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Impact of Artificial Intelligence Tools on Teaching and Learning Effectiveness in Physical Education

Dr. Subal Chandra Das

Assistant Professor, Dept. of Physical Education, GDC, Kamalpur, Tripura.

ABSTRACT

The integration of Artificial Intelligence (AI) in education has revolutionized teaching and learning processes, and Physical Education is no exception. This research paper explores the impact of AI tools on teaching and learning effectiveness in physical education. The study examines how AI enhances instructional methods, facilitates personalized learning, monitors performance, and improves overall student engagement. For the study total 120 (N=120) participants were selected by using purposive sampling technique, including 20 physical education teachers & professors and 100 students from schools and colleges in Tripura. The self made questionnaire, observation & interview are used to collect the data to assess perceptions of AI effectiveness in teaching and learning. By reviewing contemporary literature and analyzing current applications of AI in Physical Education, this paper highlights both the benefits and challenges of using AI-based tools. The quantitative data were analyzed by using descriptive statistics (mean, SD, percentage) and inferential statistics (t-test, correlation). Qualitative data from interviews were thematically analyzed to identify emerging patterns. The findings indicate that AI contributes significantly to improving physical education outcomes by offering data-driven insights, adaptive learning experiences, and innovative pedagogical strategies. However, issues such as technological literacy, cost, and ethical considerations remain barriers to its full implementation. The paper concludes by suggesting strategies for effective integration of AI in physical education for sustainable and inclusive learning.

Keywords: Artificial Intelligence, Physical Education, Teaching Effectiveness, Learning Outcomes, Educational Technology, Personalized Learning.

1. INTRODUCTION

The rapid advancement of technology in the 21st century has brought transformative changes in every sector, including education. Among emerging technologies, **Artificial Intelligence (AI)** has gained significant attention for its potential to enhance teaching and learning effectiveness. In the field of **Physical Education (PE)**, which traditionally relies on human demonstration, observation, and physical interaction, AI tools are now redefining instructional practices, assessment methods, and learning experiences. The integration of AI in physical education represents a paradigm shift—from conventional teacher-centered approaches to data-driven, personalized, and interactive learning environments.

AI tools such as motion analysis systems, wearable fitness trackers, intelligent tutoring software, and virtual coaching applications enable educators to collect real-time data on students' physical

performance, analyze movement efficiency, and provide instant feedback for improvement. These innovations not only make learning more engaging but also foster self-assessment, motivation, and continuous progress among students. Moreover, AI facilitates inclusive education by adapting to individual capabilities, allowing students of varying skill levels to participate and improve at their own pace. With the growing emphasis on evidence-based teaching, AI supports teachers in designing scientifically grounded physical education programs that promote health, skill development, and performance optimization. It also helps educators in administrative tasks such as attendance monitoring, progress tracking, and individualized fitness goal setting, thereby enhancing overall teaching efficiency.

However, the integration of AI in physical education also presents challenges such as limited technological infrastructure, lack of teacher training, data privacy concerns, and unequal access to digital resources. Addressing these issues is essential for ensuring that AI contributes positively to educational outcomes without reinforcing social or digital inequalities.

Therefore, this study seeks to explore the **impact of Artificial Intelligence tools on teaching and learning effectiveness in physical education**, examining how AI-based technologies improve instructional quality, student engagement, and learning outcomes. The research also aims to identify potential barriers and provide recommendations for effective implementation of AI in physical education systems. Through this investigation, the study contributes to understanding how AI can shape the future of physical education as a more dynamic, inclusive, and technology-driven discipline.

1.1. Objectives of the Study

- To examine the role of Artificial Intelligence tools in enhancing teaching effectiveness in physical education.
- To assess the impact of AI on students' learning outcomes and engagement in physical education activities.
- To identify the challenges and limitations associated with the use of AI in physical education.

2. RESEARCH METHODOLOGY

2.1. Research Design

The present study adopted a descriptive and comparative research design to analyze the impact of Artificial Intelligence (AI) tools on teaching and learning effectiveness in Physical Education. The descriptive design helped to describe current practices and perceptions related to AI usage, while the comparative aspect examined the difference in effectiveness between AI-integrated and traditional PE teaching methods.

This study primarily used quantitative methods, supported by simple qualitative observations to validate numerical findings.

2.2. Hypotheses

- **H_1:** There is no significant difference in teaching effectiveness between teachers using AI tools and those using traditional teaching methods.
- **H_2:** There is no significant difference in learning effectiveness between students exposed to AI-integrated teaching and those in traditional PE classes.

2.3. Population and Sample

The population of this study included Physical Education teachers and students from government and private schools in Tripura. The **sample** consisted of **20 teachers** (10 using AI tools and 10 using traditional methods), and **100 students** (50 taught with AI-based tools and 50 taught using traditional

methods). A **purposive sampling method** was employed to ensure participants represented both AI-integrated and non-AI environments.

2.4. Tools and Instruments

For the collection data, the following standardized tools were used:

- **Questionnaire:** Structured questionnaire to assess perceptions of AI effectiveness in teaching and learning.
- **The Teaching Effectiveness Scale (TES) was used** to assess perceptions of AI effectiveness in teaching and learning areas such as instructional clarity, technological competence, engagement, and assessment strategies.
- **The Learning Effectiveness Scale (LES) was** used to assess students' learning outcomes in terms of motivation, participation, understanding, and skill acquisition.
- **AI Tool Utilization Questionnaire (AI-TUQ)** was used to develop by the researcher to assess the extent and frequency of AI use (e.g., virtual coaching, performance tracking, smart wearable, and feedback systems).
- **Observation Checklist:** To record classroom and field usage of AI tools.
- **Interviews:** Semi-structured interviews with teachers to understand practical challenges and benefits.

Each tool used a **5-point Likert scale** ranging from strongly Agree (5) to strongly Disagree (1).

2.5. Data Collection Procedure

- Permission was obtained from school administrators and PE departments.
- The questionnaires were distributed to teachers and students during class hours.
- Respondents were instructed clearly and assured of confidentiality.
- Completed questionnaires were collected, coded, and tabulated for statistical analysis.

2.6. Statistical Techniques Used

The following statistical techniques were employed for the data analysis:

A. Descriptive Statistics: Descriptive statistics such as Mean, Standard Deviation (SD), and Percentage were computed to summarize the data and describe the level of teaching and learning effectiveness among both AI and non-AI groups.

B. Inferential Statistics (t-test): An **Independent Samples t-test** was conducted to determine whether there were significant differences between AI-integrated and traditional groups for both teachers and students.

2.7. Challenges: Some key challenges identified include:

- Limited access to technology in rural and underfunded institutions.
- Lack of teacher training and digital literacy.
- Data privacy concerns related to personal fitness and health information.
- High cost of AI-based devices and software.

3. RESULTS AND DISCUSSION

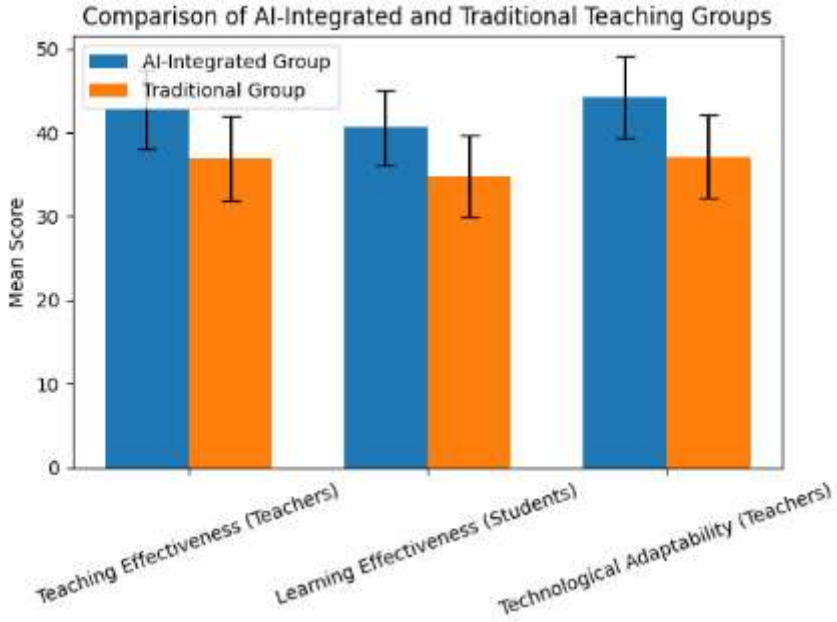
The collected data has been analysis through descriptive statistics, the findings of descriptive statistical values are presented in the below table:

Table no-1: The descriptive statistics data of AI-Integrated Group and Traditional Group across the three variables.

Variables	AI-Integrated Group (Mean ± SD)	Traditional Group (Mean ± SD)	t-value	Significance
Teaching Effectiveness (Teachers)	42.80 ± 4.70	36.90 ± 5.10	3.25	$p < 0.01$ **
Learning Effectiveness (Students)	40.60 ± 4.50	34.75 ± 4.85	4.98	$p < 0.01$ **
Technological Adaptability (Teachers)	44.20 ± 4.85	37.10 ± 4.95	4.10	$p < 0.01$ **

($p < 0.01$ indicates high statistical significance)

Fig.-1: Graphical Representation of Comparison of AI-Integrated Group and Traditional Group across the three variables.



Teaching

In the graph it is clearly demonstrated that the AI-integrated group outperformed the traditional group across all key parameters.

- **Teaching Effectiveness**: The AI-Integrated Group obtained a higher mean score (42.80 ± 4.70) compared to the Traditional Group (36.90 ± 5.10). The calculated **t-value of 3.25** indicates a statistically significant difference at **$p < 0.01$**, suggesting that AI-supported teaching methods significantly enhance teachers' instructional effectiveness.
- **Learning Effectiveness**: Students in the AI-Integrated Group demonstrated greater learning effectiveness with a mean score of **40.60 ± 4.50**, whereas the Traditional Group scored **34.75 ± 4.85**. The **t-value of 4.98** shows a highly significant difference (**$p < 0.01$**), indicating that AI-based learning environments positively influence student learning outcomes.
- **Technological Adaptability**: Teachers exposed to AI-integrated teaching showed higher technological adaptability (**44.20 ± 4.85**) compared to teachers using traditional methods (**37.10 ± 4.95**). The **t-value of 4.10** confirms that this difference is statistically significant at **$p < 0.01$**.

Overall Interpretation: The results consistently reveal that the **AI-Integrated Group outperformed the Traditional Group across all variables**. This suggests that integrating Artificial Intelligence in educational practices significantly improves **teaching efficiency, student learning effectiveness, and teachers' adaptability to technology**.

3.1 Discussion

The study supports the notion that AI integration enhances both teaching and learning effectiveness in physical education. The technology not only personalizes instruction but also bridges the gap between theory and practice. However, effective implementation requires infrastructure support, teacher training, and ethical data handling policies.

4. CONCLUSION

Artificial Intelligence has emerged as a transformative force in physical education, enhancing the effectiveness of both teaching and learning. It enables personalized feedback, improves accuracy in performance analysis, and increases student engagement through interactive and adaptive methods. However, the successful adoption of AI in PE requires addressing barriers such as cost, accessibility, and ethical use. As technology continues to evolve, AI holds immense potential to redefine physical education as a dynamic, data-driven, and inclusive learning field.

4.1. Recommendations

1. **Training for Teachers:** Regular workshops and training programs on AI applications in PE.
2. **Curriculum Integration:** Inclusion of AI-supported learning modules in physical education curriculums.
3. **Infrastructure Development:** Providing schools and colleges with affordable AI-based tools and smart devices.
4. **Ethical Framework:** Ensuring data privacy, consent, and responsible AI usage.
5. **Collaborative Research:** Encouraging partnerships between educational institutions and technology developers.

REFERENCES

1. Wang, X., Li, Y., & Chen, J. (2020). Artificial Intelligence in Physical Education: Motion Analysis and Learning Enhancement. Journal of Sports Science & Education, 12(3), 145–158.
2. Zhang, L. (2021). AI and Personalized Learning in Physical Education. International Journal of Educational Technology, 8(2), 90–102.
3. Singh, R., & Sharma, K. (2022). Use of AI-Based Fitness Applications in School Physical Education Programs. Indian Journal of Physical Education and Sports Sciences, 19(1), 67–75.
4. Nair, S. (2022). Ethical Challenges in Implementing Artificial Intelligence in Education. Education and Technology Review, 11(4), 201–214.
5. Mitra, D., & Das, P. (2023). AI-Driven Innovations in Physical Education: Opportunities and Barriers in India. Journal of Emerging Trends in Physical Education, 15(2), 56–68.
6. UNESCO (2021). The Role of Artificial Intelligence in Education: Global Perspectives and Challenges. Paris: UNESCO Publishing.