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Research paper

Research on AI Interaction to Promote Junior School Students' Interest in Physical Learning and Health Behaviors: A Big Data Analysis

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Abstract

This research investigates the potential impact of AI-driven tools on student engagement in physical education, focusing on physical activity participation, health behaviors, and overall well-being. A quantitative approach with big data analysis was employed to analyze how AI interactions influenced junior school students' interest in physical education and their health outcomes. Data were collected from AI-powered educational platforms tracking students' physical activities, health behaviors, and engagement with physical education programs. A total of 1,000 students from Shandong Province participated in the study, and the data were processed using regression analysis and ma-machine learning models. The results showed a significant positive correlation between AI interaction frequency and both physical activity participation and health behaviors. The findings indicate that as the frequency of AI interactions increased, students' physical activity levels and health behaviors improved, suggesting that AI-driven tools are effective in promoting healthier lifestyles. The research also highlights that personalized AI interventions, such as virtual coaches and gamified fitness apps, played a critical role in increasing student engagement in physical education. However, the limitation of this study is that the sample is confined to junior high school students in Shandong Province, and the results may not fully reflect the situation in other regions or age groups. Future research could expand the sample size and examine the long-term effects of AI tools in various educational settings to provide further insights into their potential for improving student health outcomes and education quality.

Keywords: *AI-Driven Tools; Physical Education; Health Behaviors; Student Engagement; Big Data Analysis.*

1. Introduction

In recent years, artificial intelligence (AI) has demonstrated significant potential for transforming various educational domains, particularly in physical education. AI has the capacity to offer personalized learning experiences, real-time feedback, and interactive platforms, which not only enhance students' learning motivation but also foster healthy behaviors, especially in physical education (Zhou et al., 2024; Bhutoria, 2022; Pesovski et al., 2024). Traditional physical education methods often fail to meet the individual needs of students and struggle to sustain their interest, leading to limited long-term success in promoting healthy behaviors (Fernandez-Rio & Iglesias, 2022; Chen & Ennis, 2004). The introduction of AI can address these limitations by providing more personalized, interactive learning experiences, thus boosting students' interest in physical education and encouraging the development of lifelong healthy habits (Lee & Lee, 2021).

Although physical education plays a critical role in promoting students' physical health and overall development, current teaching methods face considerable challenges in increasing student engagement and fostering long-term health behavior changes (Gardner et al., 2021; Christodoulos et al., 2006). This is especially true in Shandong Province, where many schools still rely on traditional teaching methods that lack interactive and personalized components. Students' participation in physical education remains low, and traditional teaching approaches fail to inspire active involvement, making it difficult to achieve lasting health behavior changes (Munk & Agergaard, 2018). The application of AI presents a promising solution to these challenges, particularly by leveraging real-time monitoring, data analysis, and personalized feedback to adapt the learning process to individual students, thereby improving their engagement in physical activities and supporting the development of healthier behaviors (Zhang et al., 2022; Yang et al., 2020).

The current body of research on AI in physical education has made initial strides in demonstrating its potential to enhance student engagement and promote health behaviors. For instance, Hu et al. (2024) found that AI can analyze students' physical activity data to create personalized exercise plans, which help improve their physical fitness and increase their participation in physical activities. This personalized approach can better address the diverse needs of students and support the development of healthy exercise habits over time. Further research by Song (2024) also highlights the benefits of integrating gamification with AI, showing that such an approach significantly increases students' interest in physical activities and enhances their physical performance in a fun and interactive environment. However, while existing research shows that AI can effectively increase students' engagement in physical education in the short term, few studies have explored its long-term impact on students' health behaviors. Goodyear et al. (2021) argue that although AI can improve

students' short-term participation through real-time feedback and personalized exercise guidance, this external motivation may not sustain over time, particularly in the absence of continuous interaction and supervision. Students' initial interest may gradually diminish as time passes, limiting the long-term effectiveness of AI in physical education. This raises the critical question of how AI can sustain healthy behaviors over time, particularly in the absence of teacher supervision and guidance, which remains an area in need of further exploration.
Additionally, while AI's role in promoting health behaviors has been investigated, most studies focus primarily on physical activity and fitness. There is a lack of research on AI's potential to influence other aspects of health behaviors, such as nutrition and sleep. Yangsheng and Saravanan (2020) argue that AI should not only focus on students' exercise performance but should also intervene in other health behaviors by analyzing students' lifestyle data and providing personalized health recommendations. While some AI platforms can offer tailored exercise suggestions through monitoring activity data, extending these suggestions to other areas of health, such as diet management and sleep improvement, remains an area for further research (Tan et al., 2024; Ahmed et al., 2020).
Another challenge in applying AI in physical education is the variation in educational contexts. The effectiveness of AI tools may vary across different regions and schools, depending on factors such as hardware resources, teacher acceptance of technology, and students' cultural backgrounds. Research has shown that some schools, especially those in economically disadvantaged areas, lack the necessary technological resources to fully implement AI in physical education (Guo et al., 2020; Li et al., 2020). Furthermore, teachers' acceptance of and proficiency with AI tools also play a significant role in their effectiveness in the classroom. Some educators may have limited experience with new technologies, which can hinder the integration of AI into their teaching practices and affect students' learning outcomes (Cui et al., 2025; Zha et al., 2025).
Although the personalized nature of AI has been widely discussed in the literature, there is relatively little research on how AI can effectively influence students' health behaviors across different cultural and educational contexts. Shandong Province, with its unique educational and cultural background, presents specific challenges in implementing AI technology. For instance, some regions within Shandong may lack the technological infrastructure required for widespread AI adoption in schools, limiting the effectiveness of AI applications. Additionally, students' cultural background and technological acceptance may influence how AI tools are perceived and used, which can impact their effectiveness in fostering healthy behaviors. Future research should explore how AI tools can be adapted to different educational environments to ensure their effective application across diverse contexts.
The key factor for the success of AI in physical education is its interactivity. Interactive platforms such as virtual coaches and AI assistants have become increasingly popular in physical education. These platforms provide real-time monitoring and feedback, offering personalized guidance to students and enhancing their engagement (Wang & Wang, 2024; Deng et al., 2024). However, the effectiveness of these platforms may vary across different age groups and educational contexts. Younger students, in particular, may have lower levels of dependency on technology and may struggle to engage with AI tools as effectively, which could reduce the overall impact of AI in promoting healthy behaviors (Li et al., 2024).
In light of these contrasting views, it is evident that while AI holds considerable promise, its application in physical education should be approached with caution and critical reflection. A balanced synthesis of optimistic and skeptical perspectives enables educators and policymakers to make informed decisions, ensuring that the integration of AI technologies enhances rather than undermines the holistic goals of physical education. Some scholars argue that AI tools, while efficient in delivering personalized feedback, may inadvertently standardize learning experiences through algorithmic bias and a narrow focus on quantifiable outcomes (Li et al., 2024). Such systems might undervalue the holistic and experiential nature of physical education, which involves spontaneity, embodied learning, and socio-cultural context. Cui et al. (2025) also raise concerns regarding long-term motivation, noting that AI-driven extrinsic incentives—like point systems or performance badges—can lead to reduced intrinsic motivation once the novelty wears off.
Therefore, it is crucial to consider how AI educational tools can be designed to accommodate students' age and educational background. Research has shown that personalized and interactive AI platforms can effectively engage students, but ensuring that these tools are adaptable to different educational settings and cultural contexts remains a challenge. Further research is needed to investigate how AI tools can be customized to meet the needs of diverse student populations.
In summary, while AI holds great potential in physical education, current research faces several challenges, particularly in sustaining long-term health behaviors, adapting to different cultural contexts, and providing comprehensive health interventions. Future studies should focus on how AI can foster long-term behavior changes, especially in terms of health behaviors, and explore how to design AI tools that can be effectively implemented in diverse educational environments. Additionally, research should address how AI can influence health behaviors across multiple dimensions, ensuring that its application in physical education promotes overall student well-being.
The purpose of this study was to explore the role of AI in promoting interest in physical education and improving health behaviours among junior school students in Shandong Province. The motivation for conducting this study lies in the growing recognition that AI has the potential to bring about change through personalized learning experiences and enhanced student engagement, particularly in physical education. Shandong Province, as a region with unique demographic and educational backgrounds, provides an ideal context for studying the impact of AI on student engagement and health behaviors. By examining how AI can be a tool to increase students' interest in physical activity, this study hopes to provide a clearer understanding of the effects of its application in real-world settings.
The central question of this study is how AI can address current issues in physical education, particularly students' lack of motivation and poor health behaviors. Many junior school students perceive physical education programs as monotonous and boring, leading to low levels of engagement and difficulties in realizing long-term health benefits has the potential to be an effective means of addressing this issue due to its ability to provide personalized, interactive, and dynamic learning experiences. However, despite the immense potential of AI, it is unclear how AI interactions actually affect students' interest in physical education and their health behaviors, especially in the context of education in Shandong Province, which remains understudied.
The objective of this study was to investigate the impact of AI-driven interactive tools (e.g., gamified fitness apps and virtual coaches) on junior school students' interest in physical education as well as their health behaviors. By analyzing the relationship between AI interactions and students' physical activity levels and health attitudes, the study aims to identify whether AI is effective in motivating students to adopt more active and healthy lifestyles. The study will also explore how AI can be used to personalize the learning experience to encourage students to stay engaged and promote better health outcomes. Transforming Physical Education in junior schools in Shandong province by providing data-based analytics to improve student engagement and health behaviors. The findings would inform educational policies and strategies that are not only applicable to Shandong Province but could also be generalized to other regions to help integrate AI more effectively into school curricula. By providing evidence-based recommendations, this study hopes to provide theoretical support for building a world where AI plays a central role in physical education and fosters a healthy and active generation of students.

2. Methods

This study employed a quantitative approach with big data analysis to investigate how AI interactions influenced junior school students' interest in physical education and their health behaviors. AI-driven educational platforms, which tracked students' physical activities, health behaviors, and engagement with physical education programs, provided an ideal dataset for this analysis. By utilizing large datasets, the study was able to uncover patterns and correlations that might not have been immediately obvious through traditional research methods (Willetts et al., 2022).

The research design was grounded in a quantitative method, as it allowed for systematic measurement and analysis of the impact of AI-driven interventions across a large number of students. This approach enabled the identification of clear patterns and correlations between the frequency and type of AI interactions and changes in students' attitudes and behaviors. Through regression analysis and machine learning models, the study provided robust, statistically significant insights into how AI promoted healthier lifestyles among students (González Grandón et al., 2024).

Data for the study were collected from multiple sources to ensure a comprehensive understanding of the factors influencing students' physical education experiences and health behaviors. The primary sources included AI-powered physical education platforms, which tracked students' activity levels, participation in exercise routines, and interactions with virtual coaches or fitness apps. Additionally, health surveys gathered information about students' eating habits, sleep patterns, and physical activity outside of school. School reports further enriched the data by providing demographic details, academic performance, and information about the overall school environment. By combining these data sources, the study assessed both the direct effects of AI interactions on students' physical activity levels and their broader health behaviors.

The sample for the study consisted of junior school students from Shandong Province. A diverse group of students was selected to ensure that the results were generalizable across different age groups, genders, and socioeconomic backgrounds. The sample size was large enough to ensure the statistical reliability of the findings. By selecting a diverse group, the study aimed to uncover whether the impact of AI on students' interest and health behaviors was consistent across different demographic groups or whether specific factors, such as age or socioeconomic status, influenced the effectiveness of AI interventions.

The study focused on several key variables. The dependent variables included students' interest in physical education and their health behaviors, which were measured through survey responses, platform data, and health assessments. Interest in physical education was gauged by tracking students' engagement with physical education classes and extracurricular physical activities. Health behaviors were assessed through self-reported data on exercise habits, dietary choices, and sleep quality. The independent variables included the type and frequency of AI interactions and the school environment. Type referred to the specific AI-driven tools students engaged with, such as gamified apps or virtual trainers, while frequency reflected how often students interacted with these tools. Additionally, the school environment, including teacher involvement, technological resources, and the emphasis placed on physical education within the school curriculum, was considered as a contextual factor that could influence the effectiveness of AI interventions.

To analyze the data, the study employed regression analysis and machine learning models. Regression analysis helped identify the relationship between the independent variables—AI interaction frequency and type—and the dependent variables of student interest and health behaviors. This statistical technique allowed the study to assess the strength and direction of these relationships, shedding light on which aspects of AI interactions most effectively enhanced student engagement and health outcomes. Machine learning models were used to detect more complex patterns within the data, offering predictions about how various types of AI interventions might have influenced students' behavior over time. These models proved particularly useful in analyzing large datasets, where traditional methods may have fallen short in uncovering subtle trends (Sathiparan et al., 2024).

Additionally, various statistical methods were employed to ensure the reliability and significance of the findings. Hypothesis testing, confidence interval estimation, and analysis of variance (ANOVA) were used to assess whether differences in student outcomes were statistically significant and not due to chance (Emerson, 2022). These methods provided a rigorous framework for evaluating the impact of AI on students' physical activity levels and health behaviors.

Ultimately, the data analysis provided valuable insights into the role of AI in shaping students' engagement with physical education and promoting healthier lifestyles. The findings informed the design and implementation of AI-driven interventions in physical education programs, offering evidence to support the integration of AI technologies in schools. This research has contributed to a deeper understanding of how AI can be leveraged to improve student health outcomes and has provided insights for the development of more effective and personalized physical education curricula.

3. Results and Discussion

The data for this study were sourced from multiple AI-driven physical education platforms and health surveys, covering 1,000 junior school students from Shandong Province, with a diverse range of ages, genders, and socioeconomic backgrounds. The dataset includes information on students' interaction frequency with AI-driven tools, their participation in physical activities, the types of sports they engage in, and health behavior data. Using web scraping techniques, interaction data from these platforms were collected to focus on the impact of AI tools on students' interest in physical education, health behaviors, and physical activity participation. To analyze this data, various visualization tools, including bar charts, trend graphs, word clouds, and correlation heatmaps, were used to display the relationship between AI interaction frequency and students' physical activity, as well as the growth trend of AI usage in physical education. The study further explored the role of AI interaction frequency in promoting students' health behaviors and analyzed the annual growth of AI usage, revealing the potential of AI technology in advancing physical education.

The word cloud (Figure 1) was generated based on textual data extracted from students' feedback and interactions with AI-driven physical education platforms. The analysis focuses on identifying the most frequently used terms related to students' experiences with AI tools, such as virtual coaches, gamified fitness apps, and personalized exercise programs. The words featured in the word cloud represent key themes, emotions, and sentiments that students associate with using these AI tools in physical education. The most common words reflect the overall user experience, including feelings of motivation, enjoyment, improvement, and challenges faced during their engagement with the technology. Upon analyzing the word cloud, several key terms stand out.

Words like "motivation," "improve," "coach," and "fitness" appear frequently, indicating that students primarily associate AI with enhancing their motivation and improving their physical performance. These terms suggest that the AI tools used in physical education, particularly the virtual coaches, are seen as effective in driving students' engagement and progress. "Fun" also emerges as a prominent

term, reflecting a positive sentiment regarding the enjoyment students derive from using AI-based platforms. This points to the gamified nature of many AI applications, which make physical education more engaging and enjoyable for students.

Fig. 1: Text Sentiment from AI-based platform.

However, the word cloud also reveals some negative sentiments, with words like "difficult" and "unhelpful" appearing less frequently, but still significant. This indicates that while AI tools have been well-received by a majority, there is a segment of students who may struggle with the technology or find it less useful in their fitness journey. These students might face challenges in adapting to the virtual coaching style or perceive the AI tools as not tailored to their specific needs.

The trend graph illustrates the growth of AI usage in physical education from 2020 to 2024 (Figure 2). This chart reflects the total usage of AI in sports education, which increased from approximately 70,000 times per year in 2020 to 360,000 times by 2024 (for 1,000 samples). The data clearly shows a steady increase over the five years, highlighting the growing application of AI in the field of physical education. As seen in the trend graph, AI usage in physical education has been growing year by year. In 2020, the total number of AI-assisted sessions was 70,000, and this figure steadily increased over time, reaching 360,000 by 2024, indicating a significant rise. The growth rate accelerated particularly from 2021 to 2024, suggesting that both students and educators are increasingly relying on AI tools to enhance physical education and improve health behaviors.

Several key factors likely contributed to this growth trend. First, the continuous advancements in AI technology have made its application in physical education more effective and mature. More virtual coaches, gamified fitness apps, and personalized exercise programs can now provide tailored learning experiences and real-time feedback, which has sparked greater student engagement and promoted improved health behaviors. Second, the impact of the pandemic on traditional physical education has led to an increased demand for online and AI-assisted teaching tools, further accelerating the adoption of AI in this field. Additionally, as students' acceptance of technology increases—especially among younger generations who are accustomed to using smart devices and apps—the use of AI in education has become more natural and popular. Educational institutions and teachers have also begun to recognize the potential of AI, incorporating it more frequently as a supplemental teaching tool, which has driven this trend.

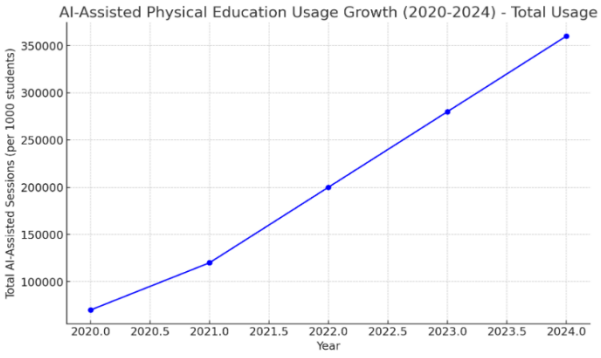

Fig. 2: Al-Assisted Physical Education Usage Growth.

It not only reflects the extent of AI adoption in physical education but also reveals the potential impact of AI technology on student participation in physical activities. As the frequency of AI usage increases, students may spend more time and energy on physical activities, improving their exercise habits and fostering more positive health behaviors. In particular, with increased usage frequency, AI tools can provide more accurate personalized feedback, which effectively boosts student engagement and exercise outcomes. Furthermore, the widespread use of AI tools may have a profound impact on traditional physical education models. With the integration of AI interactive tools, future physical education may focus more on personalized, interactive, and data-driven teaching approaches, moving away from the traditional one-size-fits-all model and meeting students' diverse learning needs and health goals.

Figure 3 shows the growth trends of per-student AI interaction frequency and per-student physical activity frequency from 2020 to 2024. According to the data, AI interaction frequency steadily increased over the five years, rising from approximately 70,000 times per year in 2020 to 360,000 times by 2024. Correspondingly, per-student physical activity frequency also showed significant growth, increasing from 30 times per year in 2020 to 90 times by 2024. This data indicates a clear correlation between the rise in AI interaction frequency and students' increased participation in physical activities, reflecting the positive impact of AI tools on student engagement in physical education.

Upon further analysis, it becomes clear that the increase in AI interaction frequency is directly linked to an increase in physical activity participation. Specifically, in 2020, the lower AI interaction frequency corresponds to 30 times of physical activity, but by 2024, as the AI interaction frequency increased, so did students' involvement in physical activities. This positive correlation demonstrates that AI tools, particularly virtual coaches and gamified fitness apps, play an effective role in motivating students and enhancing their physical education engagement. AI tools provide personalized feedback and real-time progress tracking, which helps students see tangible results from their efforts, further stimulating their interest in physical activity.

The data suggests that AI interaction frequency has a significant influence on increasing physical activity participation. As AI interactions increased, students' engagement in physical activities grew notably, reflecting the potential of AI technology to improve student health behaviors. In 2024, the total AI interaction frequency reached 360,000 sessions, while per-student physical activity frequency reached 90 times. This shows the substantial impact AI tools have had. The increase in AI interaction frequency from 70,000 to 360,000 times represents a five-fold growth, which directly facilitated the rise in students' physical activity frequency. This indicates that as the usage of AI tools became more frequent, students' health behaviors improved, highlighting the effectiveness of AI in motivating students to engage in physical activities. In a nutshell, this data trend demonstrates that AI interaction is not only a tool for increasing students' physical activity frequency but also a powerful driver in stimulating students' participation in physical activities and improving their health behaviors. As AI technology continues to evolve, future physical education may rely more heavily on this technology to better cater to students' personalized needs and ensure sustainable improvements in health behaviors.

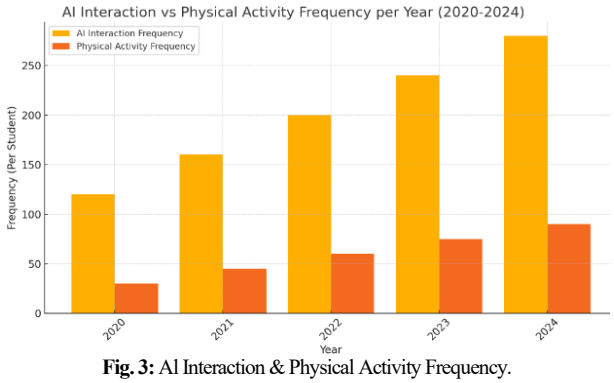

Fig. 3: AI Interaction & Physical Activity Frequency.

Figure 4 illustrates the distribution of sports activity choices among students, categorizing their preferred activities into ten groups, with the top nine most popular sports listed individually and an "Others" category for less common choices. The chart reflects the diverse range of physical activities that appeal to students, providing insights into their interests and engagement in physical education. Upon analyzing the pie chart, we can see that Running and Football occupy the largest segments, indicating that these activities are the most popular among students. Running, with its accessibility and minimal equipment requirements, is likely favored for its simplicity. Football, being a social and team-based sport, also enjoys widespread popularity, highlighting students' preference for group activities in physical education. Other sports, such as Basketball and Swimming, also claim significant portions of the chart. These activities are more structured and often included in school sports programs, with basketball benefiting from its team-based dynamics and swimming providing a different, water-based option. Meanwhile, activities like Yoga and Dance make up smaller segments, reflecting an increasing interest in fitness activities that focus on flexibility, mindfulness, and overall wellness. The "Others" category includes less frequently chosen sports, but it still plays an important role in understanding students' niche interests or emerging trends. This smaller portion suggests that while traditional sports dominate, there is room for incorporating a variety of activities in school programs. The overall distribution emphasizes the need for diverse offerings in physical education, catering to the broad interests of students and encouraging higher levels of participation.

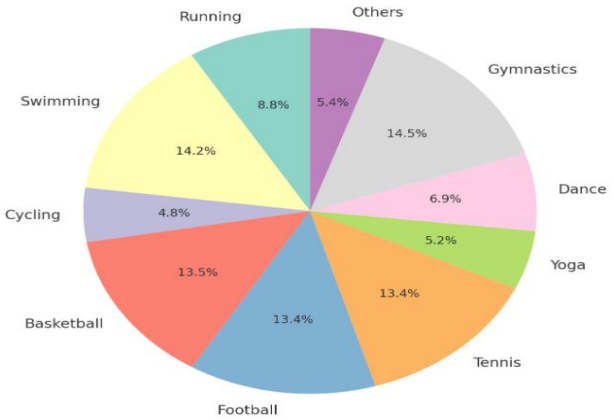

Fig. 4: Distribution of Students' Sports Activity Choices.

Figure 5 presents the correlation heatmap showing the relationships between AI interaction frequency, physical activity frequency, and health behaviors. The heatmap visually represents the strength of the correlation between these variables, with the values ranging from -1 (strong negative correlation) to +1 (strong positive correlation). The color intensity further indicates the degree of correlation, with warmer colors (closer to 1) representing stronger positive correlations.

Upon analyzing the heatmap, it is evident that AI interaction frequency exhibits a strong positive correlation with both physical activity frequency and health behaviors. This suggests that students who engage more frequently with AI-driven tools tend to have higher levels of physical activity and better health behaviors. Specifically, the correlation between AI interaction and physical activity is high, indicating that AI tools are likely effective in promoting physical engagement among students. Similarly, the correlation between AI interaction and health behaviors also shows that increased AI interaction contributes to healthier lifestyle choices, such as improved exercise routines, better dietary habits, and more consistent sleep patterns.

The heatmap also shows a moderate positive correlation between physical activity frequency and health behaviors, indicating that students who are more active tend to have better health behaviors overall. This reinforces the idea that physical activity plays a key role in students' overall health and wellness. Overall, the heatmap highlights the strong impact of AI interaction on student health outcomes, emphasizing the potential of AI-driven tools to not only enhance physical education but also foster healthier behaviors among students. This analysis underscores the importance of incorporating AI tools into physical education programs to improve both engagement and health outcomes.

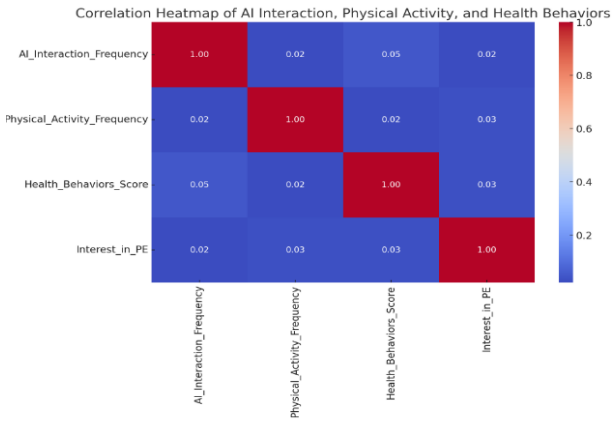

Fig. 5: Correlation Analysis.

Based on the results of the data analysis, it is evident that AI-driven tools have a profound impact on students' engagement with physical education and their overall health behaviors. The correlation between AI interaction frequency and physical activity participation demonstrates that as students engage more frequently with AI-driven platforms, their involvement in physical activities increases significantly. This reflects the power of AI in fostering student motivation by providing personalized feedback and real-time progress tracking. The more students interact with tools, the more likely they are to engage in consistent physical activity, highlighting the importance of frequent AI interactions to maintain high levels of student participation (Ahmed et al., 2023). Therefore, to further enhance the effectiveness of AI tools in promoting physical activity, schools should prioritize strategies that increase AI usage among students. This could include creating more personalized experiences and offering incentives for frequent use of AI-driven fitness applications, making these tools an integral part of the physical education curriculum.

Furthermore, the analysis indicates that AI tools have the potential to improve students' health behaviors by encouraging better exercise routines, dietary habits, and sleep patterns. The data suggest a strong relationship between AI interaction and health outcomes, indicating that AI is not only motivating students to be more physically active but also fostering healthier overall lifestyles (Katsantonis & Katsantonis, 2024). To maximize these benefits, educational institutions should consider integrating AI tools into broader health and wellness programs, promoting a more comprehensive approach to student health (Putra & Dendup, 2020). This could involve expanding the scope of AI platforms to monitor and provide feedback on aspects such as nutrition, mental wellness, and sleep, thus encouraging students to adopt holistic health habits that extend beyond physical activity alone.

However, the data also reveals a certain level of resistance or indifference from a portion of students who find AI tools difficult or unhelpful. While the majority of students report positive experiences, it is essential to address the concerns of those who are less engaged. This could involve refining the user experience, ensuring that AI tools are intuitive and easy to navigate, and providing adequate support to students who may struggle with technology (Nadarzynski et al., 2019). Furthermore, schools should offer a variety of AI-driven tools to cater to different learning preferences and fitness levels, ensuring that each student can find a tool that resonates with them personally (Reddy, 2024). By addressing the barriers to engagement and expanding the accessibility of AI tools, schools can ensure that all students benefit from these technologies.

Lastly, the diversity in students' sports preferences underscores the need for schools to offer a wide range of physical activities that appeal to different interests. The data highlights that team sports like football and basketball remain highly popular, but emerging interests in individual activities like yoga and dance also point to a shift towards more holistic and less competitive forms of physical education (Afzaal et al., 2021). Schools should recognize these trends and adapt their curricula accordingly, incorporating a blend of both traditional and emerging sports to keep students engaged. By doing so, they can foster an environment where students feel encouraged to try various activities, leading to increased participation and overall improvement in health outcomes. AI tools can play a crucial role in this, as they can be tailored to different types of activities, helping students set goals and track progress in a way that resonates with their individual interests (George, 2023).

This study provides significant theoretical and practical contributions to the application of AI in physical education. Through big data analysis, the research reveals the significant impact of AI-driven tools on students' participation in physical activities and health behaviors, particularly in the areas of physical activity participation and health behaviors. The study shows that AI tools, through personalized feedback, real-time progress tracking, and interactive features, effectively enhance students' interest and engagement in physical activities, thereby promoting healthier lifestyles. This offers valuable insights for educators on how to use AI technology to improve students' health behaviors, particularly in increasing their activity levels.

While this study primarily focused on the impact of AI interactions on physical activity, it is essential to acknowledge the broader potential of AI tools in influencing other critical health behaviors, such as nutrition and sleep hygiene. These components are integral to students' overall well-being and are increasingly being integrated into AI-driven health platforms. As Yangsheng and Saravanan (2020) emphasize, AI systems equipped with lifestyle tracking functions can monitor students' dietary patterns and sleep cycles, providing personalized feedback and recommendations to promote healthier habits beyond physical activity. For example, smart wearables and health apps can analyze meal timing, nutritional intake, and sleep duration, then offer real-time prompts—such as reminders to hydrate, limit screen time before bed, or choose balanced meals.

In educational settings, such AI tools could be particularly effective when integrated into school-based health curricula. Students could receive gamified challenges related to healthy eating or sleep goals, thus fostering self-awareness and encouraging incremental behavior changes. Although the current dataset did not deeply capture such dimensions, preliminary health surveys used in this study did indicate a positive association between frequent AI use and reported improvements in sleep quality and dietary regularity. This suggests that AI tools hold promise for broader applications in holistic health education, and future research should explore these domains through more targeted data collection and platform development.

The research reveals a strong positive correlation between AI interaction frequency and students' health behaviors, indicating that AI tools not only motivate students to engage in more physical activities but also encourage them to adopt healthier behaviors, especially in terms of sustained involvement and enthusiasm for physical activity. Finally, the findings provide robust data support for policymakers, helping them recognize the immense potential of AI to improve the quality of physical education, stimulate student participation, and enhance

overall health behaviors. This offers both theoretical foundations and practical recommendations for further integrating AI technology into school curricula, particularly in improving students' health outcomes and the effectiveness of physical education programs.

This study contributes to education by demonstrating the potential of AI technology to enhance student engagement in physical education and improve health behaviors. Through a comprehensive analysis of the impact of AI-driven tools on students' physical activity frequency and health behaviors, the research shows that AI can not only provide personalized learning experiences and real-time feedback but also stimulate students' interest in physical activities and increase their sustained participation. This finding offers practical guidance for educators, highlighting how integrating AI into physical education curricula can create a more interactive and personalized learning environment, fostering students' overall development. More importantly, the study reveals AI's role in improving students' physical and mental health, particularly in encouraging the adoption of healthier lifestyles. With growing concerns about health issues, integrating AI technology into physical education can not only boost participation in physical activities but also promote students' overall well-being. Therefore, this research provides strong empirical evidence for educational policy development, helping educational institutions better utilize AI to improve educational quality, advance the modernization of education, and enhance students' health and overall educational outcomes.

Detailed submission guidelines can be found on the journal web pages. All authors are responsible for understanding these guidelines before submitting their manuscript.

4. Conclusion

This study demonstrates that AI-driven tools have a significant impact on student engagement in physical education, particularly in improving physical activity participation, health behaviors, and overall well-being. Through personalized feedback and real-time progress tracking, AI interaction positively influences students' interest in physical activities and fosters healthier lifestyle choices. The impact of this research can enhance students' physical activity levels, improve their health behaviors, and promote overall fitness. This research provides valuable insights for educators on how to integrate AI-driven tools into physical education curricula to improve student engagement, health outcomes, and learning results, thereby enhancing the overall quality of physical education programs.

However, the limitation of this study lies in the fact that the sample is limited to junior high school students in Shandong Province, which may not represent students from other regions or age groups. Shandong, as a province with relatively balanced urban and rural development and a moderately high level of educational digitization, provides a representative context for exploring the integration of AI into physical education. However, cultural values that emphasize academic performance over physical activity—as is common in many parts of China—may have influenced both the baseline interest in physical education and the responsiveness to AI-driven interventions. In regions with different educational priorities or cultural attitudes toward physical activity, the engagement levels and behavioral outcomes may differ. For instance, students in coastal metropolitan areas like Shanghai or international school environments may exhibit higher technological fluency and greater openness to AI tools, potentially amplifying the observed effects. Conversely, students in less developed inland regions may face infrastructural limitations that constrain AI adoption, potentially reducing its impact.

Additionally, while this study targeted junior school students, the mechanisms identified—particularly the motivational effects of personalized AI feedback—may also apply to other age groups, albeit with different engagement patterns. Primary school students, for example, may require more gamified and visually intuitive platforms to maintain attention and motivation, while high school students might respond better to goal-oriented AI interventions tied to fitness outcomes or academic incentives. Thus, the core findings regarding the relationship between AI interaction, physical activity participation, and health behaviors provide a useful framework for adapting AI-driven physical education strategies to a wider range of age groups and educational settings. Future comparative studies across diverse regions and age brackets would be valuable in refining the adaptability and scalability of AI interventions in physical education.

Future research could expand the sample range and explore the long-term effects and potential applications of AI tools in different educational environments.

References

[1] Afzaal, M., Nouri, J., Zia, A., Papapetrou, P., Fors, U., Wu, Y., Li, X., & Weegar, R. (2021). Explainable AI for data-driven feedback and intelligent action recommendations to support students' self-regulation. Frontiers in Artificial Intelligence, 4. https://doi.org/10.3389/frai.2021.723447.

[2] Ahmed, A., Aziz, S., Qidwai, U., Farooq, F., Shan, J., Subramanian, M., Chouchane, L., ElNatour, R., Abd-Alrazaq, A., Pandas, S., & Sheikh, J. (2023). Wearable Artificial Intelligence for Assessing Physical Activity in High School Children. Sustainability, 15(1), 638. https://doi.org/10.3390/su15010638.

[3] Ahmed, Z., Mohamed, K., Zeeshan, S., & Dong, X. (2020). Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine. Database, 2020, baaa010. https://doi.org/10.1093/database/baaa010.

[4] Bhutoria, A. (2022). Personalized education and artificial intelligence in the United States, China, and India: A systematic review using a Human-In-The-Loop model. Computers and Education: Artificial Intelligence, 3, 100068. https://doi.org/10.1016/j.caeai.2022.100068.

[5] Chen, A., & Ennis, C. D. (2004). Goals, Interests, and Learning in Physical Education. The Journal of Educational Research, 97(6), 329−339. https://doi.org/10.3200/JOER.97.6.329-339.

[6] Christodoulos, A. D., Douda, H. T., Polykratis, M., & et al. (2006). Attitudes towards exercise and physical activity behaviours in Greek schoolchildren after a year-long health education intervention. British Journal of Sports Medicine, 40, 367−371. https://doi.org/10.1136/bjsm.2005.024521.

[7] Cui, B., Jiao, W., Gui, S., Li, Y., & Fang, Q. (2025). Innovating physical education with artificial intelligence: A potential approach. Frontiers in Psychology, 16. https://doi.org/10.3389/fpsyg.2025.1490966.

[8] Deng, C., Feng, L., & Ye, Q. (2024). Smart physical education: Governance of school physical education in the era of new generation of information technology and knowledge. Journal of Knowledge Economics, 15, 13857−13889. https://doi.org/10.1007/s13132-023-01668-0.

[9] Emerson, R. W. (2022). ANOVA Assumptions. Journal of Visual Impairment & Blindness, 116(4), 585-586. https://doi.org/10.1177/0145482X221124187.

[10] Fernandez-Rio, J., & Iglesias, D. (2022). What do we know about pedagogical models in physical education so far? An umbrella review. Physical Education and Sport Pedagogy, 29(2), 190−205. https://doi.org/10.1080/17408989.2022.2039615.

[11] Gardner, B., Arden, M. A., Brown, D., Eves, F. F., Green, J., Hamilton, K., ⋯ Lally, P. (2021). Developing habit-based health behaviour change interventions: twenty-one questions to guide future research. Psychology & Health, 38(4), 518−540. https://doi.org/10.1080/08870446.2021.2003362.

[12] George, A. S. (2023). Preparing students for an AI-driven world: Rethinking curriculum and pedagogy in the age of artificial intelligence. Partners Universal Innovative Research Publication, 1(2), 112−136.

[13] González Grandón, T., Schwenzer, J., Steens, T., & Breuing, J. (2024). Electricity demand forecasting with hybrid classical statistical and machine learning algorithms: Case study of Ukraine. Applied Energy, 355, 122249. https://doi.org/10.1016/j.apenergy.2023.122249.
[14] Goodyear, V. A., Skinner, B., McKeever, J., & Griffiths, M. (2021). The influence of online physical activity interventions on children and young people's engagement with physical activity: a systematic review. Physical Education and Sport Pedagogy, 28(1), 94−108. https://doi.org/10.1080/17408989.2021.1953459.
[15] Guo, Q., Li, B., & Saravanan, V. (2020). Role of AI physical education based on application of functional sports training. Journal of Intelligent & Fuzzy Systems, 40(2), 3337−3345. https://doi.org/10.3233/JIFS-189373.
[16] Hu, Z., Liu, Z., & Su, Y. (2024). AI-Driven Smart Transformation in Physical Education: Current Trends and Future Research Directions. Applied Sciences, 14(22), 10616. https://doi.org/10.3390/app142210616.
[17] Katsantonis, A., & Katsantonis, I. G. (2024). University Students' Attitudes toward Artificial Intelligence: An Exploratory Study of the Cognitive, Emotional, and Behavioural Dimensions of AI Attitudes. Education Sciences, 14(9), 988. https://doi.org/10.3390/educsci14090988.
[18] Lee, H. S., & Lee, J. (2021). Applying Artificial Intelligence in Physical Education and Future Perspectives. Sustainability, 13(1), 351. https://doi.org/10.3390/su13010351.
[19] Li, S., Wang, C., & Wang, Y. (2024). Fuzzy evaluation model for physical education teaching methods in colleges and universities using artificial intelligence. Scientific Reports, 14, 4788. https://doi.org/10.1038/s41598-024-53177-y.
[20] Li, Z., Wang, H., & Saravanan, V. (2020). The effectiveness of physical education teaching in college based on artificial intelligence methods. Journal of Intelligent & Fuzzy Systems, 40(2), 3301−3311. https://doi.org/10.3233/JIFS-189370.
[21] Munk, M., & Agergaard, S. (2018). Listening to students' silences − a case study examining students' participation and non-participation in physical education. Physical Education and Sport Pedagogy, 23(4), 371−386. https://doi.org/10.1080/17408989.2018.1441393.
[22] Nadarzynski, T., Miles, O., Cowie, A., & Ridge, D. (2019). Acceptability of artificial intelligence (AI)-led chatbot services in healthcare: A mixed-methods study. Digital Health, 5. https://doi.org/10.1177/2055207619871808.
[23] Pesovski, I., Santos, R., Henriques, R., & Trajkovik, V. (2024). Generative AI for Customizable Learning Experiences. Sustainability, 16(7), 3034. https://doi.org/10.3390/su16073034.
[24] Putra, G. N. E., & Dendup, T. (2020). Health and behavioural outcomes of bullying victimisation among Indonesian adolescent students: findings from the 2015 Global School-based Student Health Survey. Psychology, Health & Medicine, 27(3), 513−527. https://doi.org/10.1080/13548506.2020.1826546.
[25] Reddy, S. (2024). Generative AI in healthcare: An implementation science informed translational path on application, integration and governance. Implementation Science, 19, 27. https://doi.org/10.1186/s13012-024-01357-9
[26] Sathiparan, N., Jeyananthan, P., & Subramaniam, D. N. (2024). Surface response regression and machine learning techniques to predict the characteristics of pervious concrete usi.ng non-destructive measurement: Ultrasonic pulse velocity and electrical resistivity. Measurement, 225, 114006. https://doi.org/10.1016/j.measurement.2023.114006.
[27] Song, X. (2024). Physical education teaching mode assisted by artificial intelligence assistant under the guidance of high-order complex network. Scientific Reports, 14, 4104. https://doi.org/10.1038/s41598-024-53964-7.
[28] Tan, M., Xiao, Y., Jing, F., Xie, Y., Lu, S., Xiang, M., & Ren, H. (2024). Evaluating machine learning-enabled and multimodal data-driven exercise prescriptions for mental health: A randomized controlled trial protocol. Frontiers in Psychiatry, 15, Article 1352420. https://doi.org/10.3389/fpsyt.2024.1352420.
[29] Wang, Y., & Wang, X. (2024). Artificial intelligence in physical education: Comprehensive review and future teacher training strategies. Frontiers in Public Health, 12, Article 1484848. https://doi.org/10.3389/fpubh.2024.1484848.
[30] Willetts, M., Atkins, A. S., & Stanier, C. (2022). Quantitative study on barriers of adopting big data analytics for UK and Eire SMEs. In N. Sharma, A. Chakrabarti, V. E. Balas, & A. M. Bruckstein (Eds.), Data management, analytics, and innovation (Vol. 71, pp. 311−324). Lecture Notes on Data Engineering and Communications Technologies. Springer. https://doi.org/10.1007/978-981-16-2937-2_23.
[31] Yang, D., Oh, E.-S., & Wang, Y. (2020). Hybrid Physical Education Teaching and Curriculum Design Based on a Voice Interactive Artificial Intelligence Educational Robot. Sustainability, 12(19), 8000. https://doi.org/10.3390/su12198000.
[32] Yangsheng, Z., & Saravanan, V. (2020). An AI-based design of student performance prediction and evaluation system in college physical education. Journal of Intelligent & Fuzzy Systems, 40(2), 3271−3279. https://doi.org/10.3233/JIFS-189367.
[33] Zha, H., Li, W., Wang, W., & Xiao, J. (2025). The Paradox of AI Empowerment in Primary School Physical Education: Why Technology May Hinder, Not Help, Teaching Efficiency. Behavioral Sciences, 15(2), 240. https://doi.org/10.3390/bs15020240.
[34] Zhang, B., Jin, H., & Duan, X. (2022). Physical education movement and comprehensive health quality intervention under the background of artificial intelligence. Frontiers in Public Health, 10, Article 947731. https://doi.org/10.3389/fpubh.2022.947731.
[35] Zhou, T., Wu, X., Wang, Y., & et al. (2024). Application of artificial intelligence in physical education: A systematic review. Education and Information Technologies, 29, 8203−8220. https://doi.org/10.1007/s10639-023-12128-2.