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## ARTIFICIAL INTELLIGENCE INTERVENTION IN PROFESSIONAL DEVELOPMENT MECHANISM OF TEACHERS: A SYSTEMATIC BIBLIOGRAPHIC OVERVIEW

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**Abstract:** Education has now witnessed enigmatic changes with the arrival of rapidly developing technology in all possible ways. From the introduction of primitive technology like teaching machines or basic instructional technology to today's artificial intelligence, technology is set to transform the futuristic notion of education across the world. India, being an emerging hub of world education is now most likely to adopt Artificial Intelligence as a part of teaching learning and curriculum transaction. Teachers are the most crucial stakeholders and have the sheer responsibility of adopting Artificial Intelligence into their teaching-learning practices through AI-integrated curricula or professional development mechanisms. This paper will cover 435 relevant studies based on publishing years, publishing mode, type of documents, and index type to formulate a systematic review of using artificial intelligence in Continuous professional development. This systematic Bibliographic review will eventually show the current scenario, scopes, and challenges of integrating Artificial Intelligence in the professional development mechanism of teachers at different levels.

**Keywords:** *Artificial Intelligence, Teacher Education, Continuous Professional Development, Systematic Bibliographic reviews*

**Introduction:** Technology has been a key component in changing the paradigm shift in the education sector throughout the world scenario. The world is witnessing a radical change since the technological intervention in each possible manner especially in education. All the educational components such as teaching-learning, curriculum and content development, instruction technique, curriculum transaction, and Evaluation procedure have been broadly synthesized with the emerging tools and techniques. In the context of India, we found the proof of integrating technology could be seen in the National Policy of Education 1986 where there were recommendations of using multimedia in education. Information and Communication Technology in India came into existence in December 2004 and was later revised in 2010 to provide technology-aided learning to secondary-stage students for their capacity building in the technological field (MOE, 2016). The advancement of technical supports optimizes learning perspectives for the students and teachers irrespective of different levels. The commencement of National Education Policy 2020 has introduced key provisions of 21st-century technologies like simulation, augmented reality, artificial intelligence, etc. in current classroom scenarios which is significantly laying the foundation for futuristic advanced classrooms in our nation. The main focus of the policy is to use technology to gain access, support, and at the same time, professional development of teachers and capacity-building programs for them using these technologies (Ghosh, 2023). Teachers being the most important stakeholders of this changing panorama need to get well acquainted with all these emerging technologies and should be capable of using technology in teaching-learning situations. Artificial Intelligence is probably the most trending among all other technologies and is already in extensive use. Keeping the NEP 2020 as a vision CBSE has included Artificial intelligence as an individual optional discipline for the students of class IX to XII from the session of 2019-20 onwards. They also initiated a capacity-building program for teachers to get them acquainted with the required knowledge (Brainfeed, 2023). Researchers analyze this initiative in a critical way on how it will be implemented in two-fold ways and add their remarks along with it (Bablu Karan, 2024). The potential scope of using artificial Intelligence like automated text, intelligence tutoring systems, and personalized learning which possibly enhance student engagement, and academic and administrative effectiveness despite having numerous challenging notions (Tyagi, et al, 2024). Certain potential challenges included capacity building programs, teacher training, community engagement, and monitoring and evaluation which are not AI-ready to be implemented into reality (Saxena & Agarwal, 2022). To turn all these visions into reality we first need to educate and skill our teachers with AI-infused curriculum and teaching learning strategies. There is certain evidence where the positive inter-relatedness is shown between the use of AI-based applications and the lecturer's professional development (Pius John Bassey, et.al, 2024). A qualitative-based research study was made to do a proper review of the promises and challenges of the teachers in the time of Artificial Intelligence (I.Celik, et.al, 2024). Experimental research was conducted with teachers giving AI-based assessment tools which resulted in gaining attention to the use of AI in professional development (Tanya Nazaretsky et.al, 2022). Artificial-based intelligence tools were used in various studies to show their impact on professional development (Kairit Tammets & Tobias Ley, 2023). Generative AI-based tools were also implemented which resulted in creating huge interest among teachers to use them in teaching methods (Hamza Fakhra et.al, 2024). Researchers believe that Artificial Intelligence is a significant factor in the 21st century and needs special skills to be integrated into the professional sphere

(T. Karsenti, 2019). Some researchers show how artificial intelligence can reduce the workload of teachers instead of focusing on the negative aspect of whether AI can replace human teachers (K. Satish Kumar et.al, 2022). Researchers also show how Artificial Intelligence can transform the adaptability of Indian Higher Education (Silky Sharma et.al, 2024). Language-based instructional approach was also examined through the use of Artificial Intelligence (Pooja Nagpal & Rameshkumar M, 2024). Therefore, this paper will generate a comprehensive bibliographic analysis of journals, articles, and different databases based on this recent trend of artificial intelligence in connection with the teacher education area collectively.

**Statement of the Purpose** The elaborate discussion regarding the recent phenomena of artificial intelligence has clearly shown a path of synthesizing this emerging technology into the Education sector. A detailed overview of the recent literature will be significantly important to acknowledge the current trend and need for Artificial intelligence in teacher's professional development. Therefore, the researcher titled this study "Artificial Intelligence Intervention in Continuous Professional Development Program of Teachers: A Systematic Bibliographic Overview"

### Research Objective:

- I. To analyse the literature based on their publication duration, trend, abstract, keywords, methodology and major finding of the studies

### Research question:

- I. What was the distribution of the relevant studies published over time that examined Artificial Intelligence in Teacher's professional Development Mechanism?
- II. What are the emerging theme, trend, Methodology and pattern of finding in this relevant literature?
- III. Who are the key contributing countries and what are their contributions to this field?

**Research Methodology:** The Bibliographic study includes a systematic bibliographic review containing content analysis and quantitative data-based data representation of the publication duration over time, to draw the theme, pattern, and keywords resulting scenario regarding artificial intelligence intervention in teacher's professional development mechanism. This research study is entirely based on secondary data sources. The publication's dates ranged between 2018- 2024 and are entirely connected to the use of Artificial Intelligence in Teacher Professional Development. Keywords we used to search for publications in the different databases: Artificial Intelligence, teacher education, professional development. The search date in the different databases is July 17, 2024. The conducted research is limited to publications presented in different sources for the past 6 years. At the same time, the analysis expresses the trends in using Artificial Intelligence in Teacher Professional Development Mechanism. Intension and Extension criteria were used to find 435 relevant studies covering teacher education while explicitly 102 studies covered covering continuous professional development of teachers while using Artificial Intelligence. The intension and extension criteria are defined by following parameters listed below-

Table 1.0 – Table showing intension and extension criteria

Intension Criteria	Extension Criteria
1. All studies focusing to particular research topic	1. Published earlier than 1 <sup>st</sup> January, 2018
2. Research studies published in between 2018-2024, i.e., last five years	2. AI-based research studies which are not based in Educational purposes
3. Online databases	3. Other (less reputable databases)
4. Peer-reviewed and English written Journal papers and articles were included	4. Research studies in other language
5. Search terms were applied in the title, abstract or keywords of the papers and articles	5. Other than open access journals
6. Open access journals	

This method gives an overall idea of the effect of Artificial Intelligence in the field of continuous development mechanism of teachers that have been explored in the research studies over the years and the further scope of using artificial intelligence in the area of professional development mechanism in the futuristic aspect.

### Result:

Based on the content analysis of bibliographic studies made on 435 research studies we classified them by publication year, key contributing countries, keywords, themes, and major findings. The results are presented according to the following order of research questions.

#### I. The Distribution of Published journal over period of time:

The finding under the first research question shows the trend of research studies related to Artificial Intelligence in the sphere of Teacher Education in duration of time. Data showed that studies related to Artificial Intelligence in Teacher Education have been increasing rapidly in recent years. Total of 435 studies have been found over the past 6 years which have been represented through bar diagram to show the trend of research studies respective to years.

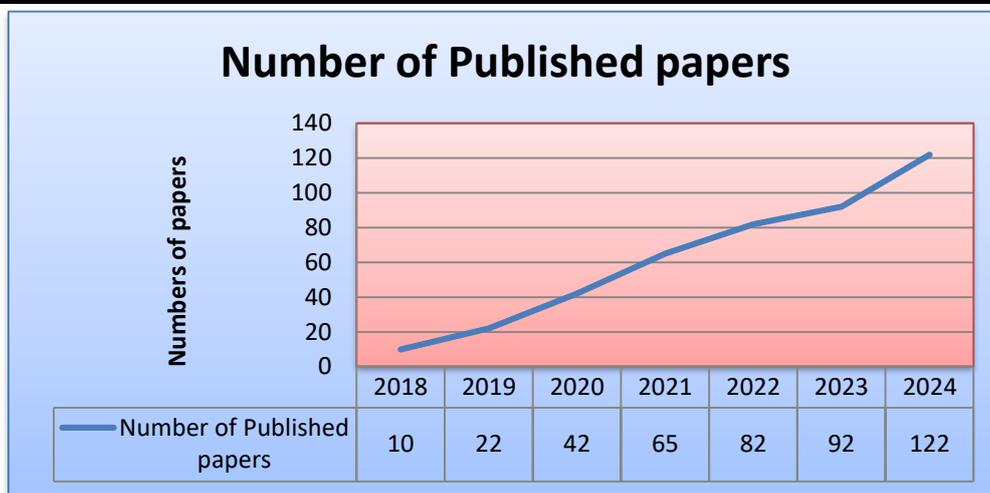


Fig 1: Publication Over time in the number of published paper on Artificial Intelligence in Education

## 1. The major pattern and themes drawn from this bibliographic overview:

The researcher has tried to investigate the major themes and patterns in the reviews and divided according to the abstracts and respective key words.

- I. **Based on abstracts:** Most of the abstracts in the reviews present an overall summary of the papers reveals the main goal of the study, the nature of study, the data collection and analysis method and most importantly the overviews of the result. As researchers found only 102 papers related to the continuous professional development, a thematic pattern has been prepared out of this based on the specified codes, keywords, tone etc. with proper frequency. Mainly two themes were generated based on the frequency rates of major codes appearances.

Table 1.1: Table showing major codes, frequency, keywords and major themes

Major Codes	Frequency	Major theme	Major Keywords
<b>Artificial Intelligence</b>	70%	Artificial Intelligence will be transformative in education field including teacher education  Artificial Intelligence should be included in the professional development of teachers to build competency.	Artificial Intelligence, Professional Development for Teachers, E-learning, Digital Age, Education, Generative Artificial Intelligence, Ethics, Integrative literature review, AI integration
<b>Generative AI</b>	20%		
<b>AI based tools</b>	30%		
<b>Teaching-Learning improvement</b>	15%		
<b>Teacher Education</b>	60%		
<b>Professional development</b>	35%		
<b>Teacher's proficiency</b>	25%		
<b>AI literacy among teachers</b>	30%		
<b>Innovative approach</b>	25%		
<b>Transformative Education</b>	7%		
<b>Teacher's competency</b>	12%		Teacher AI literacy, competency.

In the above table, major codes were distributed according to their frequencies that eventually generate two major themes regarding how Artificial Intelligence will be transformative in the field of Teacher Education and other theme claims the importance of including Artificial Intelligence in the continuous professional Development mechanism of Teachers. One of the major codes include Innovative approaches which tells about approaches being used with the help of Artificial Intelligence and teacher's relevant competencies regarding using Artificial Intelligence based tools and techniques in classroom scenario. The keywords found in the studies were gathered to extract the major ones.

- II. **Based on the Keywords:** All the reviews of related literature contain keywords specific to the research studies. Based on the studies a word cloud has been prepared to represent all the key terms associated with the studies calculating the frequency metrics of each keyword.

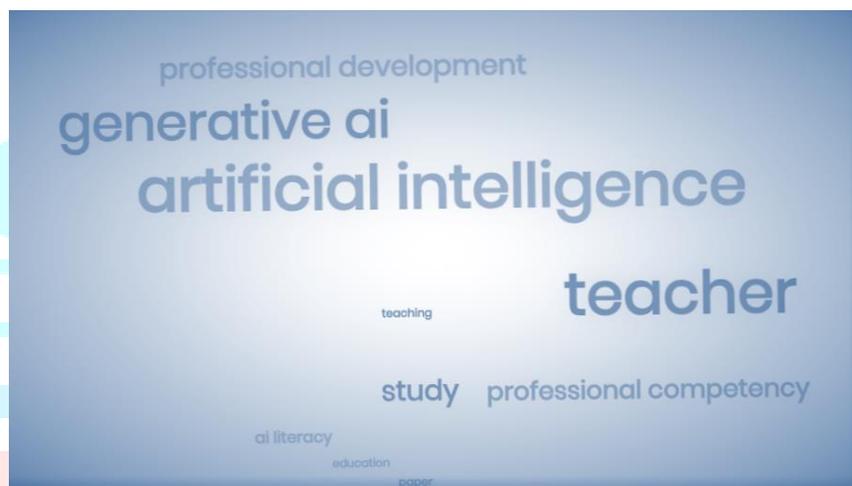


Fig 2: A word-cloud based on frequency of keywords

- III. **Based On methodology:** The overall Bibliography study reveals that almost 80% studies were totally qualitative and only 20% of the papers are quantitative in nature.

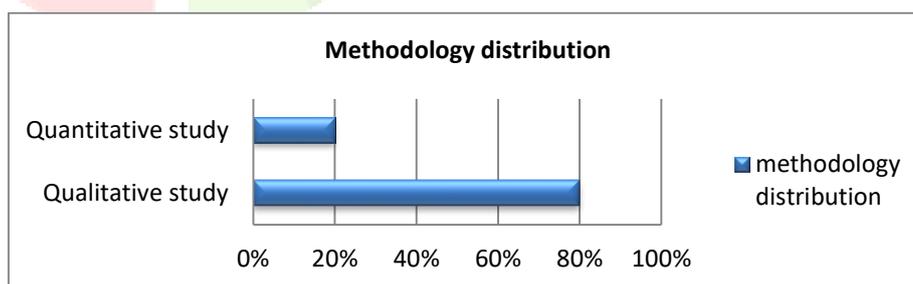
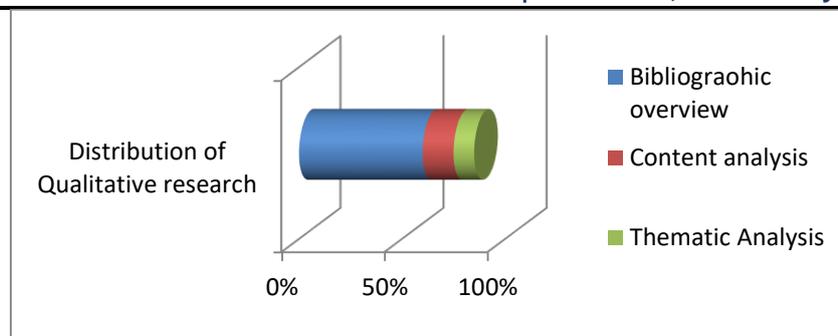
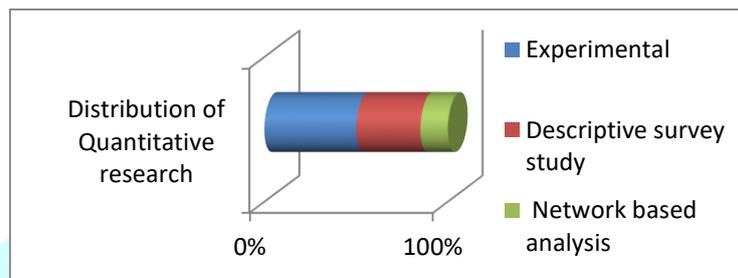


Fig 3.0: Percentage distribution of papers with different research methods

Qualitative data analysis is distributed in content, thematic and mostly bibliographic overview and very few on building thematic frameworks. Quantitative research studies are experimental, quasi-experimental, quantitative based Network analysis and survey based research which showed an implication of AI on practical basis.



*Fig4.0- Percentage distribution of Qualitative methods*



*Fig 5.0: Percentage distribution of Quantitative methods*

IV. **Based on Pattern of the Finding:** This Bibliographic overview study has produced several key findings based on the objectives and research questions. There is a major finding related to integrate policies of Artificial intelligence in innovative approach of Educational field visioning Viksit Bharat@ 2047 has been discussed with innovative Artificial Intelligence approaches in education like Intelligence tutoring system, Generative Artificial Intelligence integration, personalized learning, modified evaluation system etc.(Chandrasekhar Bhoi, et.al, 2024). Most of the findings are guided towards the need and theoretical reflection of the usage of artificial intelligence in education and teacher education field (Gunjan Dubey, et.al, 2022). In many studies many programs and modules regarding AI literacy development, Training programs were introduced to show how it can improve teacher's efficiency in AI functioning in teaching learning situation. A study also revealed the enhanced efficiency of English language teachers with the help of AI based tools and techniques (Pooja Nagpal & Rameshkumar M, 2024). A detailed review also reveals the key initiatives of Central Board of Secondary Education regarding inclusion of AI-based curriculum from the class IX-XII and also demands a clear understanding about AI from teacher's end. A few study revealed the scope of generative artificial intelligence in the field of continuous professional development (Matthew Nyaaba & Xiaoming Zhai, 2024). Policies and ethical frameworks have been suggested by the researchers to

get Artificial intelligence included in the professional field of education resulting professional efficiency among teacher. Most of the research studies included in this paper have positivistic outlooks towards including Artificial Intelligence while very few among the studies are sceptical about the major challenges and issues about integration of Artificial Intelligence in educational sphere.

### 1. Studying the key contributors and their contributions in the field of Artificial Intelligence in teacher's professional development:

The studies related to artificial intelligence in Education sector was evident since 2018 in various disciplines. In this research study researchers have mainly investigated the phenomenon of artificial intelligence in the area of teacher education. After reviewing studies from different data resources selecting proper filter and relevance, the researchers found almost 435 studies which discussed about overall impact of artificial Intelligence in teacher education. Among these papers only 100 studies were found to be entirely dedicated to the effect of artificial intelligence in the sphere of continuous professional development of teachers in different disciplines.

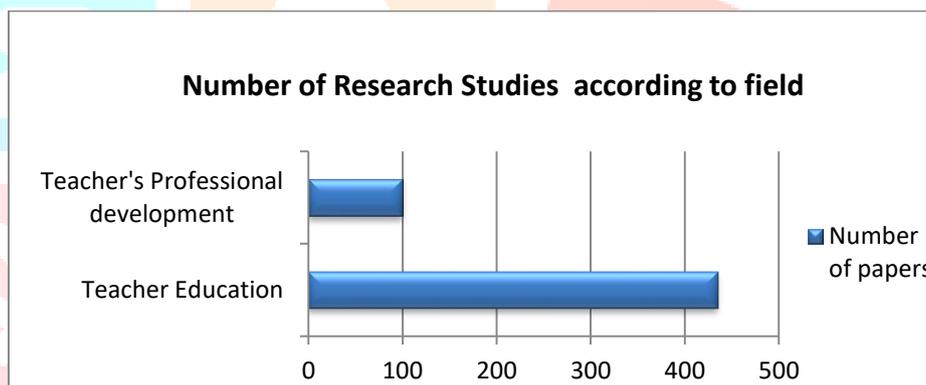


Fig 6: Distribution of papers based on field of study

In these 102 studies 47 studies talked about practical implication whereas the rests were confined to the theoretical framework of Artificial Intelligence in teacher's professional development.

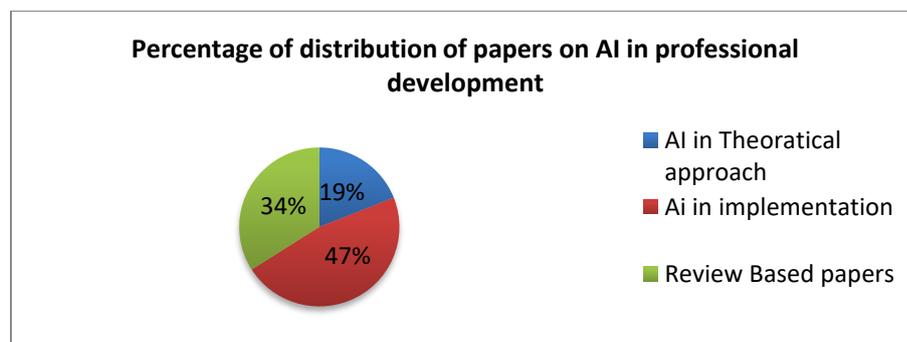


Fig 7: Distribution of study on AI in professional development

Besides this classification there was a pattern of publish paper which was based on country. A trend has been shown that that the foreign countries like China, South Korea, Saudi Arabia, Russia etc. show supremacy of AI in teacher's professional development whereas a very few paper has been published from India which is also based on reviews and theoretical approaches.

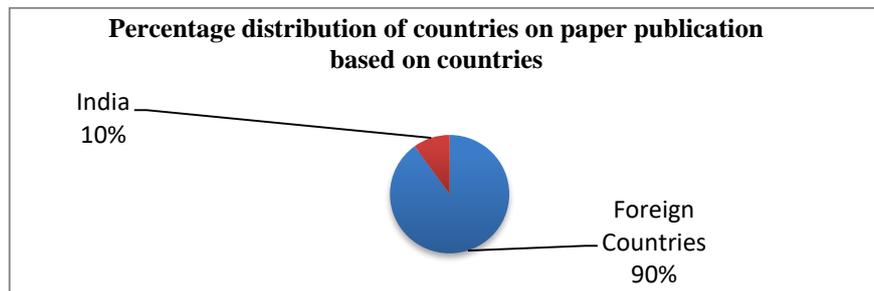


Fig 8: Pie-Chart showing Number of Research studies based on countries

Among the 90% studies that have been studied in abroad were also majorly distributed among 5 major countries viz. China, South Korea, Saudi Arabia, European and American countries.

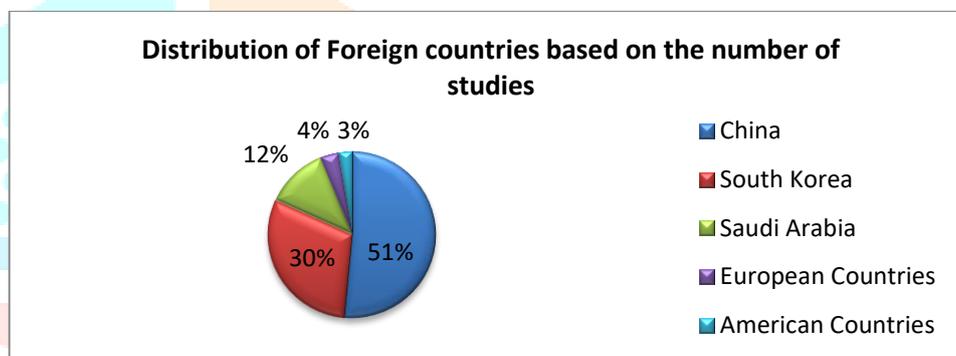


Fig 8: Pie-Chart showing Number of Research studies based on countries

**Discussion:** The finding of this study totally confined to give an overview regarding the integration of Artificial Intelligence in Teacher's professional development. The previous papers related to the same field tried to represent assumptions related to the connection between AI and current teacher education scenario. Many research studies discussed about the trend of using Artificial Intelligence among the teachers from different disciplines like Humanities, Management, and Engineering etc. But here researchers tried to focus on the professional development programs where Artificial Intelligence can revolutionize the vision of Teacher's training. Unlike the previous studies those were entirely devoted to content based analysis and theoretical perspective, this review papers tried to present graphical representation and also tried to emerge themes through collecting codes and keywords based on the availed data.

**Conclusion:** Artificial Intelligence is a significant phenomenon in the 21<sup>st</sup> century resulting a paradigm shift in the educational field. Teachers are the most significant stakeholders in education to bring forward the needed change. Therefore, it is very crucial to acknowledge our teachers with the conceptual and ethical knowledge and upgrade their skills to adopt the AI based competencies in the teaching learning scenario. This Bibliographic overview provides a clear outlook on the trending situation of Artificial Intelligence in the field of teacher education in the world wide and also the researches of this field in Indian basis. This research although lack the quantitative based Network analysis of authors and co-authors and do not cover

reviews earlier than 2018. Furthermore, readers can consider larger scale studies covering more dimensions and perspectives of including Artificial Intelligence in teacher's professional development in India. Researchers will also have the scopes to do content and empirical based analysis for the given policies and initiatives by Government and other Institutions regarding Artificial Intelligence pertinent to Educational spheres.

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