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An analysis study of the Role of Artificial Intelligence in boosting student involvement in physical education and sports activities

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Abstract:

This study, using a descriptive-analytical framework, aimed to evaluate various Arab and international research papers and studies published from 2019 to 2025 to investigate their findings and glean positive insights regarding the role of artificial intelligence in boosting student involvement in physical education and sports activities. To achieve this objective, a targeted selection of Arab and international research was used. The extracted insights were then categorized according to the research questions which the study was based upon, analyzed, and the most significant research directions were identified.

Key words: Artificial intelleigence; student's involvement; physical education and sports activities.

Introduction:

In light of the technological transformations currently reshaping the world, artificial intelligence stands out as a significant manifestation of progress, increasingly permeating various aspects of life, including the education sector. This sector has become a pivotal force in enhancing the quality of the educational process through a multitude of technologies and tools that are highly effective for educators, learners, and educational resources. Within this framework, a critical question has arisen regarding the capacity of artificial intelligence to exert a tangible influence on student engagement in classrooms, particularly in practical subjects such as physical education and sports, which fundamentally depend on motor, psychological, social, and educational dimensions.

Physical education and sports are essential disciplines that foster the holistic development of students across multiple physical, social, psychological, and cognitive dimensions. Consequently, enhancing levels of interaction during physical education classes is an educational imperative to improve student engagement within the learning environment and fulfill the objectives outlined in educational curricula. This underscores the significance of leveraging artificial intelligence tools, including augmented reality, wearable devices, and smart applications, to refine teaching methodologies and approaches, thereby facilitating more engaging and effective learning experiences.

Despite the considerable advantages of these technologies, their efficacy within the Arab educational context, especially in physical education and sports, remains uncertain, particularly due to the scarcity of empirical studies on the topic. Moreover, the success of these technologies is contingent upon various factors, including the availability of technical infrastructure, the willingness

of educators and students to adopt these innovations, and educational and legislative considerations that may limit the application of artificial intelligence in educational institutions.

Given the significance of student engagement in the effectiveness of the educational process within physical education, the following issue emerges :

How effective is the application of artificial intelligence in enhancing student engagement during physical education and sports classes, and what factors may influence the success or failure of these technologies in achieving this objective ?

Sub-questions:

- What are the most significant artificial intelligence applications and technologies presently employed to improve student engagement in physical education and sports classes ?
- How does artificial intelligence influence student motivation and engagement in physical education and sports classes? Additionally, how can it be utilized to enhance student engagement ?
- What challenges arise in the application of artificial intelligence to improve student engagement in physical education and sports classes ?

1. Significance of the research:

This study underscores the significance and function of artificial intelligence within the educational framework, particularly in physical education and sports classes, by examining scientific literature and identifying dominant trends in the application of this technology. It also aids educators in comprehending the mechanisms and applications of artificial intelligence, as well as how to utilize it to enhance student engagement and elevate the level of active participation in both theoretical and practical lessons.

2. Study objectives:

- Explore the most significant artificial intelligence methods and techniques employed in physical education and sports classes.
- Assessing students' levels of engagement and motivation through artificial intelligence methodologies.
- Identify the primary challenges obstructing the integration of artificial intelligence in the educational process.
- To formulate suggestions and recommendations that enhance the effective application of artificial intelligence in physical education and sports.

3. Concepts and terminology:

3.1 Definition of artificial intelligence: It refers to the simulation of human intelligence in machines designed to think and act like humans. The term may also encompass any machine that demonstrates traits associated with the human mind, including learning and problem-solving capabilities. (Muhammad ben Fawzi Al-Ghamdi, 2024: 12)

3.2 Definition of student interaction: A collection of behaviors and actions arising from both verbal and non-verbal communication between the two participants in the educational process, namely the teacher and the student, within a specific context, while striving to balance the fulfillment of their needs with the attainment of the intended educational objectives. (Nasreen Maraab, Saleh Alawi, 2023: 06)

3.3 Definition of physical education and sports:

It is the educational process designed to enhance human performance through selected physical activities aimed at achieving specific objectives. This aspect of education contributes to the physical, emotional, social, and mental development of each individual through the medium of physical activities. (Bouafia Abdelkarim et all, 2024: 763)

4. Research methodology:

Content analysis is defined as a data collection tool designed to describe and analyze the content of a material in order to identify prominent trends. This process serves as a methodological approach that allows researchers to gather field data and information pertinent to the phenomenon under investigation.

Where prior studies, scholarly articles, and educational reports pertinent to the research topic are examined, including:

- Gather information from reputable sources, including scientific journals, books, and scholarly articles.
- Classify and analyze content based on specific variables, including AI contributions, student engagement enhancement, and physical education and sports classes.
- Extract and analyze results in accordance with established scientific standards. (Naim Bouamoucha, 2022: 64-75)

5. Study sample:

The study sample comprised a purposive selection of prior Arab and international research, including doctoral dissertations, peer-reviewed scholarly articles, and presentations at scientific conferences, spanning the period from 2019 to 2025.

6. Analysis and discourse regarding the study findings:

6.1 Classification of prior research pertinent to the study:

Chart 01 illustrates the percentages based on the type of prior studies

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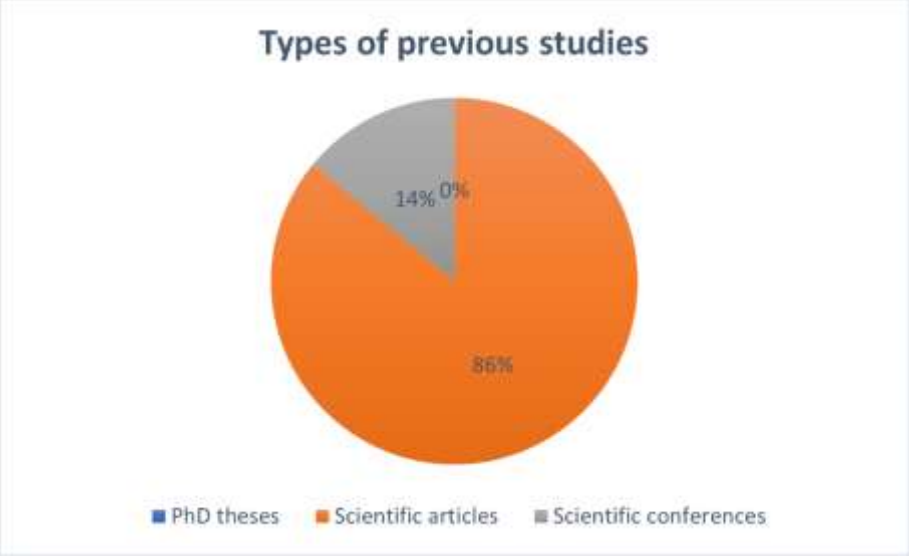

Chart 01 clearly illustrates that the number of doctoral theses was nonexistent in relation to the title and nature of the current study, as well as the timeframe of its implementation. This outcome can be attributed to the novelty of the subject within the realm of physical education and sports, coupled with the extended duration required for research and the scheduling of discussions, which can span several years. Furthermore, the selection of topics and fields for doctoral theses is governed by the scientific committee overseeing doctoral training, which is inherently linked to the scarcity of studies on this topic. In contrast, scientific articles constituted 14% of the output. This figure can be explained by the existence of international and national forums and conferences that occur periodically and in

various formats throughout the academic year across numerous universities, research centers, and graduate schools, both domestically and internationally. Meanwhile, refereed scientific research, whether Arab or foreign, accounted for the majority at a striking 86%. This prevalence is due to the extensive availability of refereed scientific journals, both national and international, which publish multiple issues annually. Additionally, scientific research is not constrained by the lengthy timelines associated with doctoral theses, which require more extensive periods for completion and face more challenging conditions for discussion.

Chart 02 illustrates the percentages of prior studies categorized by year.

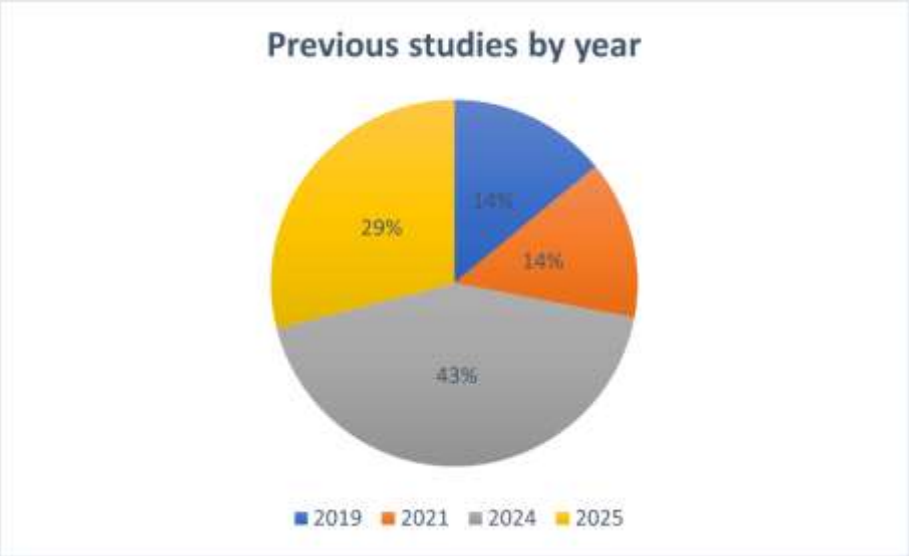

Chart 02 indicates that the proportion of prior studies for the year 2019 was 14%, a figure that remained consistent in 2021. In contrast, the percentage of prior studies for 2024 reached its peak at 43%, while the figure for 2025 was estimated at 29%, based on the timing of this study, which was conducted before the end of the first half of 2025. It is possible that the number of studies will increase thereafter; thus, these percentages reflect the timing of this research. From the analysis, we can deduce that the majority of prior studies occurred between 2024 and 2025. This trend can be attributed to the rapid advancement of artificial intelligence technologies in recent years, particularly in their integration into physical education and sports, both in team and individual contexts. Additionally, there has been a heightened interest in conducting comprehensive and varied research on artificial intelligence among researchers, institutions, and national and international conferences.

Chart 03 illustrates the percentages of prior studies based on the methodologies employed.

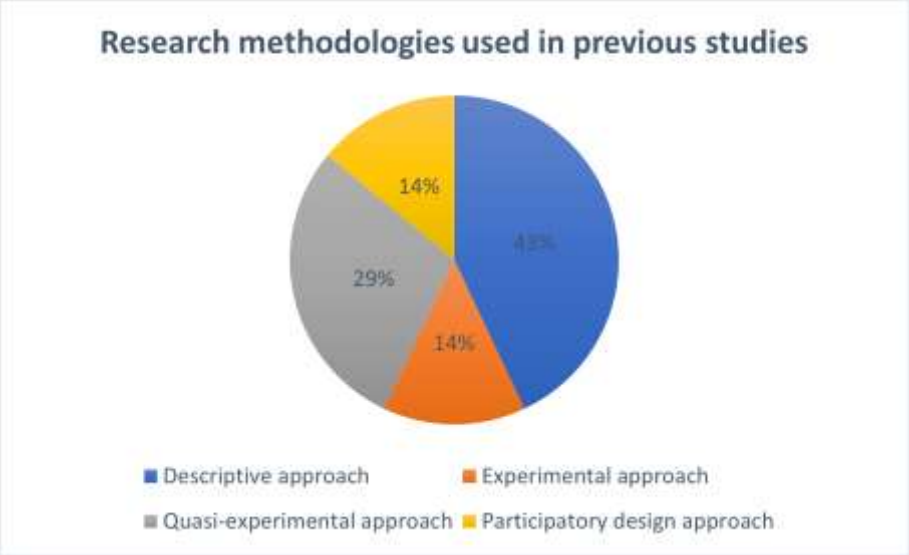

Chart 03 indicates that the proportion of studies employing the experimental approach reached 14%, a figure that mirrors the percentage attributed to the participatory design approach. This approach is characterized as: "A process that includes the involvement of end users or the target community as partners in the process of designing systems, products, or services, starting from research and planning to testing and implementation, with the aim of improving the quality of the system and ensuring that it meets the needs of users. This approach aims to improve the quality of the solutions provided by integrating multiple viewpoints and experiences in the different design stages" (Rania Masoud Saad et all, 2024: 199). The studies utilizing the quasi-experimental approach accounted for 29%, while the descriptive approach comprised 43%, indicating its predominance in this research. This outcome can be attributed to the novelty of the topic and the scarcity of applied experiments, stemming from various factors, including the absence of suitable technical resources and equipment within institutions to conduct relevant experiments in artificial intelligence. Consequently, researchers often opt for the descriptive and quasi-experimental approaches due to the relative ease of data collection through questionnaires and interviews, among other methods.

Chart 04 illustrates the percentages of prior studies categorized by sample type.

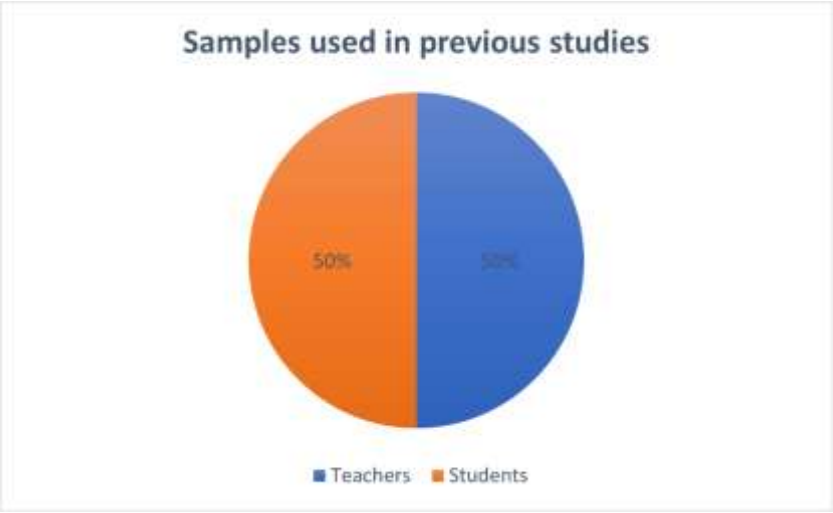

Chart 04 clearly indicates that the composition of the targeted sample in previous studies achieved an equal distribution of 50% for both teachers and students. This outcome can be attributed

to the researchers' efforts to explore the reality of artificial intelligence utilization in physical education and sports from multiple perspectives, incorporating the insights of both teachers and students. This approach aims to foster a more comprehensive and nuanced understanding of the various stakeholders involved in the educational process regarding the integration of artificial intelligence in physical education and sports classes.

6.2. Analysis and Discussion of the Results Pertaining to the First Question:

The inquiry is: What are the most significant artificial intelligence applications and technologies presently employed to improve student engagement in physical education and sports classes ?

By examining the findings of prior studies, we recognize the substantial impact of artificial intelligence technologies on educational practices, especially in physical education and sports, which necessitate concurrent motor and cognitive engagement. It is evident that researchers have concentrated their efforts on four primary areas where the applications of artificial intelligence are apparent. We will elucidate and analyze these areas as follows:

First: Smart devices as a means of enhancing interaction

Both the research conducted by Ayadi and Ashb (2021) and the investigation by Mazen Ali Lazem et al (2024) concur that wearable devices such as Player Tek and Mi Coach signify a significant transformation in the monitoring of students' performance by gathering precise and immediate data on physical activity. These technologies not only furnish quantitative data but also enable educators to generate qualitative feedback aimed at enhancing performance. This data-driven interaction heightens students' awareness of their performance and fosters intrinsic motivation for more effective participation. The study by Dapeng Yang et al. (2020) further illustrated the influence of an educational robot in boosting students' interest and positive attitudes toward physical education, as well as the effects of blended learning with artificial intelligence on enhancing their athletic performance.

While this technology may appear costly or necessitate specialized equipment, research findings indicate that the consistent utilization of these devices has resulted in a notable enhancement in student motivation and engagement, signifying a transition in the learner's role from a passive recipient to an active participant.

Second: Intelligent educational applications and interactive gaming experiences

The research conducted by Ombok and Aguinaldo (2024) alongside the investigation by Faten Ali Akbar and Jumaan Al-Ghamdi (2025) underscores the essential function of interactive applications, including Active Arcade, Tuby, and others, in fostering an engaging educational atmosphere through the incorporation of gamification strategies. These applications successfully captured students' attention, encouraged their participation, and heightened their enthusiasm for continued learning.

What sets these results apart is their dependence on a quasi-experimental design, which imparts significant explanatory power. The findings statistically indicated an enhancement in indicators of classroom interaction and participation. These studies illustrate that artificial intelligence technologies do not supplant teachers; instead, they augment their role by broadening sources of motivation.

Third: Artificial Intelligence as a Tool for Evaluation and Diagnosis

According to a study (2025) by Dakyeom Ahn and Hajin Lim, one of the most significant functions of AI is to assist educators through classroom data analysis tools, performance monitoring, and the provision of immediate reports that streamline the evaluation process. While this study did

not directly assess engagement, educators recognized the contribution of these tools in fostering a more organized and responsive classroom environment, which serves as an indirect indicator of improved engagement.

Thus, it is evident that artificial intelligence introduces a diagnostic aspect to the educational process, enabling educators to observe individual differences and make prompt adjustments to teaching methods, thereby enhancing student engagement and interaction.

Fourth: Intelligent media and their role in the educational process

The findings of the research conducted by Awad Younis (2024) and Muhammad Asim (2019) underscore the significance of utilizing multimedia and educational systems enhanced by artificial intelligence, such as computer-assisted instruction (CAI), in fostering interaction. These media facilitate the presentation of content in multiple formats-visual, auditory, and kinesthetic-thereby accommodating diverse learning styles and enhancing students' opportunities for engagement.

The findings of these studies indicate that the application of AI extends beyond mere information provision; it encompasses the creation of a learning environment that considers individual needs and facilitates opportunities for self-assessment and progress based on abilities. This form of personalization is a critical component of effective classroom interaction. Our analysis of previous studies and the four axes leads us to conclude that the most significant AI applications enhancing interaction in physical education classes are found in wearable devices, interactive educational applications, smart assessment systems, and multimedia supported by artificial intelligence algorithms. While the results affirm the effectiveness of these technologies, the variety of tools illustrates that AI is not a singular solution but rather a system of integrated solutions that can fundamentally transform student engagement in physical education and achieve comprehensive educational objectives that extend beyond the physical domain to encompass psychological, social, and cognitive dimensions. However, the success of these initiatives is contingent upon several factors, the most crucial of which include infrastructure readiness, teacher qualifications, and the integration of artificial intelligence within the curriculum.

6.3 Analysis and Discussion of the Results Pertaining to the Second Question:

The inquiry is: In what ways does artificial intelligence influence student motivation and engagement in physical education and sports classes? Additionally, how can it be leveraged to enhance student engagement ?

The findings of prior research indicate a common understanding of the beneficial effects of employing artificial intelligence in physical education classes, especially in terms of enhancing student motivation and engagement. This influence can be categorized into four primary axes that represent various application models, which we elucidate as follows :

First: Artificial intelligence as a means to augment motivation and feedback

The research conducted by Ombok and Aguinaldo (2024), Mazen Ali Lazem et al. (2024), and Faten Ali Akbar and Jumaan Al-Ghamdi (2025) concurs that the implementation of artificial intelligence applications significantly enhances student motivation by offering immediate and personalized feedback, thereby enabling students to track their motor development and attain specific objectives. Conversely, they diverge from the findings of Amzal Sara and Saifi Belkacem (2025), which determined that a majority of professors prefer traditional assessment methods despite their familiarity with artificial intelligence techniques, citing material constraints such as insufficient financial support and inadequate mathematical frameworks.

These advanced systems have fostered a sense of accomplishment among learners, thereby enhancing their intrinsic motivation and cultivating enthusiasm for active learning. For instance, the outcomes of the Ombok experiment demonstrated a notable rise in engagement and participation metrics, which correlates with heightened student motivation.

Second: Fostering an engaging environment for interaction through gaming methodologies.

Through gamification and intelligent interaction techniques, tools such as Active Arcade, Tuby, and Jumpr have transformed classroom content into an enjoyable experience, as evidenced by the research conducted by Ombok and Aguinaldo. This approach enhanced students' engagement with the material and fostered both physical and emotional involvement. The findings of the study by Faten Ali Akbar and Jumaan Al-Ghamdi (2025) further corroborated this, revealing that students exhibited a pronounced inclination to utilize these applications repeatedly. Educators also conveyed their satisfaction with the noticeable improvement in learners' motivation, particularly in the development of motor skills and interest in learning. Additionally, Chen Jiang's research (2024) demonstrated that the hybrid educational model integrating physical education and artificial intelligence resulted in enhanced teaching efficiency, increased student motivation, and improved interaction within the classroom. (Chen Jiang, 2024: pp. 3165-3176)

Third: Fostering individual differences

The study conducted by Awad Younis et al. (2024) emphasized that artificial intelligence facilitates the creation of educational content tailored to learners' abilities and individual differences, allowing each student to feel as though they are at the center of the educational process, which is evident in their participation and interaction. Through the implementation of computer-supported educational technologies and interactive curriculum design, the learning conditions for students have been enhanced, leading to increased engagement and interactivity, particularly through the use of audio, visual, and kinetic resources that align with various learning styles. This was further corroborated by the research of Dapeng Yang et al. (2020), which demonstrated an increase in interest in physical education and an improvement in students' learning outcomes.

Fourth: Alleviating the teacher's workload and ensuring a safe and conducive classroom environment.

According to Ahn & Lim (2025), the role of artificial intelligence transcends mere student support; it also alleviates field and administrative burdens for educators, enabling them to concentrate on guiding and inspiring students. Functions such as audio analysis, lighting adjustment, performance measurement, and intelligent task allocation serve as tools that enhance the classroom environment and foster psychological comfort, a crucial factor in boosting student motivation for active engagement.

We deduce from the findings of prior studies and the examination of the four axes that artificial intelligence is not solely associated with improving student interaction, but also with the dynamics among the learner, the content, and the educator, all within a more holistic, engaging, and sustainable educational framework. Furthermore, it is employed effectively to enhance student motivation through:

- Immediate and individualized engagement.

- Embrace individual differences.

- Alleviating pressure on educators while fostering a conducive and appropriate learning environment.

6.4 Examination and discourse regarding the outcomes of the third question:

The inquiry is: What challenges confront the implementation of artificial intelligence in enhancing student engagement within physical education and sports classes ?

An analysis of prior studies reveals that the challenges associated with integrating artificial intelligence into physical education are multifaceted, involving technical, pedagogical, human, and organizational dimensions. These challenges can be categorized into four primary axes:

First: Infrastructure and technology

Both Ahn and Lim (2025) and Faten Al-Ghamdi concur that inadequate infrastructure poses a significant barrier to the implementation of artificial intelligence within educational settings. This is evidenced by the scarcity of advanced equipment and poor internet connectivity in certain institutions, as well as the lack of regular maintenance and updates for devices.

Mazen Ali Lazem's study (2024) indicated that the substantial sample size presented challenges in the practical implementation of artificial intelligence, reinforcing the notion that technology alone is inadequate without an appropriate environment.

Second: Insufficient qualifications and training of educators

The findings of the research conducted by Faten Ali Akbar and Jumaan Al-Ghamdi (2025), along with those of Muhammad Asim (2019), reveal that a significant barrier is the inadequate professional training in the realm of artificial intelligence. Many educators experience a deficiency in digital competence and the strategies necessary for the effective application of this technology, compounded by apprehension regarding technical and technological challenges. This assertion is further supported by Chen Jiang's study (2024), which identifies substantial obstacles, including the limited capacity of teachers to engage with artificial intelligence technologies.

Third: Barriers to education in physical education classes

According to Ahn and Lim (2025), physical education encounters numerous challenges, including the difficulty of monitoring individual differences within densely populated classes and the limited time allocated for lessons, which diminishes opportunities to utilize advanced technological tools. Additionally, open spaces, such as playgrounds, complicate the management of a smart educational environment.

The research conducted by Awad Younis (2024) and Chen Jiang (2024) indicates that challenges persist regarding the inadequate adaptation of artificial intelligence to conventional curricula and methodologies, as well as the absence of a definitive strategy for its integration into lesson planning.

We conclude from the aforementioned that the challenges associated with the implementation of artificial intelligence to improve student engagement in physical education classes are not confined solely to technology; they also encompass educational culture, teacher training, and the physical and organizational environment. To address these challenges, the following criteria must be fulfilled:

- Delivering intelligent infrastructure.
- Specialized educator training.
- Establishing legal frameworks to safeguard students' privacy.
- Integrating artificial intelligence into curriculum planning in a deliberate and considered manner.

Comprehending these challenges is the initial step toward developing effective strategies that position AI as a tool to enhance learning, rather than as an added burden on the educational landscape.

8. Suggestions:

- Educating educators on artificial intelligence methodologies.

- Striving to deliver intelligent infrastructure.

- Integrating artificial intelligence into curriculum planning in a deliberate and considered manner.

- Alleviating pressure on educators by decreasing class sizes.

- Supplying contemporary smart devices while enhancing the speed and coverage of the Internet network.

- Utilizing diverse forms of multimedia in the classroom enhances interaction and serves as a crucial factor in motivating students.

Conclusion:

This study concludes that artificial intelligence is garnering considerable attention, especially within the realm of physical education and sports. Previous analyses and studies have unveiled a variety of topics and an expansion of associated research areas. The findings from these studies underscore the increasing significance of incorporating artificial intelligence and its diverse technologies into educational and sports contexts, necessitating further field studies to reinforce this trend and translate its findings into practical applications .

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