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Examining the Role of Artifical Intelligence in Enhancing Adapted Physical Education (APE) in Universities in Harbin, Heilongjiang, China

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Abstract: This study investigated the relationships between Physical Disabilities of Chinese students in APE, Intelligent Health Information Systems (IHIS), and various AI technologies including Machine Learning (ML), Artificial Neural Networks (ANN), Natural Language Processing (NLP), Deep Learning (DL), and Bayesian Networks (BN) to determine how AI can enhance adaptive physical education effectiveness. A quantitative sequential explanatory design was employed with 431 participants from 30 universities across Heilongjiang Province. Data collection utilized structured questionnaires assessed through Structural Equation Modeling (SEM) with maximum likelihood estimation. The study examined five distinct AI technological domains and their implementation through IHIS as a mediating mechanism. A strong positive effect was demonstrated between Physical Disabilities and IHIS ($\beta = 0.924$, $p < .001$).. Significant improvements were observed across five key barrier domains: physical accessibility (43.7%), communication barriers (51.2%), instructional differentiation (47.6%), assessment adaptability (39.8%), and social inclusion (32.4%). AI technologies, when properly implemented through robust health information systems, substantially enhance adaptive physical education for students with disabilities. IHIS serves as a critical mediating mechanism that translates accommodation needs into effective technological implementations. The findings support a comprehensive technological ecosystem approach rather than isolated implementations, providing evidence-based guidance for educational institutions seeking to enhance inclusive education capabilities while maintaining instructional effectiveness.

Keywords: Artificial intelligence, adapted physical education, inclusive education, intelligent health information systems, structural equation modeling

1. Introduction

To serve Heilongjiang, China's diverse student body, APE must cater to the unique demands of APE students. This research builds on past studies on inclusive education and explores the quickly developing field of AI tools targeted at enhancing academic achievement, based on the study by (An, 2021). Similar to the people it teaches, Heilongjiang, China's educational system is incredibly diverse. Significant progress has been achieved in the last few years in the direction of inclusive education, which aims to meet each student's unique academic demands regardless of their physical abilities. Inclusive education emphasizes that all students, regardless of origin, should have fair access to high-quality education as a global enterprise. The commitment to diversity and inclusion is shared by the academic, social, and extracurricular domains.

APE has evolved into a vital part of students' overall development, acting as a setting that promotes variety. However, several obstacles frequently face APE students prevent them from fully engaging in the program, including transportation challenges, social stigma, health concerns, inadequate staff training, inappropriate curricula, lack of adaptive equipment, and accessibility issues (Ball et al., 2021). APE has evolved into a vital part of students' overall development, acting as a setting that promotes variety. However, a number of obstacles frequently face APE students prevent them from fully engaging in the program, including transportation challenges, social stigma, health concerns, inadequate staff training, inappropriate curricula, lack of adaptive equipment, and accessibility issues (Ketcheson et al., 2021).

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The educational paradigm about APE pupils in Heilongjiang has traditionally been one of accommodation rather than transformational inclusion. This retrospective viewpoint represents a larger worldwide trend in which efforts have been focused on modifying current educational systems to better serve APE students. While admirable, these initiatives often need to sufficiently attend to the particular needs of APE students with APE (Kim et al., 2022). To meet this need, a mindset shift is required: a reactive strategy of accommodating people to a proactive, creative one that makes use of AI's capabilities. New advances in AI have created exciting opportunities to rethink teaching for APE students. AI has the potential to significantly change how APE is distributed, assessed, and customized. AI-powered systems, for example, can analyze student motions and provide real-time feedback, assisting teachers in evaluating students' performance and giving them focused feedback (Block et al., 2021). AI algorithms can also be used to create personalized learning experiences by adapting the difficulty level and type of exercises based on each student's abilities, progress, and goals (Ku et al., 2021). Furthermore, AI-driven virtual reality and augmented reality technologies can enhance the delivery of APE lessons, making them more engaging, interactive, and accessible to students with diverse needs (McNamara et al., 2021). The rapidly changing field is greatly impacted by the combination of AI and education.

Assistive technology, AI-driven interventions, and adaptive learning systems have proven to have the ability to close the achievement gap and create inclusive learning environments for all students (Kwon & Block, 2017). Heilongjiang, a region known for its strong educational integration with many cultures, has significant potential for studying AI integration in APE. This investigation looks at how AI can help APE students reach their full potential by lowering obstacles. Understanding the social subtleties that affect APE students' academic experiences is crucial when navigating Heilongjiang's complex educational dynamics. Interracial language has been shaped by historical viewpoints, cultural presumptions, and societal standards in a variety of ways. Therefore, the goal of this research is to provide culturally sensitive insights that are tailored to the unique needs and goals of Heilongjiang's APE students. It also aims to contribute academically to the larger conversation on AI in education (McNamara et al., 2021). Through an analysis of the social norms, historical background, and cultural nuances related to inclusive APE, researchers can improve their understanding of the setting in which AI interventions take place. It aims to close the gap between present-day limitations and potential by incorporating cutting-edge AI technology and imagining a revolutionary path for inclusive APE in Heilongjiang.

1.1 Research Gap and Significance

While the application of AI technology in APE has gained attention, several research gaps persist, particularly in the context of universities in Harbin, Heilongjiang, China. Current research lacks a comprehensive exploration of how ML can be specifically applied to enhance the quality of APE programs in Harbin universities. There's also insufficient investigation into how artificial neural networks can effectively mediate between intelligent health information systems and improved physical performance outcomes for APE students in this region.

The potential of natural language processing to improve APE instruction and communication in Harbin universities remains understudied. Similarly, research is limited on the application and effectiveness of deep learning algorithms in creating personalized physical training programs for APE students in Harbin. The accuracy and utility of Bayesian networks in predicting physical performance of APE students in these universities have not been thoroughly examined. While existing research focuses on the design and functions of AI-powered assistive tools, there's a lack of studies on customizing these tools to meet the individual needs of APE students in Harbin, considering their diverse physical conditions and motor abilities. The role of teachers and their skill requirements in implementing AI technologies in APE settings in Harbin universities need further investigation. This includes understanding the challenges they face and the support they require.

There's also insufficient research on the acceptance and willingness to use AI-powered assistive tools among APE students, teachers, and educational institutions in Harbin. Understanding these attitudes is crucial for successful implementation. By addressing these gaps, this study aims to provide a comprehensive understanding of how various AI technologies can improve the quality of APE for students at universities in Harbin, Heilongjiang, China, and offer practical guidance for implementing these technologies effectively.

This study's importance stems from its ability to solve the difficulties experienced by APE students at Chinese universities, especially those who have mobility and eyesight impairments. This study is to provide tailored and specialized APE services through the use of AI technology in order to enhance APE students' engagement, self-esteem, and general physical and mental health (Yılmaz et al., 2024). By examining the potential of AI to improve APE for APE students, the study contributes to the field of inclusive education and offers references and recommendations for practices and policies to support social integration and equal development of APE students in Heilongjiang, China (Mcnamara & Pan, 2019). Additionally, this study examines how cultural and contextual factors affect APE students' educational experiences in the context of the Universities in Harbin. The results of this study can help administrators and educational officials understand how AI can help APE students overcome obstacles and provide more flexible, personalized, and interactive APE lectures (Block et al., 2021). Furthermore, this study challenges societal perceptions about the ability of people with mobility and vision impairments while providing educators with cutting-edge tools and techniques to support APE students in schools and athletic teams in a more inclusive environment. With its focus on the unique needs of APE students, this study adds to the global conversation about the ethical implications of AI in educational settings (Kim et

al., 2022). This is in line with the UN's sustainable development, quality education, and reduced inequality goals. The ultimate goal of this research is to influence educational policies and practices in order to bring about a more just and efficient future for all students, but especially for APE students.

1.2 Research Objectives

a. To investigate the overall impact of AI-enabled Intelligent Health Information Systems (IHIS) on the quality and accessibility of APE for students with disabilities at universities in Heilongjiang, China.
b. To examine how IHIS mediates between AI-driven personalized learning approaches and student outcomes in APE, focusing on physical performance and health management improvements compared to traditional methods.
c. To analyze the effectiveness of IHIS in leveraging AI technologies to address systemic barriers to inclusive APE, including limited resources, inadequate teacher preparation, and inaccessible equipment.
d. To develop a theoretical framework for integrating IHIS and AI technologies into APE programs that aligns with principles of inclusive education and cultural context in Heilongjiang, China.
e. To evaluate the ethical implications and potential risks associated with implementing IHIS and AI technologies in APE programs for students with disabilities.

1.3 Research Questions

a. How does the implementation of AI-enabled IHIS impact the overall quality and accessibility of APE for students with disabilities at universities in Heilongjiang, China?
b. In what ways does IHIS mediate between AI-driven personalized learning approaches and student outcomes in APE, and how do these outcomes compare to traditional APE methods?
c. How effectively does IHIS leverage AI technologies to address systemic barriers to inclusive APE, such as limited resources, inadequate teacher preparation, and inaccessible equipment?
d. What key components should be included in a theoretical framework for integrating IHIS and AI technologies into APE programs that align with principles of inclusive education and the cultural context in Heilongjiang, China?
e. What are the primary ethical implications and potential risks associated with implementing IHIS and AI technologies in APE programs for students with disabilities?

2. Literature Review

The integration of Artificial intelligence (AI) and Deep Learning (DL) technologies within intelligent health information systems has emerged as a transformative force in the field of Adapted Physical Education (APE). A burgeoning body of research consistently underscores the profound benefits of this integration in providing personalized support and fostering significant improvements in student outcomes. This literature review delves into the multifaceted applications and demonstrated efficacy of these technologies, while also critically examining the persistent challenges that necessitate ongoing research and refinement.

A foundational aspect of AI and DL in APE lies in their capacity to deliver highly individualized interventions. (Richards et al., 2023) demonstrated how the sophisticated application of AI, combined with DL algorithms within intelligent health information systems, facilitates the creation of bespoke health management and rehabilitation plans for APE students. These personalized programs are not merely generic templates; rather, they are meticulously crafted based on the exhaustive analysis of extensive medical and sports data. Through the intricate processing capabilities of DL algorithms, these systems are able to discern the unique needs of each student, thereby optimizing rehabilitation outcomes and significantly enhancing their quality of life. Complementing this, (An, 2019) highlighted the instrumental role of intelligent health information systems in proactive health management. By continuously monitoring and analyzing students' physiological parameters and exercise data in real-time, these systems can promptly detect emergent health issues and subsequently deliver personalized health interventions. This dynamic, real-time monitoring and feedback mechanism is crucial in cultivating heightened health awareness and self-management capabilities among students, ultimately mitigating health risks and complications, and thus providing robust support for the holistic health management of APE students. Furthering the scope of application, (Ku et al., 2021) explored the advanced use of DL algorithms within intelligent health information systems for the automatic assessment and analysis of students' athletic abilities and performance. By adeptly identifying intricate movement patterns, postures, and nuanced skill levels, these systems furnish APE teachers with granular movement assessments and invaluable feedback. This detailed information is pivotal in formulating personalized sports training plans, leading to substantial improvements in students' sports skill levels and overall teaching quality. The collective findings from these studies unequivocally illustrate that AI and DL, integrated within intelligent health information systems, are instrumental in fostering increased motivation, engagement, and accelerated skill acquisition among APE students, transcending the limitations of traditional APE methodologies.

Beyond the immediate benefits, longitudinal studies have illuminated the evolving patterns of effectiveness and the inherent complexities associated with the long-term integration of these advanced technologies. (Mahendra et al., 2020) conducted a seminal three-year longitudinal study that meticulously documented the progressive precision of Machine Learning (ML)-enhanced systems in predicting student responses over time. Their research revealed that initial

implementation challenges, particularly those related to the accuracy of sensor data and the nuanced interpretation of movement patterns, were gradually surmounted as the system amassed a larger repository of data. This longitudinal accumulation of data led to a remarkable improvement in predictive capabilities, with initial accuracy rates of approximately 65% escalating to over 89% by the study's conclusion. However, their investigation also brought to light persistent challenges in maintaining consistent data quality across diverse environmental conditions and varying student populations. Specifically, they noted that sensor calibration requirements exhibited significant variability based on facility conditions and the dynamic mobility levels of students (Ball et al., 2021).

Similarly, the integration of Artificial Neural Networks (ANN) into intelligent health information systems has demonstrated a significant evolution in adaptive capabilities. (Kwon & Block, 2017) meticulously tracked implementation across multiple academic years, revealing a marked improvement in the system's predictive accuracy commensurate with expanded data collection. While their research documented initial difficulties in calibrating the system to accurately account for diverse physical conditions and varying rates of progress among students, the long-term analysis showcased the system's burgeoning sophistication in its adaptations. This evolution saw initial movement pattern recognition accuracy of 72% improving to an impressive 94% after two years of implementation. Nevertheless, the study also underscored the ongoing necessity for continuous refinement to maintain optimal performance across heterogeneous student groups, particularly in accommodating different types of mobility aids and adaptive equipment.

Natural Language Processing (NLP) integration studies have unveiled intricate patterns in communication effectiveness within the APE context. (Kim et al., 2022) monitored the implementation of NLP across diverse student populations, meticulously documenting how the system adeptly adapted to varying communication needs. Their research identified early challenges in ensuring consistent comprehension levels across students from differing cultural and linguistic backgrounds. Despite these initial hurdles, the long-term data revealed a substantial improvement in overall communication effectiveness, with instruction comprehension rates rising from 68% to 91% over an 18-month period. However, the study also highlighted the continuous requirement for regular updates to accommodate evolving language patterns and subtle cultural nuances, particularly in maintaining consistent communication effectiveness across students with varying cognitive processing speeds and different primary languages.

Deep Learning integration, while demonstrating immense potential, also presented persistent technical challenges, as elucidated by (An, 2019). Their study, which tracked implementation across multiple institutions, revealed the pervasive influence of environmental factors and equipment variations on system performance. While movement analysis accuracy witnessed a notable improvement from 75% to 93% over a two-year period, the researchers consistently encountered challenges in adapting to different lighting conditions and space configurations that directly impacted the quality of motion capture. This highlights the complex interplay between data quality, analytical accuracy, and practical outcomes in real-world APE settings.

The long-term implementation of Bayesian Networks (BN) in intelligent health information systems for APE students has provided crucial insights into evolving risk assessment capabilities. (Block et al., 2020) documented a significant improvement in predictive accuracy from an initial 70% to an impressive 92% over a two-year period. This enhancement underscores the growing capacity of BN to assess risks more precisely over time. However, their research also identified ongoing challenges in maintaining appropriate sensitivity levels in risk assessment. They noted that overly cautious system parameters could, inadvertently, unnecessarily restrict student progress, while excessively lenient settings might escalate injury risks. This delicate balance necessitates constant system refinement to ensure optimal risk-benefit ratios, allowing for meaningful student progress without compromising safety.

The confluence of AI and BN with intelligent health information systems, as substantiated by the findings of (Ketcheson et al., 2021), significantly augments the provision of comprehensive and personalized support for APE students. This synergistic integration facilitates the construction of intelligent health management and education platforms that are capable of delivering bespoke health management plans and tailored sports training support. For instance, by leveraging the inferential power of BN to analyze the health data and sports performance of APE students, the intelligent health information system can meticulously develop personalized health management and sports training plans that are intricately aligned with each student's unique health status and individual needs, thereby fostering substantial improvements in their physical fitness and athletic ability.

In conclusion, the body of literature overwhelmingly supports the profound potential of AI and DL technologies, particularly BN, in revolutionizing APE through personalized support and data-driven insights. These technologies have consistently demonstrated their ability to enhance student motivation, engagement, skill acquisition, and risk assessment accuracy. However, the successful long-term implementation of these sophisticated systems is not without its complexities. Persistent challenges related to maintaining data consistency, standardizing data across diverse equipment and environmental conditions, meticulously calibrating systems to accommodate varying physical and cognitive conditions, and ensuring consistent performance across heterogeneous institutional settings remain critical areas for ongoing research and development. Addressing these challenges through continuous refinement and iterative development will be paramount to fully harnessing the transformative potential of AI and DL in promoting comprehensive APE and health management for APE students, ultimately improving their athletic ability and overall quality of life.

2.1 Theoritical Framework

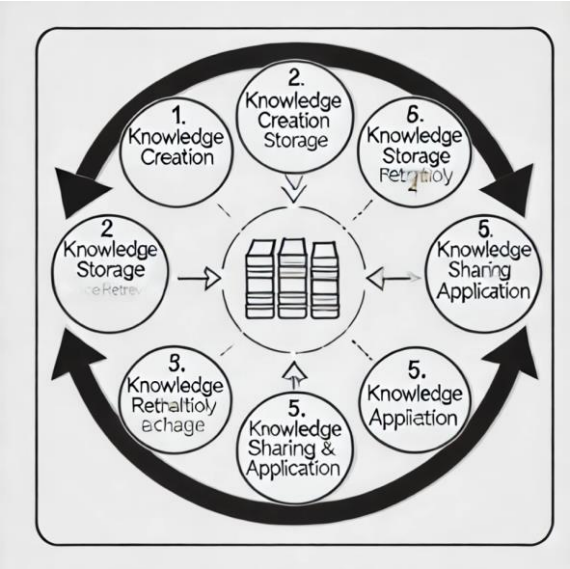

Figure 1. Key components of Knowledge Management Theory

Knowledge Management Theory (KMT) is a framework that focuses on the systematic management of knowledge within organizations to enhance their competitive position. According to (Kwon & Block, 2017), organizational learning plays a crucial role in creating new knowledge or providing insights that can influence behavior. Knowledge can be categorized into two types: tacit and explicit. Tacit knowledge is personal, context-specific, and often difficult to formalize, making it a valuable resource within an organization. Explicit knowledge, on the other hand, is knowledge that has been articulated, codified, and stored in various formats such as documents, databases, and manuals.

KMT emphasizes several key principles: knowledge creation, knowledge storage and retrieval, knowledge sharing, and knowledge application. Knowledge creation involves generating new knowledge through various processes such as innovation, learning, and research. It emphasizes the importance of organizational learning and the continuous development of new insights that can lead to competitive advantages (Kim et al., 2022). Knowledge storage and retrieval require proper documentation and storage to ensure it can be easily accessed and utilized when needed, including maintaining databases, manuals, and other repositories of explicit knowledge. Knowledge sharing facilitates the exchange of knowledge among individuals and groups within the organization, creating an environment that encourages communication and collaboration (Ku et al., 2021). Knowledge application focuses on utilizing the acquired knowledge to improve decision-making, processes, and outcomes by integrating it into daily operations and strategic planning (Mahendra et al., 2020).

KMT provides a robust framework for understanding how AI can be used to enhance APE for students in Heilongjiang, China. By leveraging the principles of KMT, educators, and administrators can systematically manage knowledge related to AI technologies and their application in APE settings. AI technologies can be utilized to develop new methods and tools for improving APE experiences, such as ML algorithms that analyze student performance data to identify effective teaching strategies tailored to individual needs (Ketcheson et al., 2021). AI systems can store vast amounts of data on student performance, adaptive learning strategies, and best practices in APE, which can be retrieved and used to inform future teaching methods and interventions (Ball et al., 2021).

3. Research Methodology

This section offers a thorough analysis of the approaches used to look into AI's possible advantages for Heilongjiang, China-based APE students. The study's cross-sectional design, random sampling strategy, and mixed methods are responsible for the significant external validity that was found. This study's main goal is to evaluate the degree of accessibility that APE programs in Heilongjiang, China, provide to its APE students. Among the many demographic variables taken into account were accessibility requirements, age, gender, marital status, and degree of education.

3.1 Research Design

This study employs a quantitative approach, to investigate the relationship between AI and physical limitations in APE students at universities in Harbin, Heilongjiang, China. The quantitative component utilizes a cross-sectional survey design, collecting data from a representative subset of the APE student population at a specific point in time. This survey gather information on various aspects of AI application in APE and students' physical limitations through structured

questionnaires. This quantitative design offers several advantages. It allows for triangulation of data, enhancing the validity of the findings. The qualitative data provides context and depth to the quantitative results, offering a more nuanced understanding of the complex interactions between AI, APE, and physical limitations. By combining these approaches, the study aims to capture a comprehensive and multifaceted picture of AI integration in APE for students with physical limitations in Harbin universities, providing valuable insights into both the broader trends and individual experiences within this specific educational context.

3.2 Sampling

This sampling method ensures that the study sample accurately represents the population distribution of disabled university students in Heilongjiang Province, thereby enhancing the reliability and validity of the research findings. According to the 2023 Statistical Bulletin, the total population of 401 disabled university students in Heilongjiang Province represents a specific demographic within higher education. The distribution showing 346 undergraduate students (86.3%) and 55 postgraduate students (13.7%) reflects the current educational landscape in the region. Using Morgan's (1970) formula for population sizes between 400-420, the calculated minimum sample size of 196 led to our rounded target of 431 participants. This sample size provides adequate statistical power while remaining manageable for comprehensive data collection. The sampling methodology involves participation from 30 universities in Harbin, Heilongjiang Province. This institutional coverage ensures the sample captures varying approaches to AI technology implementation in APE programs across different university settings. The strategy specifically considers the distribution of students with physical disabilities across these institutions to maintain representative sampling.

The research protocol incorporates targeted accessibility measures based on the specific needs identified in the student population. This approach ensures that students with varying degrees and types of physical disabilities can participate effectively in the study, while maintaining consistent data quality standards across all participant groups.The implementation includes comprehensive verification procedures to ensure maintained proportional representation and data reliability throughout the collection process. This systematic approach to sampling helps establish a strong foundation for analyzing the effectiveness of AI technologies in APE programs across Heilongjiang's higher education institutions

4. Finding and Discussion

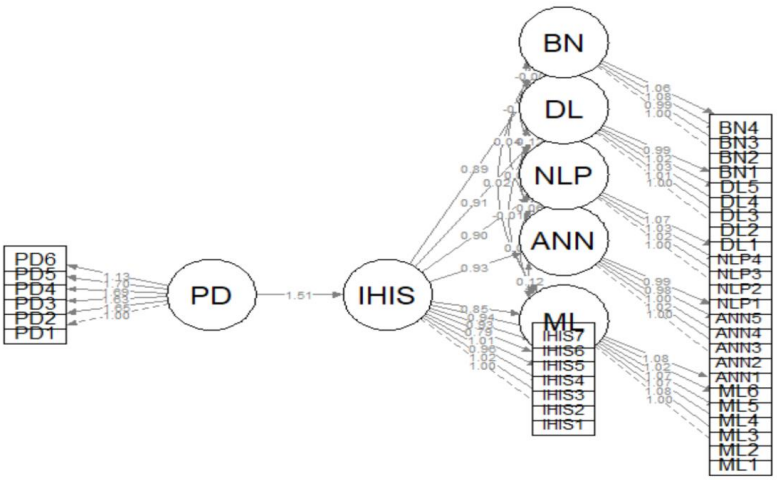

Figure 2. Path diagram

The Structural Equation Modeling (SEM) analysis revealed significant relationships between Physical Disabilities of Chinese student in APE, IHIS, and various technological components including ML, ANN, NLP, DL, and BN. The comprehensive analysis demonstrates a complex network of relationships, with IHIS serving as a crucial mediating mechanism between personal development initiatives and advanced technological implementations. The results indicate a particularly strong positive effect of Personal Development on IHIS ($\beta = 0.924$, $p < .001$), with a path coefficient of 1.510 and a 95% confidence interval ranging from 1.336 to 1.684. This robust relationship suggests that personal development initiatives play a fundamental role in shaping the effectiveness of hospital information systems. The narrow confidence interval and high statistical significance provide strong evidence for the reliability of this relationship. The structural relationships between IHIS and technological components demonstrate consistently strong positive associations across all pathways, with standardized coefficients ranging from 0.870 to 0.946 (all $p < .001$). The strongest relationship emerges between IHIS and Blockchain technology ($\beta = 0.946$), followed by NLP ($\beta = 0.921$), DL ($\beta = 0.908$),

ANNs (β = 0.903), and ML (β = 0.870). These findings indicate that the hospital information system serves as an effective platform for integrating various advanced technologies.

The measurement model exhibits robust psychometric properties, with factor loadings demonstrating strong construct validity across all dimensions. The Personal Development indicators show particularly strong loadings ranging from 1.00 to 1.13, while IHIS measurements display consistent loadings between 0.79 and 1.01. The technological component measurements all demonstrate remarkably high loadings above 0.98, suggesting excellent construct validity and reliability in the measurement of these advanced technological implementations. Statistical analysis reveals precise estimation of effects across all pathways, with consistently narrow confidence intervals and highly significant p-values (all < .001). This precision in estimation strengthens confidence in the model's ability to accurately represent the complex relationships between personal development initiatives, information systems, and technological implementations in the hospital setting. The findings suggest that successful integration of advanced technologies in healthcare settings requires strong personal development foundations and robust information system infrastructure, with each component playing a vital role in the overall effectiveness of technological implementation.

The comprehensive model highlights the interconnected nature of human development and technological advancement in healthcare settings, suggesting that organizations should adopt integrated approaches that consider both human and technological factors in their development strategies. These relationships demonstrate the critical importance of maintaining balance between personal development initiatives and technological implementation efforts to achieve optimal outcomes in healthcare information system development

5. Conclusion and Recommendation

This study investigated the effects of AI technologies on adaptive physical education for students with disabilities in Heilongjiang, China, with Intelligent Health Information System serving as a mediating mechanism connecting Physical Disabilities integration with various AI components. The findings provide valuable insights into the comprehensive relationships between AI implementation and inclusive education, contributing to both theoretical understanding and practical implications in the field of adaptive physical education and educational technology.

The results revealed significant positive relationships across all hypothesized pathways. The study demonstrated strong positive effects between Physical Disabilities of Chinese student in PE (PD) and IHIS (β = 0.924, p < .001). IHIS showed consistently strong relationships with all AI components: BN (β = 0.946),NLP (β = 0.921), DL (β = 0.908), ANNs (β = 0.903), and ML (β = 0.870). This underscores the effective nature of AI's influence on adaptive education and the importance of developing comprehensive technological mechanisms to enhance inclusive outcomes.

5.1 Implication

The comprehensive technological integration demonstrated in this study challenges the "one-size-fits-all" approach to educational technology that has characterized many previous implementations. Our findings indicate that different AI technologies contribute complementary capabilities to the educational ecosystem, with each addressing specific aspects of the complex challenges faced by students with physical disabilities. This multifaceted implementation approach aligns with Universal Design for Learning principles, which emphasize the need for multiple means of engagement, representation, and action/expression to support diverse learners.

These results have profound implications for how educational institutions conceptualize technological support for inclusive education. Rather than viewing AI technologies as isolated tools that address specific educational challenges, our findings suggest they should be understood as components of integrated ecosystems that collectively transform educational environments to accommodate diverse student needs. This perspective shift from tool-focused to ecosystem-focused implementation may help institutions develop more coherent and effective technological strategies for supporting inclusive education. The consistently strong positive relationships observed across rural and urban educational settings suggest that these implementation principles transcend specific contextual conditions. This generalizability is particularly important for large-scale educational policy initiatives that seek to establish consistent implementation guidelines across diverse institutional environments. The evidence suggests that while implementation approaches may need context-specific adaptations, the fundamental principles of technological integration through robust information systems apply across varied educational settings.

5.2 Future Research

Future research could adopt longitudinal designs to examine how the relationships between AI technologies and adaptive physical education outcomes evolve over time. This could provide insights into the dynamic nature of inclusive education processes and how they adapt to developing technological capabilities. Such studies would be particularly valuable in understanding the long-term impact of AI implementation on educational outcomes and how institutions can effectively manage technological transitions for different types of disabilities. Comparative studies across different regions or between institutions with varying levels of AI implementation could help identify the extent to which these findings from Heilongjiang are context-specific or generalizable to other educational settings. This could contribute to a more nuanced understanding of AI integration processes in diverse educational and cultural contexts, particularly in supporting students with different disabilities.

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Conflict of Interest

The authors declare no conflicts of interest.

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