzing athletes' physical endurance under different conditions	P2, P3, P5
	Studying psychological responses to exercise among athletes with disabilities	P3, P3, P7

Empowering and Motivating Veteran and Disabled Athletes As illustrated in Table 3, one of the key themes emerging from expert interviews is the role of technology in enhancing psychological empowerment, motivation, and personal growth. The use of AI to analyze emotions and provide motivational feedback, the design of tailored mental training programs, and the creation of digital social support platforms were frequently mentioned. These technologies promote self-confidence, improve focus, and reduce psychological barriers. This table clearly demonstrates that technology serves not only a functional role in physical development but also a critical role in strengthening mental and emotional resilience in sports.

Table 3. Empowering and Motivating Veteran and Disabled Athletes

Main theme	Subtheme	Interview	concepts
Empowering and motivating veteran	Personal growth and development of self-efficacy skills	Observing motor behavior patterns for progress tracking	P6, P8, P15
		Identifying key factors that influence athlete motivation	P2, P13, P14
		Analyzing emotional states and motivation using AI tools	P3, P4, P5, P7, P8, P12
		Assessing psychological barriers affecting athlete participation	P5, P15
		Using motivational games to encourage engagement	P10, P11, P13
		Delivering real-time feedback through interactive technologies	P5, P7, P13
		Providing virtual coaching feedback using AI systems	P5, P7, P14
		Creating reinforcement exercises to build self-confidence	P10, P13
		Strengthening mental skills using digital assessment tools	P2, P3, P5
		Improving focus and concentration with assistive technologies	P3, P3, P7
		Designing specialized rehabilitation programs for individuals with complex needs	P6, P8, P17
		Predicting and supporting athlete progress with AI and data tracking	P2, P13, P15
		Detecting athletic talents among individuals with disabilities using smart evaluation systems	P3, P4, P5, P7, P8, P14
	Motivation and social support for veteran and	Building supportive social networks among athletes with disabilities	P5, P10, P13, P15
		Analyzing team performance patterns to	P10, P11, P12

and disabled athletes	disabled athletes	identify success factors	
		Creating communication platforms between athletes and coaches	P9, P15
		Using digital tools to increase participation in sports programs	P2, P8, P9
		Designing motivational group sessions using Virtual Reality	P1, P4, P5, P7

Management and Strategy Table 4 captures strategic and managerial insights gathered from lived experiences of professionals working in the field of sports for veterans and the disabled. The findings highlight key needs such as developing legal and policy frameworks, overcoming environmental and cultural barriers, enhancing coach training, and creating international collaborations. Additionally, participants stressed the importance of using big data for competition management, performance evaluation, and identifying future trends. The table presents a clear argument that sustainable progress in this field requires thoughtful planning, supportive infrastructure, and a strong commitment to inclusive, data-driven governance.

Table 4. Management and Strategy

Main theme	Subtheme	Interview	concepts
Management and strategy	Sports management for veterans and the disabled	Analyzing environmental barriers for disabled athletes	P1, P3, P5, P6, P7, P8, P10
		Identifying management challenges in veteran and disabled sports	P1, P11, P12
		Providing training opportunities for coaches	P7, P15
		Designing new strategies in competition management	P1, P3, P5, P6, P7, P8, P10
		Managing communications between veteran and disabled athletes and coaches	P1, P12, P14
		Improving support policies for veteran and disabled athletes	P7, P15
		Creating appropriate infrastructures for athlete training	P7, P11, P13
		Analyzing cultural differences in veteran and disabled sports	P7, P10
		Developing legal frameworks for inclusive sports development	P7, P11, P12
		Improving coach performance evaluation systems	P5, P9,
	Development strategies in sports for veterans and the disabled	Designing new models for attracting financial sponsors	P1, P7, P8, P9
		Identifying success factors in competition management	P5, P7, P13
		Analyzing the needs of the disabled sports market	P5, P7, P15
		Developing international partnerships in	P3, P11, P12, P15

	veteran and disabled sports	
	Using technology to improve competition management	P2, P4, P8, P10
	Designing continuous performance monitoring systems	P9 P15
	Optimizing competition holding processes	P6, P7, P8, P10
	Creating support networks for athletes and coaches	P1, P14
	Evaluating the effectiveness of development programs	P3, P5, P7, P9
	Predicting future trends in veteran and disabled sports with data analysis	P7, P11, P14, P15

In Figure 1, the final research model is shown.

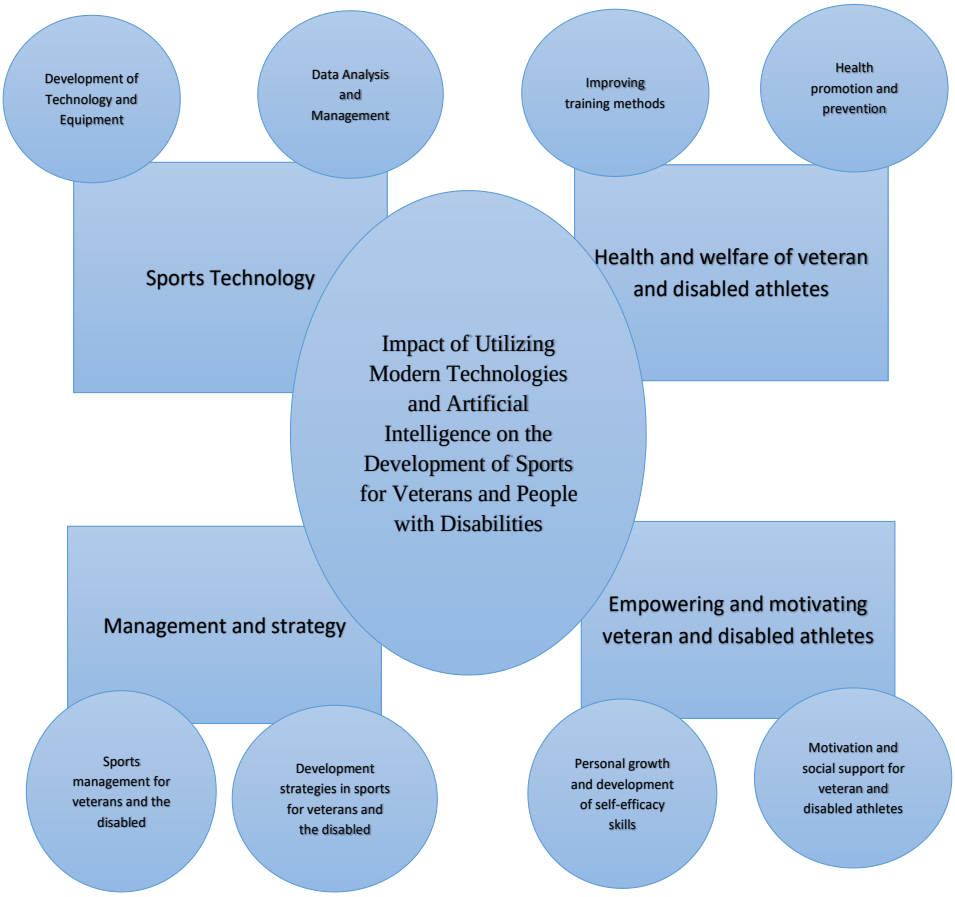

Figure 1. The Final Research Model

Discussion

The rapid advancement of artificial intelligence and new technologies has introduced significant opportunities for transformation in the field of sports. While these innovations have been widely applied in professional and able-bodied athletics, their application in adaptive sports particularly among persons with disabilities and war-injured veterans remains less explored and

less structured. Given the increasing emphasis on inclusivity, rehabilitation, and equal access to sport, it is critical to understand how these technologies are perceived and utilized by those directly involved. This research, by adopting a phenomenological approach, sought to uncover deep insights from experts and practitioners to better understand the real-world impacts and challenges of integrating intelligent systems into the development of adaptive sports.

The theme of sports technology under the theme of technology and equipment development refers to the fact that the advancement of sports equipment such as smart prostheses, advanced sports wheelchairs, and digital training tools has enabled increased participation and performance of veteran and disabled athletes. The results of this study are in line with the research of Wang and Shu (2024) and Rajšp & Fister (2020). They have shown that artificial intelligence and the Internet of Things (IoT) have had a significant impact on sports data analysis and management. Also, the results of these studies emphasize the importance of intelligent modeling of sports technologies, which is consistent with the findings of the theme of sports technology. In advanced countries, modern technologies are widely available and play a key role in rehabilitation and performance improvement. However, in Iran, limited access to advanced equipment is one of the main obstacles. Many veteran and disabled athletes do not benefit from up-to-date technologies due to the high costs or the fact that this equipment is imported. Also, domestic production in this area has not yet reached global standards. Therefore, it is suggested to support the domestic production of advanced equipment by providing facilities to knowledge-based companies and to create financial facilities for athletes to purchase specialized equipment. Also, holding international exhibitions to introduce new technologies and create connections between domestic and foreign manufacturers is a suitable solution.

In the area of data analysis and management, the use of artificial intelligence in sports data analysis can help coaches and managers design optimal and personalized training programs. This technology also allows for the prediction of injuries and better management of athlete performance. The lack of digital infrastructure and data collection and analysis systems is evident in Iranian veteran and disabled sports. In most cases, management decisions are made based on personal experiences, not scientific data. Developing national systems for collecting and analyzing sports data, training coaches and managers to use data analysis tools, and investing in artificial intelligence software and algorithms tailored to the needs of veteran and disabled sports can be appropriate solutions. Furthermore, AI can facilitate real-time monitoring of athletes' progress, identify patterns in performance improvement, and enable the adaptation of training regimens to individual needs. This personalized approach not only optimizes athletic performance but also reduces the likelihood of overtraining and injury. Building strong data infrastructures at both the local and national levels will empower stakeholders to make informed, evidence-based decisions that enhance the efficiency and effectiveness of training and rehabilitation programs for disabled and veteran athletes.

The theme of health and well-being of veteran and disabled athletes under the theme of improving training methods refers to simulation technologies, virtual reality, and smart tools that can improve athletes' training methods and prevent injuries. These technologies allow for the simulation of real competition conditions and optimization of training techniques. Lack of access to advanced tools and scientific training methods is one of the challenges of veteran and disabled sports. These results are consistent with the findings of Rum et al (2021) and Chase (2020), which refer to the use of wearable sensors to prevent injuries and

improve the health of athletes. These findings indicate the importance of smart technologies in the health and well-being of athletes. In Iran, many exercises are performed using traditional methods that are less efficient. Solutions such as creating training centers equipped with simulation technologies and smart tools, collaborating with scientific centers to develop evidence-based training methods, and holding training workshops for coaches on the use of technology in training can be fruitful. Additionally, incorporating data analytics into training programs can offer real-time feedback on an athlete's progress, helping to refine exercises and prevent overexertion. Personalized coaching systems, powered by AI, can ensure that training regimens are continuously adjusted to meet the individual needs of disabled and veteran athletes, leading to improved outcomes in both performance and recovery.

In the domain of health promotion and injury prevention, the integration of smart technologies such as wearable health monitors, AI-based fitness tracking applications, and real-time biometric sensors offers substantial potential for improving both immediate safety and long-term wellbeing of athletes. These tools can assist in tracking physiological indicators, detecting early signs of fatigue or imbalance, and recommending personalized interventions. However, in Iran, the adoption of such technologies among veteran and disabled athletes remains significantly limited, primarily due to high costs, lack of insurance coverage, and insufficient awareness about their benefits. To address this gap, it is essential to implement targeted subsidies for acquiring health-monitoring equipment, raise awareness through educational campaigns for athletes and coaches, and establish specialized sports health clinics focused on preventive care. Moreover, integrating these technologies into national rehabilitation and sports development programs could enhance accessibility and promote a culture of proactive health management.

The theme of empowerment and motivation of veteran and disabled athletes under the theme of individual empowerment of veteran and disabled athletes refers to access to new technologies such as training applications and self-learning systems that can help athletes become more independent and empowered. These results are in line with the research of Guo & Li (2021); they have confirmed the role of artificial intelligence in providing personalized training strategies. In Iran, the use of self-learning applications and tools is not yet widespread among veteran and disabled athletes. Also, many features have not been localized in Persian. Therefore, designing and developing Persian applications for veteran and disabled athletes, providing digital training to increase self-learning skills, and supporting content producers to develop digital educational resources are appropriate solutions. Moreover, implementing virtual reality (VR) or augmented reality (AR)-based training programs could provide these athletes with immersive, adaptive environments for skill enhancement and rehabilitation. These technologies would allow athletes to practice at their own pace, giving them the autonomy to engage in effective training at any time, fostering self-confidence, and building both mental and physical strength. To maximize the impact, it is essential that such tools are designed to be user-friendly, culturally relevant, and accessible to a broad range of individuals, regardless of their technological proficiency.

In the area of motivation and social support, communication technologies such as social networks and support applications can help strengthen the motivation and social support of athletes. These results are consistent with the findings of Alqahtani et al. (2021), who emphasized the need to pay attention to the individual and social differences of people with disabilities. Social networks are widely used in Iran, but have not been exploited in a structured way to support veteran and disabled athletes. Therefore, it is suggested that dedicated

platforms be created for communication between veteran athletes and coaches. The success stories of veteran athletes should be promoted on social media to increase motivation. Moreover, creating online communities where athletes can share their experiences, challenges, and achievements would foster a sense of belonging and emotional support. These platforms could also provide educational resources, wellness tips, and regular updates on upcoming events or competitions. Furthermore, through digital interactions, athletes could receive immediate feedback, enhancing engagement and creating opportunities for peer mentoring and group motivation. Developing such interactive, supportive ecosystems can significantly improve athletes' mental health and overall performance, ensuring they feel valued and connected within the broader sports community.

The theme of management and strategy under the theme of veterans and disabled sports management emphasizes that artificial intelligence can play a key role in resource management, competition planning, and budget allocation. Veterans and disabled sports management in Iran is often done in a traditional way, and modern management tools are rarely used. Therefore, solutions such as setting up digital management systems for sports organizations, training managers on the use of artificial intelligence in decision-making, and establishing international cooperation to update management methods are very useful. Additionally, AI can optimize resource distribution by analyzing historical data and predicting the needs of various teams, ensuring that limited resources are allocated where they are most needed. AI can also assist in planning competitions by analyzing athlete data, predicting performance trends, and providing insights into optimal matchups and scheduling. Furthermore, AI can improve the effectiveness of sports programs by identifying gaps in training, nutrition, or rehabilitation, helping to create a more tailored and efficient environment for athletes. These advancements in management will not only streamline operations but will also contribute to long-term sustainability by making the most efficient use of available resources.

In the development strategies section of veteran and disabled sports, the use of new technologies can help formulate sustainable development strategies. These results are consistent with the findings of Kirchner (2020) and Rajšp & Fister (2020), who emphasized the role of artificial intelligence in improving management processes and decision-making. Also, Zheng's (2016) research has addressed strategies to prevent obstacles in wheelchair sports, which is somewhat consistent with management issues. In Iran, the lack of long-term planning and limited use of scientific data in formulating strategies are fundamental challenges; therefore, the following suggestions are presented. Establishing specialized committees to formulate data-based strategies, utilizing the experiences of successful countries in this field, strengthening the connection between universities and sports organizations for knowledge and technology transfer. Additionally, leveraging AI-powered data analysis could assist in identifying trends and gaps in athlete participation and performance, helping to optimize the allocation of resources. Moreover, fostering collaborations with international sports organizations would allow Iran to access best practices, improve its competitive edge, and enhance infrastructure development. This approach would ensure that policies are not only informed by data but also by global innovations in adaptive sports.

The findings of this study highlight the multifaceted potential of artificial intelligence and new technologies to transform the landscape of sports for persons with disabilities and war injured veterans. Beyond improving athletic performance and training personalization, these technologies offer tools

for health monitoring, injury prevention, psychological support, and inclusive sport management. However, for these benefits to be fully realized, several practical steps are required. Policymakers and sport organizations must invest in the development and localization of adaptive technologies, ensure equitable access to smart equipment, and provide specialized training for coaches and technical staff. Furthermore, sports federations should foster collaborations with tech companies and research institutions to design user centered systems tailored to the unique needs of disabled and veteran athletes. From a research perspective, future studies should adopt interdisciplinary approaches to evaluate the long-term impacts of technology on athlete development, motivation, and inclusion. It is also critical to assess the ethical implications of AI deployment in adaptive sports to ensure fairness, data privacy, and accessibility. In sum, this study provides not only an empirical foundation but also a strategic direction for integrating intelligent technologies into the sustainable development of inclusive sport environments.

Conclusion

The present study aimed to explore the impact of integrating new technologies and artificial intelligence on the development of sports for veterans and individuals with disabilities, drawing from the lived experiences of experts in the field. The study identified 81 distinct concepts, grouped into four main themes: Sports Technology, with sub-themes focused on Technology and Equipment Development and Data Analysis and Management; Health and Welfare of Veterans and Disabled Athletes, categorized into Improving Training Methods and Health Promotion and Prevention; Empowerment and Motivation of Veterans and Disabled Athletes, with sub-themes covering Individual Empowerment and Motivation and Social Support; and Management and Strategy, which includes Management of Sports and Development Strategies in Veterans' and Disabled Sports. The findings highlight the far-reaching effects of technological innovations in enhancing athletic performance, improving health outcomes, and fostering greater social inclusion.

One of the key outcomes of this study is the recognition of how artificial intelligence can not only optimize training techniques but also provide real-time feedback for athletes, enabling a more personalized approach to their physical and psychological development. Additionally, wearable technologies and smart equipment have been shown to reduce injury risks and improve overall recovery times, which is crucial for individuals facing physical limitations. The integration of AI-driven data analysis in sports management also helps in designing data-driven strategies for resource allocation and event planning, further optimizing the management of veteran and disabled sports.

Moreover, the social and motivational benefits brought by new technologies cannot be understated. By using platforms for virtual engagement and online support, athletes experience stronger connections with their peers and coaches, boosting their sense of empowerment and social inclusion. These technologies have the potential to break down barriers of isolation, offering athletes the tools they need to build confidence, participate more fully, and remain engaged in their sport. In conclusion, the study provides a roadmap for the implementation of innovative solutions that can address both the physical and emotional challenges of veterans and disabled athletes, paving the way for more inclusive and effective sports development programs.

In addition to the advancements in training and management, this study emphasizes the critical role of technology in creating inclusive, equitable environments for disabled athletes. By providing targeted support through adaptive technologies, the integration of AI ensures that

training and performance optimization are not only accessible but also effective across varying levels of ability. Furthermore, the ability to track and predict athletes' progress through data analytics enables a continuous feedback loop, ensuring ongoing development and personalized care. This level of tailored intervention offers the potential to significantly enhance both the athletic experience and overall quality of life for veterans and disabled athletes.

References

[1] Alaghbari, M. A., Ateeq, A., Alzoraiki, M., Milhem, M., & Beshr, B. A. H. (2024, January). Integrating technology in human resource management: innovations and advancements for the modern workplace. In *2024 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETSIS)* (pp. 307-311). IEEE.

[2] Alqahtani, S., Joseph, J., Dicianno, B., Layton, N. A., Toro, M. L., Ferretti, E., & Cooper, R. (2021). Stakeholder perspectives on research and development priorities for mobility assistive-technology: a literature review. Disability and Rehabilitation: Assistive Technology, 16(4), 362-376.

[3] Brittain, I., Bunds, K., & Bocarro, J. (2024). The contribution of sport in the rehabilitation process of disabled military veterans: A case study of the 2016 Invictus Games. *Journal of Global Sport Management*, *9*(1), 62-85.

[4] Cassidy, S. P., & Albanesi, H. (2023). "You haven't gone out and done anything": Exploring Disabled Veterans Experiences in Higher Education. *Armed Forces & Society*, *49*(2), 507-530.

[5] Cheng, J., & Wang, X. (2021). Artificial intelligence based on effectiveness of inverted classroom teaching of college sports. Journal of intelligent & Fuzzy Systems, 40(2), 3755-3765.

[6] Chase, C. (2020). The data revolution: Cloud computing, artificial intelligence, and machine learning in the future of sports. *21st Century Sports: How Technologies Will Change Sports in the Digital Age*, 175-189.

[7] Guo, Q., & Li, B. (2021). Role of AI physical education based on application of functional sports training. Journal of Intelligent & Fuzzy Systems, 40(2), 3337-3345.

[8] Harris, E. J., Khoo, I. H., & Demircan, E. (2022). A survey of human gait-based artificial intelligence applications. *Frontiers in Robotics and AI*, *8*, 749274.

[9] Kang, S., & Kang, S. (2019). The study on the application of virtual reality in adapted physical education. Cluster computing, 22, 2351-2355.

[10] Kang, Y. S., & Lee, G. Y. (2015). The effect of a virtual reality-based exercise program utilizing video game on health-related physical activity and physical activity level in adults with developmental disability. Korean Soc. Adapt. Phys. Act. Exerc, 23(4), 15-29.

[11] Kirchner, F. (2020). Robotics and AI: How Technology May Change the Way We Shape Our Bodies and What This Does to the Mind. 21st Century Sports: How Technologies Will Change Sports in the Digital Age, 73-89.

[12] Korteling, J. H., van de Boer-Visschedijk, G. C., Blankendaal, R. A., Boonekamp, R. C., & Eikelboom, A. R. (2021). Human-versus artificial intelligence. *Frontiers in artificial intelligence*, *4*, 622364.

[13] Ling, W., Yu, G., & Li, Z. (2019). Lower limb exercise rehabilitation assessment based on artificial intelligence and medical big data. IEEE Access, 7, 126787-126798.

[14] Linu, A., & Balasubramanian, K. (2020). Sports technology development of physically challenged students and intellectually disabled students in the field

of physical education. In International Conference on Enhancing Skills in Physical Education and Sport Science.

[15] Mateus, N., Abade, E., Coutinho, D., Gómez, M. Á., Peñas, C. L., & Sampaio, J. (2024). Empowering the Sports Scientist with Artificial Intelligence in Training, Performance, and Health Management. *Sensors*, *25*(1), 139.

[16] Mercado-Aguirre, I. M., & Contreras-Ortiz, S. H. (2017). Design and construction of a wearable wireless electrogoniometer for joint angle measurements in sports. In *VII Latin American Congress on Biomedical Engineering CLAIB 2016, Bucaramanga, Santander, Colombia, October 26th-28th, 2016* (pp. 389-392). Springer Singapore.

[17] Nahavandi, D., Alizadehsani, R., Khosravi, A., & Acharya, U. R. (2022). Application of artificial intelligence in wearable devices: Opportunities and challenges. *Computer Methods and Programs in Biomedicine*, *213*, 106541.

[18] Rajšp, A., & Fister Jr, I. (2020). A systematic literature review of intelligent data analysis methods for smart sport training. *Applied Sciences*, *10*(9), 3013.

[19] Rane, N., Choudhary, S., & Rane, J. (2023). Enhanced product design and development using Artificial Intelligence (AI), virtual reality (VR), augmented reality (AR), 4D/5d/6d printing, internet of things (IOT), and Blockchain: A review. *Virtual Reality (VR), Augmented Reality (AR) D*, *4*.

[20] Rum, L., Sten, O., Vendrame, E., Belluscio, V., Camomilla, V., Vannozzi, G., & Bergamini, E. (2021). Wearable sensors in sports for persons with disability: A systematic review. *Sensors*, *21*(5), 1858.

[21] Srivastava, P. K., Pandey, R. K., Srivastava, G. K., Anand, N., Krishna, K. R., Singhal, P., & Sharma, A. (2024). Intelligent Integration of Wearable Sensors and Artificial Intelligence for Real-time Athletic Performance Enhancement. *Journal of Intelligent Systems & Internet of Things*, *13*(2).

[22] Senjam, S. S., Foster, A., Bascaran, C., Vashist, P., & Gupta, V. (2020). Assistive technology for students with visual disability in schools for the blind in Delhi. *Disability and Rehabilitation: Assistive Technology*, *15*(6), 663-669.

[23] Yilmaz, A., Kirimoglu, H., & Mirze, F. (2020). Examining the Sports Participation Motivation Levels of Physically Disabled and Hearing-Impaired Athletes. *International Journal of Applied Exercise Physiology*, *9*(3), 55-65.

[24] Vakili tanha, M., ahmadi, S. and Soleimani, M. (2020). Identify and Formulate a Model of Motivations for Sports Participation of Veterans and Disabled. Sport Psychology Studies, 8(30), 143-160.

[25] Wang, L. (2023). Analysis of sports training and load forecasting using an improved artificial neural network. *Soft Computing*, *27*(19), 14515-14527.

[26] Wang, P. (2023). Evaluation and analysis of effectiveness and training process quality based on an interpretable optimization algorithm: The case study of teaching and learning plan in taekwondo sport. *Applied Artificial Intelligence*, *37*(1), 2189667.

[27] Wang, W., Liu, Q., & Shu, C. (2024). The Analysis of Communication Strategy of Disabled Sports Information Based on Deep Learning and the Internet of Things. *IEEE Access*.

[28] Willingham, T. B., Stowell, J., Collier, G., & Backus, D. (2024). Leveraging emerging technologies to expand accessibility and improve precision in rehabilitation and exercise for people with disabilities. *International journal of environmental research and public health*, *21*(1), 79.

[29] Zheng, Y. (2016). Research on the application of PID control technology combined with fnn algorithm in intelligent wheelchair obstacle avoidance for disabled athletes. Romanian Review Precision Mechanics, Optics & Mechatronics, (49), 134.