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Vinay Pratap

Research Scholar, IGIPES,
Department of Physical
Education and Sports Science,
University of Delhi, B-Block
Vikas Puri, New, Delhi, India

Dhananjay Shaw

Professor, IGIPES,
Department of Physical
Education and Sports Sciences,
University of Delhi, B-Block
Vikas Puri, New, Delhi, India

Artificial intelligence: A pedagogical paradigm shift in the learning outcomes of physical education & sports

Vinay Pratap and Dhananjay Shaw

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Abstract

Although physical education is not a pure but an applied subject which has been implemented in the Indian curriculum keeping in mind its specialties and roles. It is the only subject in the world that covers all three domains (Cognitive, affective, and psychomotor) of learning. In the last few years, a significant Pedagogical Paradigm Shift has been seen in its learning outcomes, and our study also shows the significant change in pedagogical shift in the field coaching teaching and research in different ways.

This qualitative study explores the role of Artificial Intelligence (AI) in transforming tailoring, pedagogical implementations and learning outcomes in physical education and sports. Data were collected through semi-structured interviews from 15 participants, including 05 coaches, 05 teachers, and 05 researchers to record their perception regarding AI intervention and its impact on their professional work.

We have used phenomenological approach and six-step thematic data analysis framework to categorise all the interview proceedings/recordings into four sub themes T₁: Knowledge of AI based tool general/specific, T₂: Pedagogical shift & Learning Outcomes, T₃: Challenges faced in implementation, T₄: Ethical concern regarding utility.

Findings indicate that AI uplifts the horizon of understanding skills, techniques, styles of teaching learning and tactical development while introducing challenges related to access, ethical knowledge, and proper implementation (precise and accurate input). The study also emphasizes that AI represents a pedagogical paradigm shift, suggesting that successful integration requires ethical safeguards, professional development, and equitable access.

Keywords: Artificial intelligence, learning outcome, paradigm shift, physical education etc.

1. Introduction

Applications of artificial intelligence making things smart, like smartphone, smart city, and so, smart teaching learning procedure through automation. Sport is most popular part of physical education, and so its outcome, ^[2, 16, 17].

Despite its potential, integrating AI into physical education presents challenges, including unequal access, ethical concerns, and teacher readiness ^[9, 10]. While global research has highlighted AI's applications in cognitive and academic education, there is limited exploration of its role in sports pedagogy, particularly in higher education ^[3, 7].

This study aims to address this gap by investigating the perceptions and experiences of students, teachers, and researchers regarding AI in physical education.

Although literature supports AI's role in improving educational practices, limited empirical research explores its specific impact on physical education and sports pedagogy, ^[1]. Existing studies primarily focus on technological potential rather than lived experiences of teachers, students, and researchers. This gap highlights the need for qualitative inquiries—such as semi-structured interviews—to understand how AI is perceived as a pedagogical paradigm shift in shaping learning outcomes and instructional design.

1.1 Research question

How does use of AI shift the professional work of coaches, teachers and researchers in context shaping learning outcomes and instructional design?

Corresponding Author:

Vinay Pratap

Research Scholar, IGIPES,
Department of Physical
Education and Sports Science,
University of Delhi, B-Block
Vikas Puri, New, Delhi, India

1.2 Literature review

Recent research highlights the positive outcomes of AI implementation across various educational and athletic settings. For instance, Xavier High School demonstrated that the adoption of AI-driven fitness tracking applications enables students to monitor their activity levels and receive individualized feedback, promoting motivation and accountability in their physical development. Similarly, the Sports Academy employed AI-based video analysis to evaluate athletes' movements, allowing coaches to "provide tailored drills that targeted individual weaknesses," which led to measurable improvements in performance and confidence (NADCE, n.d.), ^[1, 4].

Moreover, large-scale initiatives such as the Citywide PE Initiative illustrate the potential of AI to inform data-driven decision-making in educational policy and practice. By aggregating and analysing performance data from multiple schools, the program supported equitable resource distribution and the design of targeted interventions aimed at specific demographic groups, ^[1].

AI is enhancing effectiveness of teachers with concise student centric teaching material, teaching aids for in depth understanding, quick revision, shadow exam practice, project & model building, etc. But uneven access of tool facility is matter of challenge, ^[2, 3, 4].

A meta-analysis study of 130 articles says that integration of artificial intelligence in physical education presents significant opportunities to enhance teaching effectiveness, learning personalization, and performance analysis. Despite its promising potential, challenges such as data privacy, system reliability, and teacher preparedness remain critical concerns ^[18].

1.3 Significance

The significance of this study lies in synthesizing the lived experiences of coaches, teachers, and researchers regarding the use of artificial intelligence (AI) in physical education & Sports.

In the modern era, where technology and AI play a crucial role in education, this research provides valuable insights that can help coaches, teachers, researchers, and policymakers design better instructional plans, ensure more effective implementation, and ultimately achieve improved learning outcomes in physical education, ^[6, 7, 10, 12].

2. Materials and Methods

Research methodology is an indispensable and keenly designed part of a research study. It is a road map which decides the different ways to reach the destination of a research problem by inculcating every possible detail & description. Especially dealing with research design, data gathering, coding-decoding of data, and data analysis with proper description.

2.1 Research design

This study is based on qualitative research design consisting of 15 samples (05 coaches, 05 teachers, and 05 researchers) for data collection through semi-structured interviews to explore their experience and perception regarding use of AI as a pedagogical upliftment in the learning outcomes of physical education & sports, ^[15]. The purposive sampling (Snowball sampling) was used to choose the sample and population of physical education & sports.

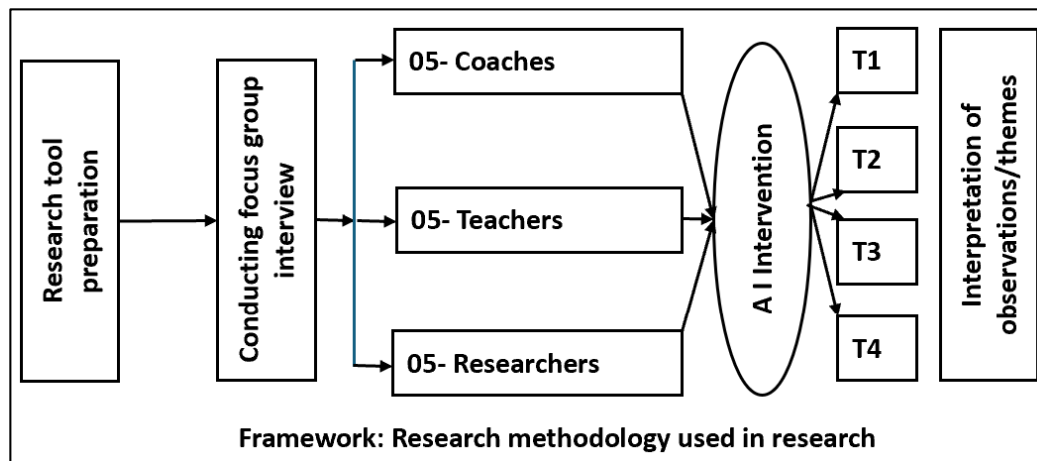


Fig 1: Framework of research methodology used in this study

2.2 Research approach

Best suitable research approach for this study is phenomenological approach because lived experiences of coaches, teachers, and researchers with certain ideology is being used. The aim of this approach is to tap out in-depth knowledge and experiences in subjective responses from their professional settings, ^[15]. who advocate for phenomenological designs in education studies when

examining emerging technologies that transform instructional practices, ^[14].

2.3 Data Analysis

The thematic analysis was used to analyze subjective data with the help of six-step thematic data analysis framework, ^[14].

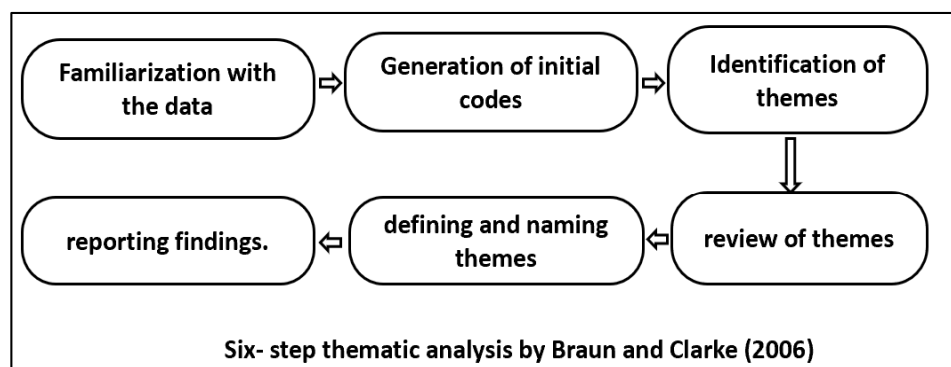


Fig 2: Step by step theme analysis by Braun and Clarke (2006)

We have completed the analysis of data with the help of NVivo software. Entire data was categorized into four main themes/observations (T_1 , T_2 , T_3 , and T_4) and they are as follows:

- Theme1- T_1 : Knowledge of AI based tool general/specific.
- Theme 2- T_2 : Pedagogical shift & Learning Outcomes.
- Theme 3- T_3 : Challenges faced in implementation.
- Theme 4- T_4 : Ethical concern regarding utility.

3. Results

3.1 Theme1- T_1 : Knowledge of AI based tool general/specific

The data outcome under this theme was subcategorized into two general and specific subgroups. In general, most of the participants have knowledge of ChatGPT, Google form, Google Gemini, Perplexity, Deep seek, Siri, Alexa, Grammarly, Mata AI Quill boat, Facebook, Instagram, chat boat, etc. Specific Ai tool used by coaches, teachers and researchers are as follows.

Coaches: Chat GPT advance version, Pixellot, Tezeract, motion analyzer, NV play Vision AI, 3D modeling, Cric Vision, StanceBeam, Fulltrack AI, Hawk-Eye, DRS, Bowling machine, Smart11, PlaymakerAI, Flickit coach academy, Saiva-Coach Assistant, PlayIQ, CoachSwift, Pixellot, FieldStats, StepOut.ai, GoalBot, Hudl Hockey, Folio3 AI Hockey Video Analysis, CATAPULT VECTOR for Ice Hockey, CricVision, AI Boxing Coach, Sparr.AI, IPPONshootin etc.

Teachers: Copilot, VXR Labs Google form, Canva, Khanmigo, Curipod, MagicSchool, Eduaide.ai, Gradescope, Semantic Scholar, Grammarly, QuillBot etc.

Researchers: Elicit, Semantic Scholar, ResearchRabbit, Explainpaper, Litmaps, Connected Papers, Chat GPT advance version, IBM SPSS, Chat GPT advance version, NVivo, Copilot, Elicit, Dupli Chaker, Rayyan, Sourcely, Litmaps, Wordtune, Jasper, Zotero, Mendeley, Scite.ai, Iris.ai, Qualls.ai, Cuali.ai, QInsights, Qualzy, Delve, InfraNodus, voice typing etc.

3.2 Theme 2- T_2 : Pedagogical shift & Learning Outcomes

Having such basic, advanced knowledge, and its use has shown a huge change in planning and implementation of our coaching with much focused, time-bound learning outcome prior it was based on vision, experience & intuition of a coach/teacher/researcher.

3.3 Theme 3- T_3 : Challenges faced in implementation

As we all know, AI is such a wonderful tool by using this we could save the time to get precise knowledge, but few challenges are as follows:

Coaches at senior level get the facilities and assistance but what about rural areas, all are not ready to use technology. Unavailability of technology like High GPU computers and camera. lack of expertise is also a big concern. Artificial intelligence tools with high accuracy and precision are costly and need a proper operator.

VR labs, and EdTech can be prohibitively expensive. Many teachers are not trained enough to deal with AI. What if an AI think like biased teacher, then whole grade system will be affected. In state board schools some teachers even do not use smartphones.

Advance tools may have high licensing fees, not a part of research coursework, so students can learn its judicial use, limited use for cloud-based computing, etc.

3.4 Theme 4- T_4 : Ethical concern regarding utility

Video and photos were taken at the time of training may morph and use for bad purposes. Sensitive research data like research and development data of nuclear programs of country or game plan of a team need a secure handling. A researcher may create false data (cooked data), or AI can steal the data of researcher.

4. Discussion

So, this is how the AI facilitates us to shift our route planning, learning, and execution method to AI based effective coaching, teaching, and more precise research.

NV Play Vision AI, Fulltrack AI, and Cric Vision use commonly in video analysis for performance and skill. Smart 11 may be useful for selection of best 11. StanceBeam is a sensor-based motion tracking tool to deal with bat swing, power generation, and timing. Hawk-Eye is used in DRS system by umpires to get conclusive evidence for ultra edge, run out, no ball, clear catch, and ball trajectory for LBW. Automated bowling machine do analyze the bowling of any bowler and later ball accordingly to a batsman for practice. (Cricket coach).

AI Boxing Coach and Sparr.AI both are motion tracking tools in which first one deals with real-time feedback on punches, form, and training and second one is special for sparring and form correction (Boxing coach).

Hudl Hockey and Folio3 AI Hockey Video Analysis are used to prepare perfect match, player breakdown and team analysis. While CATAPULT VECTOR is used for motion tracking (speed, workload & effort) (Hockey, Hockey coach)

SHOTZERO is real time skill analyzing and correction (grip issues, flinch, trigger control, stance, recoil, etc.) providing tool which is based on video processing while AI Stagecoach utilizes in hole detection in target and remedial drill recommendations (Shooting coach)

ChatGPT (GPT-5/ChatGPT Edu), MagicSchool.ai, Eduaide.AI, and Lesson Plans AI use for curriculum and lesson plan design. Grammarly, Wordtune, ChatGPT, Copilot, Notion AI use for to improving writing skills. School AI, Copilot, Google Gemini, and Power BI quickly analyze student reports. The students can experience virtual labs like VXR Labs by VictoryXR (Teachers).

ResearchRabbit, Elicit, and Semantic Scholar help to get relevant research. More Relevant research is in very short period give you a chance to go through all the research then you can choose appropriate studies aligned with your study. Explainpaper deals with extract findings & methods. On the other hand, Litmaps, connected papers, NVivo use to map themes, identify patterns and research gaps. To extract themes from a huge data set manually is a very tedious task and chance of making mistakes is more but with the help of these tools you can do it easily even they give you more facility to choose different patterns based on you can find out actual research gaps. Wordtune and Jasper are used to write a clear research draft. Zotero and Mendeley used to manage citations. Grammarly and QuillBot use to improve clarity and tone. Voice typing is another revolutionary tool which is very useful for book writing and research writing as well it is also helpful for people who are differently able. Even though you don't have good typing speed. If you have clear accent to speak it will be after you. It depends only on speaking speed It will write whatever you say Simultaneously. Sci-Hub provides free access to research articles by passing the journal by using the links it helps to democratize the availability to an article. (Researchers)

5. Conclusion

On behalf of all recorded conclusive statements of coaches, teachers and researchers, we can conclude that intervention of artificial intelligence shows a paradigm shift in outcomes in the form of performance-based themes of athletes, Students and better and innovative research [7, 11, 14]. AI plays a pivotal role in the pedagogical paradigm shift by designing more authentic, achievable, and Intended Learning Outcomes instead of simple learning outcomes such as:

5.1 Coaches: We can read recent research, get more in-depth knowledge about the prose and cones of a team and an individual with the help of AI tools, prepare best suitable process model-based plan of skill, technique, tactic, style of play for own team/player and opponent, track health status, food plan, injury management, real time suggestion and solutions [11, 14] etc.

5.2 Teachers: We can implement hybrid mode of pedagogical approach, prepare best teaching materials in few minutes, interactive panels can change poor writing to word text format simultaneously, live 2D, 3D models, VR laboratories conducts chemical experiments without any potential danger, all tough concepts are on finger tips, evaluation can be done with multi-mode process, facilitating students with sorted and precise knowledge to deal with projects preparation, etc [3, 4, 5].

5.3 Researcher: In modern era AI proves like a boon to researchers. It helps them to find a précised and justified research gap. It also supports them with Multi-dimensional view to look a problem, literature review, methodological framework, suggestive tools, so that they could frame and direct their own research work for data collection analysis and so on. While dealing with a quey it directs like a supervisor and suggests like a friend

AI is just a designed program to simplify & support human work, which gives us suggestions and recommendations. This is our duty to verify all the information which is suitable ethically & morally for the batter learning outcomes in all domains of physical education and sports [10].

6. Recommendations

- **Workshop/training:** Introduce skill development program for comprehensive understanding to coaches, teachers, and researchers, later they could apply it [7, 8, 11, 17].
- **Coursework part:** The ethical use of AI should be part of course work for research scholars and the part of training for teachers and coaches [6].
- **Regular monitoring:** Uge of AI and its impact on learning outcome should be measured regularly so that we can make a safeguard if it is creating any threatening effect [7, 14].
- **Ethical use:** As it is AI, it may potentially danger of data theft and intellectual ideas. Make sure about proper use of AI as an aid to coaches, teachers, and researchers ethically, so get rid of mentioned probability [10].

7. Limitation

This study was based on a purposive sampling method (Snowball sampling) along with semi-structured interviews from 15 participants, including 05 coaches, 05 teachers, and 05 researchers, which may limit the transferability of the findings. A big sample size may get more concrete result. Data were collected through interviews, making the results potentially subject to participant or researcher bias. Despite efforts to maintain reflexivity, interpretations remain influenced by the researcher's perspective.

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