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The Role and Extend of Artificial Intelligence in Enhancing Volleyball Learning

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ABSTRACT

This study aims to explore the role and degree of artificial intelligence (AI) usage in enhancing the learning of volleyball among students in colleges of physical education. Specifically, it investigates students' perceptions of AI's importance and the differences between undergraduate and postgraduate students in terms of their understanding and application of AI technologies. The descriptive method was employed, and the sample consisted of 200 undergraduate and 50 postgraduate students from various Iraqi universities. A 31-item questionnaire, divided into two axes. (1) the importance of AI in education and (2) the challenges of its implementation-was distributed during volleyball classes. The results showed that postgraduate students demonstrated a more consistent and logical understanding of AI's educational functions, particularly its flexibility, adaptability, and role in self-directed learning. In contrast, undergraduate students exhibited varied responses, indicating a lack of familiarity with some aspects of AI. Although the postgraduate group had higher mean scores, T-test results showed no statistically significant mean difference ($p > 0.05$) between the two groups.

Keywords: *Artificial Intelligence, Volleyball Learning, Physical Education, Higher Education, Educational Technology*

INTRODUCTION

Today, the world is witnessing a digital transformation across all fields, including volleyball learning. Modern technologies have become an integral part of the development of learning processes in various domains, particularly in physical education and, more specifically, in volleyball. The emergence of these technologies has shifted learning from an experimental stage to a more practical and applied phase. Artificial intelligence (AI) has contributed significantly to self-directed learning, performance analysis, and self-assessment, thereby enhancing the interaction between students and educational content. This shift has moved the learning process away from the monotony of traditional methods and encouraged students to become more active in their learning journeys (Paška, L., Horička, P., & Šimonek, J.,2023).

With ongoing technological advancement, the availability of smart devices and their software has made it possible to integrate knowledge from diverse sources without the constraints of time and place. Tools, images, and texts can now be transmitted and manipulated via the Internet, creating expansive and innovative learning environments. These environments promote more creative and engaging educational experiences ports (Oubed, W. A., Ashoor, R. A., & Shehab, S. G., 2021).

AI is considered one of the most innovative and modern sciences, relying on intelligent systems capable of performing actions without prior programming. These systems can make new decisions autonomously to adapt to evolving situations and surrounding conditions over time (Abdel-Halim Mohamed Aly, A., 2022).

Artificial intelligence is not merely an emerging technology; rather, it is considered an "access technology," as it appears capable of understanding instructions and generating responses similar to those of humans. It behaves as a companion to many in an otherwise isolated and solitary world. At the same time, AI creates "jagged technological boundaries," where it can perform exceptionally well—or very poorly—on tasks that are remarkably similar (Achilleopoulos, I., However al., 2022).

Salmana, T. D., & Muhsen, A. D. A. (2020) indicated that students expressed satisfaction with AI-based learning and demonstrated competence when relying on AI in the learning process. AI is defined as one of the computational pillars that grant students the abilities of thinking, perception, and deriving solutions from

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Vol. 3, No. 2, Juli 2025

information that leads to the discovery of truths. It also enables them to apply those truths to new educational and real-life situations to make appropriate decisions and interpret data through the creative and skillful use of information (Al, A. H. S,2025).

Accordingly to Zwierko, M., Jedziniak, W., Popowczak, M., & Rokita, A. (2023) employing AI can assist both teachers and students in achieving educational goals more efficiently and effectively. Although the human brain remains unmatched in acquiring knowledge, AI is one of the sciences that relies primarily and fundamentally on computers and their programs. It connects various domains of learning through neural networks, categorizing, distinguishing, and clarifying them. This represents a paradigm shift in knowledge construction and has a positive impact on student success (A Al-Ansari, I. A. (2023).

Shihab, M. W., Kareem, O. A., & Mohamed, D. A. (2021) mentioned that AI supports decision-making by analyzing multiple scenarios and contributes to enhancing decision-making efficiency by offering more appropriate solutions to the problem under investigation (Boichuk, 2023). It seeks to emulate the functioning of the human brain (1), assisting in solving complex problems with speed and accuracy—without relying on prior human expertise (2). It also identifies individual goals and indicators, compares them to benchmarks, and delivers unbiased feedback (3).

Moreover, artificial intelligence aims to understand the nature of human intelligence. Among its most important objectives are: 1) Retaining the maximum amount of information derived from the human mind; 2) Processing data and information regardless of its volume or type; 3) Coordinating between the processes of action and perception in an intelligent and integrated manner (4).

Given that educational institutions are among the most student-centered establishments, they have consistently resorted to various teaching methods to accommodate students' diverse levels and learning needs. In this context, artificial intelligence has emerged as a foundational element that must be integrated into learning. Through AI, information can be accessed, managed, and applied to improve the educational process. The researcher observed a noticeable decline in student achievement in the subject of volleyball, which may be attributed to teachers' continued reliance on traditional teaching methods.

Howefer, Rahim, M. J., & Gatia, A. J. (2021) observed that does not diminish the importance of the teacher, who remains a central figure in implementing such technologies by leveraging their expertise and specialization to guide students—especially given the natural individual differences among learners. Therefore, it is essential for educators to play an active role in directing students within this vital area. This should mark the starting point toward modern, technology-enhanced learning.

The situation presents a pedagogical challenge that requires the adoption of varied instructional strategies. The researcher believes that the time has come to incorporate artificial intelligence into teaching practices. Numerous studies have emphasized that this type of instruction represents a new direction in preparing and training students to overcome the weaknesses they face when relying on conventional methods in learning volleyball (Rahim, M. J., & Gatia, A. J., 2021).

The research problem can be identified through the following questions: 1) What is the extent of students' knowledge about artificial intelligence and its importance from the perspective of undergraduate students in physical education who are learning volleyball? 2) What is the extent of students' knowledge about artificial intelligence and its importance from the perspective of postgraduate students in colleges of physical education? 3) What is the perceived importance and degree of use of artificial intelligence among both groups? Are there differences in the perceived importance of artificial intelligence between undergraduate and postgraduate students?

The following hypotheses are depended: There are statistically significant differences in the degree of artificial intelligence use among the sample members according to their academic level.

There are statistically significant differences in the perceived importance of artificial intelligence between undergraduate and postgraduate students.

METHOD

To achieve the objectives of this study, the researcher employed the descriptive method. The research population consisted of male and female students from the College of Physical Education at the University of Baghdad and other colleges, during the first academic semester. These students were all enrolled in volleyball courses (Mancini, N., et al., (2024).

The research sample was drawn from two main groups. The first group included undergraduate students

e-ISSN: 3031-2949
Vol. 3, No. 2, Juli 2025

learning volleyball, and the questionnaire was distributed during their volleyball classes. This group comprised 100 students from the University of Baghdad, 50 from the University of Diyala, 30 from the University of Babylon, and an additional 20 from another branch of the University of Diyala—resulting in a total of 200 undergraduate students (Liu, Y., 2022).

The second group included postgraduate students formally enrolled in graduate studies in physical education. The sample was distributed as follows: 15 from the University of Baghdad, 7 from the University of Babylon, 8 from the University of Diyala, 7 from the Basic Education College, 7 from Al-Mustansiriya University, and 8 from the College of Women. Due to the relatively small number of postgraduate students, additional colleges were included in the sample to ensure sufficient representation. This brought the total number of postgraduate students to 50.

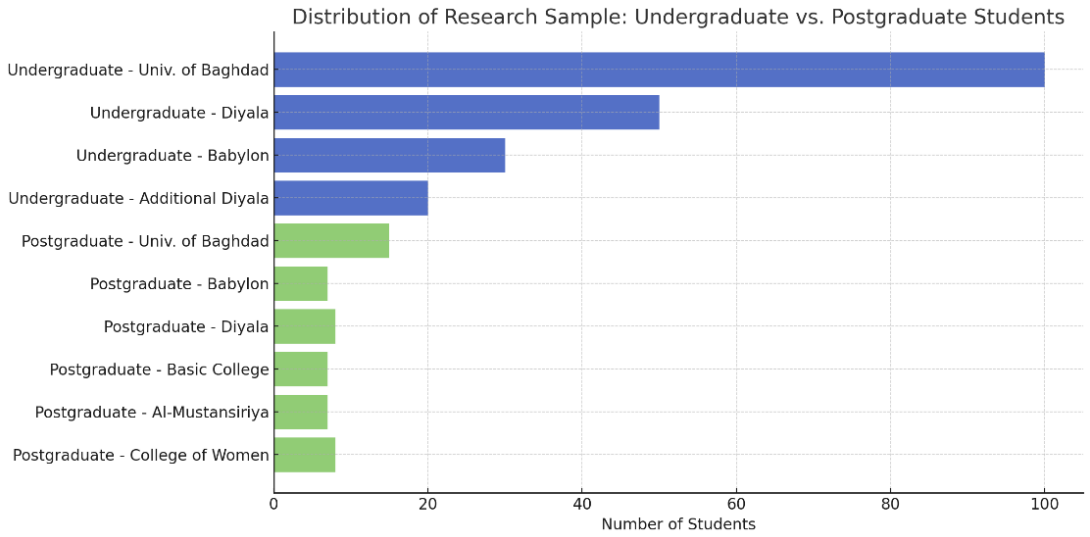

Figure 1. Distribution of Research Sample

The chart above visually represents the distribution of the research sample, distinguishing between undergraduate and postgraduate students across various universities. The blue bars indicate undergraduate participants, while the green bars represent postgraduate participants (Jabar, N. A. S., & Jari, H. S., 2021).

A questionnaire prepared by Mohammed Aql et al (1), which contained 31 items, divided into two axes, was used by the researchers. The first axis (21 items) assesses the importance of artificial intelligence technology in education, and the second axis (10 items) focuses on the barriers to implementing it. The questionnaire was implemented on a five-point Likert scale (multiple-choice), with response options for all items being five since the response options were, Strongly Agree = 5; Agree = 4; Neutral = 3; Disagree = 2; and Strongly Disagree = 1.

The instructions of the questionnaire stated how to respond, brief description of the purpose of the questionnaire and body of the items. Students were also instructed not to label or write any identifying information on the sheets containing the questionnaires.

The instrument was validated and tested for reliability in two pilot studies, one on undergraduate and the other on postgraduate students at College of Physical Education, University of Baghdad. This is to confirm the clarity, correctness, and stability of the questionnaire. In addition, three academic experts (judges) evaluated the instructions clarity and the items appropriate for the target sample. All reviewers agreed that the questionnaire had no ambiguous wording and was suitable for the target student population.

The reliability of the questionnaire was calculated after its application to a pilot sample of 21 undergraduate and 6 postgraduate students from the College of Physical Education at the University of Baghdad. The questionnaire was completed by each group, separately, and then was administered again a short time later. The reliability coefficient of the first axis (the importance of artificial intelligence in education), 0.90, and for the second axis (the challenges of using artificial intelligence), 0.77, for the undergraduate group; both numbers indicate a statistically significant level of reliability. Reliability coefficients were 0.72 and 0.70 the first and second axis respectively for the postgraduate sample (6 students). These figures are also acceptable for research instruments. The gap between the administration of the first and second round of questionnaires was four days, allowing enough duration between the two influxes to avoid major shifts in the perceptions of the participants, while still being close enough together to measure stability.

e-ISSN: 3031-2949
Vol. 3, No. 2, Juli 2025

RESULTS

First: Analysis of the Preliminary Students' Sample Results (Table 1)

Table 1 presents the responses of preliminary students regarding their perceptions of the role of artificial intelligence in enhancing the learning process of volleyball. The data reflect the students' evaluation of various AI-related educational functions, such as its ability to account for individual differences, provide feedback, and increase learning flexibility.

Table 1. Attitudes of Preliminary Students Toward AI in Volleyball Learning

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Weighted Mean	Std. Deviation	Relative Importance (%)	Rank
Takes into account individual differences among students	—	—	—	—	—	3.965	1.23	79.30	1
Provides feedback to teachers and students	44.22	30.15	11.06	7.04	7.54	3.947	1.08	78.95	3
Offers flexibility in presenting educational material	34.21	42.11	13.16	5.26	5.26	3.281	1.32	65.62	16

The first findings showed a positive attitude of students towards the importance of artificial intelligence (AI) in volleyball learning. In studying how Artificial intelligence (AI) is helping to address individual differences among students, participants mentioned that AI plays a major role in tackling individual differences among students. The highest weighted mean (3.965) and relative importance of (79.30%) were indicative of the great degree of awareness attached to this core function. Results likewise revealed that AI entity aids in enhancing students' motivation to take part in the learning process as it controversies to the second item at a weighted mean of (3.950).

Another distinct measure included students' recognition of AI's capacity to render effective feedback to educators and students alike, manifesting a weighted mean of (3.947). In addition, they cautioned against AI's role in supporting the learning of basic skills. These results imply that students already have an awareness of what two of the major purposes for using AI are, namely enhancing the learning experience and increasing interactivity in the classroom Chuang, C. H., Hung, M. H., Chang, C. Y., Wang, Y. Y., & Lin, K. C. (2022).

In contrast, some dimensions were evaluated lower by students, specifically, AI's ability to serve students with special needs received a mean score of (2.400), reflecting an area with limited familiarity or direct experience. Other functions, such as reducing anxiety related to learning or helping students make decisions about education, ranked lower as well. Such reflects either naïve approach to understand the full spectrum of AI potential in the primary students who are likely to have constraints like exposure or understanding of smart applications till such levels of experience.

Second: Analysis of the Postgraduate Students' Sample Results (Table 2)

Table 2 summarizes the responses of postgraduate students concerning the educational utility of artificial intelligence in volleyball instruction. The results indicate a more advanced and consistent recognition of AI's contributions, particularly in enabling ubiquitous learning and fostering critical thinking.

Table 2. Attitudes of Postgraduate Students Toward AI in Volleyball Learning

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Weighted Mean	Std. Deviation	Relative Importance (%)	Rank

e-ISSN: 3031-2949
Vol. 3, No. 2, Juli 2025

Ability to learn anytime and anywhere in the world	50.00	40.00	4.00	4.00	2.00	4.32	0.89	86.40	1
Encourages students to think about how to use information	54.17	25.00	16.67	4.17	0.00	4.29	1.09	85.83	2
AI-supported programs help students learn basic skills	50.00	30.00	10.00	6.00	4.00	4.16	1.09	83.20	3

From postgraduate students' responses, the Data showed a more mature and informed view on the role of AI in education. The ranked skill was gained access to learn ubiquitously and at any time which attained a weighted mean of (4.32), with a relative significance of (86.40%). This suggests that postgraduate students are well aware of a critical aspect of AI, namely its ability to transcend the limitations of time and space in learning. Finally, the statement that AI facilitates student reflection on how to utilize information, as opposed to just finding it, was rated relatively high, (4.29) weighted mean.

Other highly endorsed features were AI's knack for teaching basic skills, its ability to provide targets with accurate feedback and its potential to uncover individual student characteristics and adjust the learning experience to their preferences. These findings highlight the postgraduate students' appreciation of the adaptability and interactivity AI can offer, while also acknowledging its capacity to personalize the educational experience (Hafidh, H. F., Radhi, M. N., & Mohammed, M. H, (2021).

Nonetheless, several challenges were clearly identified by the participants. Chief among them were the difficulties in using robotics and smart technologies, as well as the shortage of qualified AI specialists. Participants also noted concerns related to implementation costs and cybersecurity risks, including potential hacking or virus propagation in AI systems. However, certain concerns—such as the fear of AI negatively affecting human interaction—received lower importance ratings, suggesting that postgraduate students generally view AI as a complementary tool rather than a threat to traditional educational dynamics (Jabar, N. A. S., & Jari, H. S. (2021).

These findings illustrate a higher level of critical thinking among postgraduate students when evaluating the opportunities and limitations of AI, as well as a stronger inclination toward integrating such technologies into their academic and professional development.

Third: Statistical Comparative Analysis Using the T-Test

To determine whether there were statistically significant differences between the two groups, an independent samples T-test was conducted. The data collected from the questionnaire responses were entered into the standard T-test formula, with the mean and variance calculated separately for each group. The average score of the preliminary students was (3.546), whereas the postgraduate students achieved a slightly higher average of (3.621), indicating a marginal advantage for the latter. In terms of variance, the preliminary group showed a variance of (0.140), while the postgraduate group exhibited a higher variance of (0.406), suggesting greater dispersion in their responses.

The mean and variance of each group were computed using the following equation 1:

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i]$$

e-ISSN: 3031-2949
Vol. 3, No. 2, Juli 2025

$\bar{X}$= sample mean

X_i = each individual observation

n = number of observations in the sample

To test for statistically significant differences between the two groups, the following independent samples T-test formula (2) was applied

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$$

S^2: sample variance

n: number of observations

X_i: each observation

X_i^-: sample mean

As shown in Equation (3), the computed t-value was -0.561, and the associated p-value was (0.578). Since the p-value exceeded the conventional significance level of 0.05, the differences between the two groups were deemed statistically insignificant. This means that the variations in responses between the groups likely resulted from random variation rather than meaningful or systematic differences Chuang, C. H., Hung, M. H., Chang, C. Y., Wang, Y. Y., & Lin, K. C. (2022).

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

$\overline{X_1}, \overline{X_2}$: sample means of group 1 and 2

S_1^2, S_2^2: sample variances of group 1 and 2

$n_1, 2$: sample sizes of group 1 and 2

Fourth: Interpretation of Results considering the Hypotheses

The T-test results indicate that the hypothesis asserting statistically significant differences between undergraduate and postgraduate students in their use of AI cannot be supported. While postgraduate students scored slightly higher in terms of their perceptions and applications of AI, the difference was not statistically significant enough to be considered meaningful (Boichuk, R. et al., 2023).

This outcome can be interpreted through several lenses. First, the general awareness of AI's educational benefits appears to be gradually increasing among all student levels, regardless of academic standing. However, the greater variability among postgraduate students suggests a wider range of personal experiences and exposure to AI-based tools, likely due to their research engagement and academic maturity. This highlights the need to strengthen digital literacy and equitable access to AI tools across all levels of higher education (Al-Ansari, I. A., 2021).

The results also confirm what has been suggested in the literature: when properly implemented, AI can transform educational practices, especially in skill-based fields such as physical education. Consequently, the integration of AI into curricula and instructional practices emerges not only as a contemporary educational trend, but as an essential strategy for building a future-ready academic environment (Al, A. H. S., 2025).

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Figure 2 below illustrates the comparison of the mean scores between the two student groups, with error bars representing standard deviation. The chart visually confirms that although postgraduate students scored slightly higher, the variability in their responses was greater, aligning with the statistical findings of non-significance (Abdel-Halim Mohamed Aly, A., 2022).

e-ISSN: 3031-2949
Vol. 3, No. 2, Juli 2025

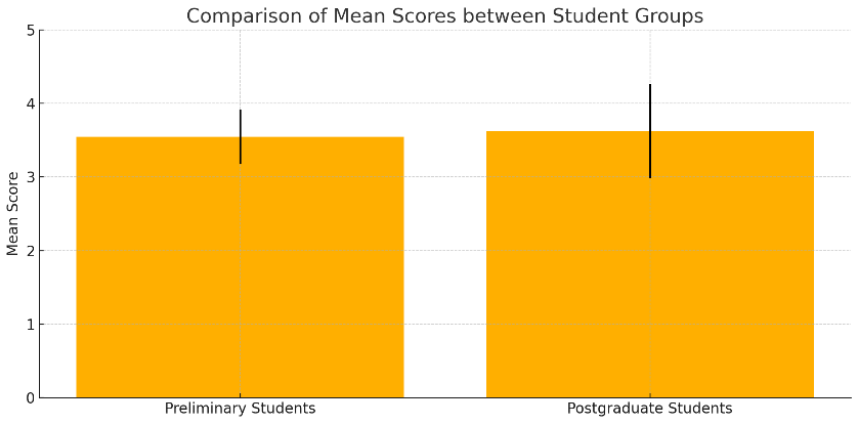

Figure 2. Comparison of Mean Scores between Student Groups

CONCLUSIONS

In conclusion, this study reveals a developing awareness of artificial intelligence (AI) applications in volleyball education among physical education students, with postgraduate students demonstrating a more informed and coherent understanding of AI's potential for personalized, self-directed, and inclusive learning. While undergraduate students acknowledge some benefits, their overall grasp remains limited, particularly regarding AI's role in supporting special needs and reducing learning anxiety. Despite these perceptual differences, statistical analysis showed no significant differences between the two groups, suggesting a generally similar awareness level. However, challenges such as inadequate infrastructure, technical support, and AI literacy persist and hinder broader adoption. Therefore, to foster effective AI integration in physical education—especially in volleyball learning—institutions must prioritize educator training, enhance technological support, and establish dedicated AI resource units to modernize teaching and bridge the digital divide.

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