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ORIGINAL RESEARCH PAPER

Identifying the opportunities of artificial intelligence for teacher leadership in the education process

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ABSTRACT

Background and Objectives: The 21st century has witnessed the rapid advancement of technologies that have transformed human life. Artificial intelligence, one of these emerging technologies, has the potential to fundamentally change various sectors, including education. In recent years, artificial intelligence has been utilized in educational systems to enhance the quality of learning and teaching. This research, considering the increasing importance of artificial intelligence in education and its impact on the role of teachers, conducts a thorough examination of the role of this technology in teacher leadership in the educational process and seeks to identify the opportunities presented by artificial intelligence for improving teachers' leadership and performance.

Methods: The present research is qualitative and of a narrative nature. The study population consisted of a total of 70 articles, from which 30 articles were selected based on acceptance criteria. The critical Glaser tool was also used to ensure the quality of the selected articles. For data analysis, a coding method was employed, initially extracting 162 open codes. Subsequently, 18 axial codes were identified, and finally, 3 selective codes representing the opportunities of artificial intelligence in teacher leadership during the educational process were recognized.

Findings: The findings of the research indicated opportunities for artificial intelligence in teacher leadership in the educational process across three categories:1.Planning: Assisting teachers in delivering intelligent content to students, providing information about students' educational backgrounds, automated scheduling and planning of lessons, designing customized training, offering teaching methods based on individual student needs, and providing intelligent platforms for self-learning.2. Implementation: Making the teaching process more engaging through chatbots, fostering active student participation in the learning process, improving the quality of education and the learning experience, creating independent learning opportunities for students, personalized instruction, and providing an exploratory learning environment.3.Evaluation: Automated grading of assignments and exams, providing feedback on the effectiveness of educational performance, managing data related to the evaluation of assignments and exams, assisting students in improving their learning, predicting students' academic performance, and making data-driven decisions based on evaluations.

Conclusions: Artificial intelligence serves as a transformative force in the field of education, playing a central role in improving the quality and personalization of the learning process. AI can be used as a powerful tool to enhance teacher leadership and improve the overall educational process. This technology offers tools for lesson planning, enhances teaching methods, and accurately assesses student performance. It not only assists teachers in their leadership roles but also provides access to extensive educational resources and enables immediate feedback.

By analyzing learning data, AI facilitates the provision of personalized educational content tailored to the individual needs of each student. In this way, it helps optimize the learning experience and increases interaction between teachers and students. The educational implications of AI technology will transform how students learn and how teachers operate. Ultimately, the use of artificial intelligence in education will improve educational systems, leading to enhanced learning quality and improved student outcomes worldwide.

NUMBER OF REFERENCES 34
NUMBER OF FIGURES 1
NUMBER OF TABLES 4

مقاله پژوهشی

شناسایی فرصت‌های هوش مصنوعی بر رهبری معلمان درفرایند آموزش

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چکیده

پیشینه و اهداف: قرن بیست و یکم شاهد پیشرفت شتابان فناوری‌ها بوده که زندگی بشر را متحول کرده‌اند. هوش مصنوعی، یکی از این فناوری‌های نوظهور، پتانسیل تغییر اساسی در بخش‌های گوناگون، از جمله آموزش، را دارد. در سال‌های اخیر، هوش مصنوعی در نظام‌های آموزشی مورد استفاده قرار گرفته تا کیفیت یادگیری و آموزش را ارتقا بخشد. این پژوهش با توجه به اهمیت روزافزون هوش مصنوعی در آموزش و تأثیر آن بر نقش معلم، به بررسی نقش این فناوری در رهبری معلمان در فرایند آموزشی پرداخته و می‌کوشد فرصت‌های موجود در هوش مصنوعی برای بهبود رهبری و عملکرد معلمان را شناسایی کند.

روش‌ها: پژوهش حاضر کیفی از نوع روایت پژوهی بود. جامعه پژوهش شامل کلیه مقالات به تعداد ۷۰ بود که از این میان ۳۰ مقاله براساس معیارهای پذیرش انتخاب شد و از ابزار حیاتی گلین نیز برای تأمین کیفیت مقالات استفاده شد. به منظور تحلیل داده‌ها از روش کدگذاری استفاده شد که ابتدا ۱۶۲ کد باز استخراج شد، سپس ۱۸ کد محوری و در نهایت ۳ کد انتخابی به عنوان فرصت‌های هوش مصنوعی بر رهبری معلمان در فرایند آموزش شناسایی شد.

یافته‌ها: یافته‌های پژوهش فرصت‌های هوش مصنوعی بر رهبری معلمان در فرایند آموزش را در ۳ بعد نشان داد که شامل شد؛ ۱- برنامه‌ریزی: کمک به معلمان در ارائه محتوای هوشمند برای دانش‌آموزان، ارائه اطلاعات در مورد پیشینه‌آموزشی دانش‌آموزان، زمان‌بندی و برنامه‌ریزی دروس به صورت خودکار، طراحی آموزش‌های سفارشی شده، ارائه روش‌های تدریس بر اساس نیازهای فردی دانش‌آموزان، ارائه بسترهای هوشمند برای خودیادگیری؛ ۲- اجرا مانند: جذاب تر کردن فرآیند تدریس از طریق چت‌بات‌ها، مشارکت فعال دانش‌آموزان در فرایند آموزش، بهبود کیفیت آموزش و تجربه یادگیری، ایجاد یادگیری مستقل برای دانش‌آموزان، تدریس شخصی سازی شده، محیط یادگیری اکتشافی؛ و ۳- ارزشیابی مانند: نمره‌دهی خودکار به تکالیف و امتحانات، ارائه بازخورد در مورد اثربخشی عملکرد آموزشی، مدیریت داده‌های مربوط به ارزیابی تکالیف، امتحانات، کمک به دانش آموزان برای بهبود یادگیری، پیش بینی عملکرد تحصیلی دانش‌آموزان، تصمیم‌گیری مبتنی بر داده‌های ارزیابی بود.

نتیجه‌گیری: هوش مصنوعی به عنوان یک نیروی تحول‌آفرین در عرصه آموزش، نقشی محوری در بهبود کیفیت و شخصی‌سازی فرآیند یادگیری ایفا می‌کند. هوش مصنوعی می‌تواند به عنوان ابزاری قدرتمند در ارتقاء رهبری معلم و بهبود کلی فرآیند آموزش مورد استفاده قرار گیرد.این فناوری با ارائه ابزارهایی برای برنامه‌ریزی درسی، بهبود روش‌های تدریس و ارزیابی دقیق عملکرد دانش‌آموزان، نه تنها به معلمان در ایفای نقش رهبری کمک می‌کند، بلکه امکان دسترسی به منابع آموزشی گسترده و ارائه بازخورد فوری را نیز فراهم می‌سازد. هوش مصنوعی با تحلیل داده‌های یادگیری، امکان ارائه محتوای آموزشی شخصی‌سازی شده و متناسب با نیازهای فردی هر دانش‌آموز را فراهم کرده و از این طریق، به بهینه‌سازی تجربه یادگیری و افزایش تعامل بین معلم و دانش‌آموز کمک می‌کند. این پیامدهای آموزشی فناوری هوش مصنوعی، نحوه یادگیری دانش‌آموزان و شیوه فعالیت معلمان را متحول خواهد کرد. در نهایت، استفاده از هوش مصنوعی در آموزش، بهبود سیستم‌های آموزشی فراهم را به همراه خواهد داشت که می‌تواند به کیفیت آموزش و بهبود نتایج تحصیلی دانش‌آموزان در سرتاسر جهان منجر شود.

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Introduction

Artificial intelligence (AI) is a broad term encompassing various analytical methods, including machine learning, neural networks, and deep learning [1]. Generally, AI can be defined as the application of computers, machines, and other tools that exhibit behaviors similar to human intelligence. These behaviors include cognitive abilities, learning, adaptation, and decision-making. In other words, AI is a collection of computer programs and technologies that attempt to mimic the function of the human brain and intelligence [2]. Furthermore, Artificial intelligence is the ability to imitate human intelligent behavior under any conditions [3]. This technology allows us to perform tasks effectively and efficiently. Artificial intelligence is not only a source of modern knowledge and information, but it is also a branch of computer science that focuses on the development of machine intelligence and patterns of thought and behavior similar to those of humans. The impact of artificial intelligence on our daily lives is extensive and is clearly evident in search engines, mobile applications, and healthcare systems [4].

Artificial intelligence (AI), a dynamic and evolving phenomenon, has found widespread applications in various fields. AI's entry and influence on educational environments and the teaching-learning processes in schools are undeniable. As this trend continues, awareness and understanding of AI's importance in education are growing. The rapid development of AI in recent years has highlighted the necessity and feasibility of its use within educational systems. Simultaneously with global scientific and technological advancements, AI has also experienced significant improvements and enhancements. AI, by revolutionizing teaching and learning methods and developing innovative educational programs, has become a significant and important area of focus in educational research [5].

Modern technologies have brought significant transformations to teaching and learning methods. Schools are increasingly leveraging artificial intelligence to enhance various aspects of the educational process [6]. AI algorithms enable personalized learning experiences by analyzing student performance data to address individual needs [7]. Applications of AI in education are diverse. These include its integration into educational tools like chatbots [8], intelligent tutoring systems, and automated grading systems. These AI-powered systems create numerous opportunities for all stakeholders in the teaching and learning process [6].

Shen et al. [9] identified technological literacy as a fundamental competency, emphasizing the need for teachers to effectively understand and utilize AI-based tools, data analysis, and educational technologies. These researchers highlighted adaptability and continuous learning as essential skills for embracing new technologies, emerging pedagogical approaches, and evolving roles. Consequently, it is recommended that educational leaders participate in ongoing professional development and stay abreast of the latest advancements in artificial intelligence. Furthermore, teachers must adapt their pedagogical practices to effectively integrate AI tools and resources. This will allow for maximizing the potential of AI and providing richer learning experiences for students.

Using predictive artificial intelligence analysis, teachers can identify students at risk of academic decline and provide timely support [10]. Furthermore, natural language processing (NLP) tools can analyze student writing and provide feedback on grammar, spelling, and

other writing skills [11]. Additionally, AI tools utilized by teachers include chatbots, which can answer student and parent questions about procedures, schedules, and other information instantly [12]. These technologies play a significant role in enhancing the quality of education and fostering constructive interaction between teachers and students.

Virtual assistants and voice recognition tools are increasingly utilized to support administrative tasks such as scheduling, record-keeping, and communications [13]. Additionally, some schools are experimenting with AI-based educational assistants that can help teachers with grading assignments, identifying student learning gaps, and suggesting personalized educational materials [14].

Using these tools, teachers can more effectively and efficiently handle various administrative tasks, such as reviewing and grading student assignments, allowing them to dedicate more time and resources to the educational aspects of their work. Furthermore, as AI leverages machine learning, curricula and content are customized and personalized to meet the individual needs of each student. This enhances student engagement and retention, ultimately improving the learning experience and overall quality of education [6]. The benefits of AI in education are increasingly recognized for providing specialized support, addressing knowledge gaps, facilitating effective learning and instruction, and enabling timely assessments of complex skills and knowledge [15].

Furthermore, it is believed that AI-powered educational systems can analyze classroom dynamics. This can help teachers better understand students' learning needs and behaviors, optimizing their teaching approaches. These capabilities can contribute to creating personalized and flexible learning environments, leading to improved academic results and a more positive learning experience for students. AI empowers teachers to make more informed decisions based on data, creating engaging and student-centered learning experiences that yield a more positive impact on student learning outcomes. AI also represents a transformative change in school curricula and national frameworks, enabling real-time monitoring of the learning process. These tools assist teachers in adapting content to meet students' needs and enhance their engagement in school activities [5-9-16].

Recent studies have demonstrated how artificial intelligence can be constructively integrated into and utilized in classrooms [17]. Given that the application of AI in education requires substantial changes in pedagogy, teachers must seriously consider updating the strategies and tools they employ in their curricula. Furthermore, they should leverage their professional judgment to effectively incorporate AI into the classroom setting [17].

In a study by Ghamrawi et al. [18], a group of teachers viewed artificial intelligence as a tool that could enhance their instructional leadership. They highlighted AI's potential to automate administrative tasks, provide data-driven insights, and free up teachers' time to focus on instructional leadership, guiding students, and innovating in the classroom.

Furthermore, as Salas-Pilco et al. [19] suggest, data-driven decision-making has emerged as a key competency. This competency emphasizes the need for teachers to analyze and interpret data generated by AI systems to inform instructional strategies, personalize learning experiences, and guide evidence-based decision-making. Currently, educational and administrative teams are re-evaluating their roles and work methods, as some existing practices are no longer effective in the new educational paradigm [20]. While AI

can help reduce the heavy administrative and managerial burdens faced by school leaders, it may also potentially weaken leadership functions.

However, assessment processes will inevitably become more challenging, as the range of AI products available to students is complex and easily accessible [21]. In such circumstances, teachers need not only to leverage new technologies but also to rely on their analytical and evaluative abilities to ensure their positive impact on the learning process.

AI-assisted education encompasses various aspects, including intelligent tutoring, innovative virtual learning, and data analysis and prediction. These technologies offer new possibilities for evaluating students and schools and developing adaptive and personalized learning methods [22]. Overall, the integration of AI into educational processes can lead to a more engaging and effective learning experience, benefiting both students and teachers

Ultimately, in today's fast-paced world, traditional teaching methods are slow and inefficient, failing to deliver modern scientific and educational concepts with the power and excitement that today's generations of students require. Furthermore, teachers are not optimally able to review student performance and modify teaching techniques to suit their needs [23]. Today, traditional teaching and learning methods are not meeting the needs of learners; as a result, learners do not experience the joy of learning, and school becomes tedious for them. One solution to address these problems is to employ innovative methods in education.

Given that artificial intelligence is increasingly being used in educational settings, it is crucial to examine how it affects teacher leadership in the educational process. It is believed that the introduction of AI technologies in education changes the roles and responsibilities of teachers in schools.

Ultimately, the goal of the present research is to answer the question: What are the opportunities of artificial intelligence for teacher leadership in the education process?

Review of the Related Literature

AI technologies, by leveraging big data, enable increased customization and targeting of educational needs at the individual level. These technologies help adapt the curriculum and understand the needs of each student in the teaching and learning process. The use of platforms in education improves the relationship between teacher and student and guides the learning process according to the characteristics of each individual. Furthermore, these technologies help teachers tailor content to the needs of the school and increase participation in school activities [24].

Artificial Intelligence in education refers to the application of AI technologies, such as intelligent tutoring systems, cohabits, and automated assessment, as well as all forms of digital artifacts that support and enhance education. AI in education has great potential to improve learning, teaching, assessment, and educational management by providing learners with more personalized and adaptive learning, enhancing teachers' understanding of the learning process, and providing machine-supported inquiries at any time and immediate feedback [25].

The technologies can be used in providing customized educational content, supporting the professional development of educators, personalized teaching, intelligent teachers, intelligent education, personalized/adaptive learning, chatbots, automated grading of assignments and exams, teaching evaluation,

personalized feedback, time management, international collaborations between educational systems in the context of AI, and automating administrative tasks [26].

UNESCO [27] proposes that it is now time to prepare the next generation of students for a future in which AI is an increasingly important part of their lives. They propose that AI educational tools should be integrated into curricula policies accordingly. The European Commission [28]. Recently, it published a guide that contained advice for educators and school administrators, which concluded:

From the way we stay informed to the way we make decisions, artificial intelligence (AI) is becoming ubiquitous in our economy and society. Naturally, it has reached our schools as well. AI in education is no longer a distant future. It is already changing the way schools, universities, and educators work and our children learn. It is making educational settings more responsive by helping teachers address each learner's specific needs. It is fast becoming a staple in personalized tutoring and in assessment.

And it is increasingly showing its potential to provide valuable insights into student development. The impact of AI on our education and training systems is undeniable and will grow further in the future.

Cooper [29] considers the impact of AI as a fundamental shift in education globally, noting that technologies like ChatGPT have immense potential to improve various aspects of education, including learning, teaching, educational innovations, assessment, and educational management. This potential can be leveraged through intelligent tutoring systems, catboats, and robots, learning analytics dashboards, adaptive learning systems, and automated assessment.

Chen et al. [6], in their study, emphasized that improving learner outcomes requires designing teaching methods based on their personal data. This approach helps teachers provide immediate and accurate feedback and perform administrative tasks such as reviewing and grading student assignments more effectively and efficiently. By using AI, the curriculum and educational content are customized and personalized according to the needs of students, which helps to attract and retain students and improves the learning experience and overall quality of the teaching-learning process.

Celik et al. [30], added that AI provides numerous opportunities for teachers to improve planning, implementation, and assessment. This technology can help define student needs, familiarize teachers with these needs, and enhance teaching quality by providing immediate feedback and educational interventions. It also facilitates the assessment process by using automated essay grading. These approaches allow teachers to optimize their teaching and improve student learning outcomes.

Almasri [31] in his research showed that AI-based tools can help improve the learning environment, create exams more efficiently, conduct more accurate evaluations of student work, and also predict their academic performance. These tools, by analyzing educational data and providing instant feedback, can improve the quality of student learning and help teachers tailor their teaching methods to the individual needs of students. In addition, AI can be effective in reducing the administrative burden on teachers and optimizing assessment and educational management processes. Thus, it can be said that AI acts not only as a technological tool, but also as a key factor in the transformation of education and learning.

AI can host intelligent content and enable independent learning. This technology

improves virtual learning environments by analyzing student data and enabling the customization of content and educational delivery methods based on the individual needs of students. In addition, AI, by automating tasks such as correcting papers and providing feedback, allows teachers to focus on their other essential and important responsibilities. This automation not only frees up teachers' time but also helps them to provide more accurate and personalized analyses to students, thereby improving the quality of education [32].

Based on previous research, this study aims to identify the opportunities that artificial intelligence presents for teacher leadership in the educational process.

Method

The study used a qualitative approach, specifically narrative research. Narrative research is a method that combines and analyzes a collection of extensive and scattered articles on a topic, creating a bridge for a reader who does not have enough time and resources to follow all those scattered sources [33]. This method is specifically carried out in four steps, each of which has specific details as follows:

Implementing the Search Strategy

At this stage, among domestic and foreign databases (such as SID, Normags, Elsevier, Scopus, ProQuest, and Sage), six reputable databases were reviewed using the keyword "Artificial Intelligence in Education and Learning" for the period from 2020 to 2024. Article acceptance criteria include research language, study area, research methodology, acceptable study specifics and details, study type, and indexing, as listed in Table 1.

Table 1: Article Acceptance Criteria

Acceptance Criteria	
Research Language	Persian/English
Research Timeline	2020-2024
Area of Study	Artificial Intelligence in the Learning Process
Research Method	Qualitative/Quantitative/Mixed Methods
Conditions and Details for Study Acceptance	Opportunities of Artificial Intelligence in Education and Learning
Study Type	Articles Published in Reputable Research Journals
index	Elsevier, Scopus, ProQuesr, SAGE, SID, Noormags

Stage Two: Collecting Scientific Documents

In this phase, an initial review of the articles available in domestic and international academic databases was conducted, leading to the analysis of 70 articles. Each of these articles included concepts or keywords relevant to the focus of this research.

Selection and Choice

At this stage, from among 70 collected scientific documents, 25 foreign and 5 Persian articles, totaling 30 scientific articles, were selected and analyzed using a coding method (Table 2). To ensure the validity of the research findings, a structured process of recording and writing research findings, as well as self-review by the researcher, was used. Additionally, to ensure the quality of the content of the documents, a critical evaluation method was employed using the Glynn critical appraisal tool. This tool provides a comprehensive list of questions (Value of the Research, Clear and Explicit Presentation of Findings, Accuracy of Data Analysis, Ethical Considerations, Data Collection, Sampling Method, Research Design, Logic of Method, Research Objectives. Of the 30 articles, each was assessed using a Glynn tool and a nine-question questionnaire, with each question rated on a scale of 1 to 5. The total

score for each article was determined based on the following standardized scale: 1.33 to 2.33, weak; 2.33 to 3.66, moderate; and 3.66 to 5, good. Ultimately, five articles were assessed as moderate, and twenty-five were assessed as good. Table 3

Analysis of Scientific Documents

The scientific documents collected in the previous stages were studied and analyzed, and the findings were organized in the form of a table (Table 4). The findings were organized first by extracting relevant statements from the article texts and assigning a concept to each. Then, similar and related concepts were categorized and named as categories.

Table 2: Introduction of Reviewed Articles

Article Code	Authors	Year of Publication	Article Code	Authors	Year of Publication
1	Ghamrawi	2024	16	Sharawy	2023
2	Kurkan& Cetin	2024	17	Ishfaq. Vijaya	2023
3	Papadakis et al.	2024	18	Lameras& Arnab	2022
4	Filgueiras	2024	19	Celik et al.	2022
5	Arar et al.	2024	20	Nalbant	2021
6	karakose & Tulubaş	2024	21	Haefner et al.	2021
7	Onome &Olasumbo	2024	22	Huang et al.	2021
8	Fullan et al.	2024	23	Wang	2021
9	Imasri	2024	24	Hashem Mahmoud	2020
10	Tang	2024	25	Chen et al.	2020
11	Chen et al.	2023	26	khabareh	2024
12	Kamalov et al	2023	27	Rezaei& Abdollahi	2023
13	Cooper	2023	28	Dadashpour, & Dehghanpour	2023
14	Zhang& Mao	2023	29	Bahijab et al.	2023
15	Alier et al.	2023	30	Nader	2022

Table 3. Vital Assessment Tools

Article Code	Value of the Research	Clear and Explicit Presentation of	Accuracy of Data Analysis	Ethical Considerat	Data Collection	Sampling Method	Research Design	Logic of Method	Research Objectives	Summary	Evaluation
1	5	5	5	5	5	5	5	5	5	5	Good
2	5	5	5	5	5	5	5	5	5	5	Good
3	4	4	5	5	5	5	4	3	5	4.44	Good
4	4	4	3	4	3	3	3	3	5	3.55	avera ge
5	4	5	5	4	3	3	4	3	3	3.77	Good
6	5	4	5	4	4	5	5	5	4	4.55	Good
7	4	4	4	5	4	4	3	4	5	4.11	Good

Article Code	Value of the Research	Clear and Explicit Presentation of	Accuracy of Data Analysis	Ethical Considerat	Data Collection	Sampling Method	Research Design	Logic of Method	Research Objectives	Summary	Evaluation
8	5	5	5	5	5	5	5	5	5	5	Good
9	5	5	5	5	5	4	4	5	5	4.88	Good
10	5	5	5	5	5	5	5	5	5	5	Good
11	5	5	5	5	5	5	5	5	5	5	Good
12	5	4	5	4	4	5	5	5	4	4.66	Good
13	4	5	5	4	3	3	3	4	4	3.88	Good
14	4	5	4	4	3	4	4	4	5	4.11	Good
15	5	5	5	5	5	4	4	5	5	4.88	Good
16	4	5	4	4	3	3	4	4	5	4.11	Good
17	5	5	5	5	5	5	5	5	5	5	Good
18	5	5	5	5	5	5	5	5	5	5	avera ge
19	5	5	5	5	5	5	5	5	5	5	Good
20	4	4	4	4	4	3	4	4	4	3.88	Good
21	5	5	5	4	5	۴	4	4	5	4.55	Good
22	5	5	5	5	5	4	4	5	5	4.88	Good
23	4	4	4	4	4	4	4	4	4	4	Good
24	5	5	5	5	5	5	5	5	5	5	Good
25	4	4	3	3	3	3	3	3	3	3.22	avera ge
26	5	5	5	5	5	5	5	5	5	5	Good
27	5	4	5	4	5	4	4	4	5	3.50	avera ge
28	5	5	5	5	5	5	5	5	5	5	Good
29	5	5	5	5	5	4	4	5	5	4.88	Good
30	4	5	4	5	4	4	4	4	5	4.33	avera ge

Table 4: Coding of Artificial Intelligence and Teacher Leadership Findings in the Education Process

Row	Open Codes	Axial Codes	Selective Codes
1	Having technology literacy (1), rich and diverse collaboration with colleagues (2), virtual collaborations (2), saving time (2)(7), easier tracking of accountability (2), stimulating students' enthusiasm in the learning environment (22)(3)(23), collection, processing, and analysis of data (3); use of big data (4)(20)(11), innovation in teaching management (5), creating intelligent content for students (5), intelligent content can dynamically change and adapt depending on who reads it (5), providing educational materials (6); security, and processing of student information (6), learning analytics or educational data mining (6), providing customized education (6), processing large datasets (6), transparency in activities (6), participation and digital skills (6), integrating teachers, students, and parents in educational processes (6), necessary synergy to achieve educational goals (6), automation of tasks by automating processes (27)(8), helping to support and intervene with students (8), a long-term perspective (8); maintaining student records (7), reducing administrative errors (7), allocating more resources to core educational activities (7), improving the quality of education and the learning experience of students (7), changing teaching methods (9), artificial intelligence can host smart content (10), artificial intelligence improves virtual learning environments by analyzing student data (10); providing customized educational content (26)(10)(7), providing teaching methods based on individual needs (10)(26); learning analysis dashboards (13), providing adaptive learning systems (13), supporting and strengthening the educational process (13); updating the strategies and tools they use in their educational programs (14), also, they must use their professional judgment when planning to include artificial intelligence in the classroom (14), data analysis and simplified administrative processes (that artificial intelligence can automate repetitive administrative operations such as scheduling, admissions, and registration (15), designs the teaching method for each learner based on their personal data (25), providing intelligent platforms for self-learning (26), facilitating decision-making (29); providing curricula (11), adjusting the content and difficulty level of education based on individual needs (27), analyzing individual interests and needs (27).	Providing intelligent platforms for self-learning Providing intelligent content for students Providing information about students' backgrounds Automated scheduling and planning of lessons Designing customized education Providing teaching methods based on individual student needs	Planning
2	Evaluation processes will also inevitably become more challenging, as the scope of artificial intelligence products becomes increasingly complex and readily available to students(14), adaptability and continuous learning(1), collaborative and mentoring skills(1), faster communication capabilities(2), facilitating meetings(2), promoting better classroom management(3)(22),(23) supporting customized learning(3)(22)(23), increasing customization of learning(4), enabling the targeting of educational needs on an individual scale(4), allowing the adaptation of curriculum and understanding the needs of	Improving the quality of education and the learning experience	Implementation

Row	Open Codes	Axial Codes	Selective Codes
	each student in the teaching and learning process(4), the use of platforms in education(4), reforming the relationship between teacher and student(4), guiding the learning process according to the profiles drawn by each individual(4), increasing the creativity of teachers and students(3)(22)(23), adapting content to the needs of the school(4), helping teachers adapt content(4), improving the learning environment(9), increasing participation in school activities(4); creating new educational and learning modes(5), storing the previous learning history of students(17), personalized learning experiences(17), transcribing teacher lectures into local languages(17), access to classrooms without any limitations(17), creating smart content(17), adaptive learning(17), facilitating the learning process(17)(5)(29)., helping students apply knowledge(18), helping students become self-regulated learners(18), engaging students with adaptive learning tasks(18), task-oriented chatbots(18)(16), preparing and transferring educational content(18), content recommendation system(18), personalized content sequencing(18), tracking student attendance(20), personalization in education(20), distance learning(20), smart contents(20), virtual learning environments(20), personalized learning(20), intelligent educational systems(20), speech generation and language translation systems(20); school management must follow the learning needs of each student(21), produce and share appropriate content(21), more flexible curricula(21); intelligent teacher(22)(23)(26), cognitive educators or intelligent teachers that act as a conversation-based private tutor that supports learning(22), greater accuracy in understanding trends and problems in educational environments(22) smart learning(22)(26), intelligent education(24)(26), innovative virtual learning(24), educational activities achieve higher quality(25), since artificial intelligence uses machine learning, curriculum and content are customized and personalized according to student needs that enhance engagement and retention(25); improves the learner experience and overall quality of learning(25);: increased ability of trainers to teach(26), support for professional development of trainers(26), personalized/adaptive learning(26), conversational robots(26), intelligent and personalized teaching(27)(24), exploratory learning environment(26), individual counseling to learners(26)(27), facilitating education(29), active participation of students(11) improving learning(13), transformation in teaching(13), educational innovations(13), intelligent education systems, chatbots and robots(27)(13), personal learning(15), intelligent education(15), adaptive learning method(27)(24) personal learning approach(27)(24), digital assistants(27)(16)(24), adaptive and personalized learning(27)((16); generation of intelligent content(27)	Exploratory learning environment Personalized teaching Creating independent learning for students Active participation of students in the learning process Making the teaching process more engaging through chatbots	

Row	Open Codes	Axial Codes	Selective Codes
3	Data analysis and prediction(24), automated evaluation(13); scientific analysis(24), grading and evaluation of exams(24), learning analytics(24), improving learners' learning(25), providing feedback and instant grades(25)(16), reviewing and grading student assignments more effectively and efficiently(25), automated grading of assignments and exams(26), controlling the learning process(26), predicting learner performance(26), evaluating teaching(26), personalized feedback(26); understanding more efficient resource allocation(28), faster and more accurate automation of administrative tasks(28); timely detection of problems in the performance of the educational system(28), providing data analysis(8), transformation in evaluation strategies and administrative processes(9), creating automatic tests(9), evaluating student work(9), predicting academic performance(9); evaluation of all students(21)(24), educational evaluation and management(13), helping students improve learning through evaluation and feedback(18), web-based intelligent feedback systems(18), intelligent evaluation systems(20)(28), changing teachers' teaching methods(12), changing students' learning(12), changing the performance of schools(12); retrieval of personal information(18), access to information(20), artificial intelligence, by automating tasks such as correcting papers and providing feedback, allows teachers to focus on other essential responsibilities(10); data and evidence-based decision-making(3)(1)(6); creating and evaluating effective educational policies(23)(22), improving administrative functions(11), predicting trends and automating routine tasks(11); managing data related to the evaluation of assignments, exams(21), innovation in evaluation systems(5); immediate feedback to learners(15), providing accurate and immediate feedback to the learning process(30), evaluating individual performance and providing suggestions for improvements to enhance learning(30), recommending appropriate educational resources and providing personalized guidance(30), analyzing and predicting student performance(30)(27), adaptive tests(27)	Data-driven decision-making Automated grading of assignments and exams Providing feedback on the effectiveness of teaching performance Helping students improve their learning Predicting students' academic performance Managing data related to the evaluation of assignments and exams	Evaluation

Results and Discussion

The findings were organized by first extracting related statements from the articles and assigning a concept to each. Similar and related concepts were then categorized and named as categories. Based on the research findings, artificial intelligence opportunities for teacher leadership in the instructional process were categorized into three main domains: planning, implementation, and evaluation (Figure 1). Figure 1 provides a detailed analysis of these findings.

Planning

AI offers transformative possibilities in the planning phase, enabling teachers to design instruction more efficiently and effectively. Key opportunities include:

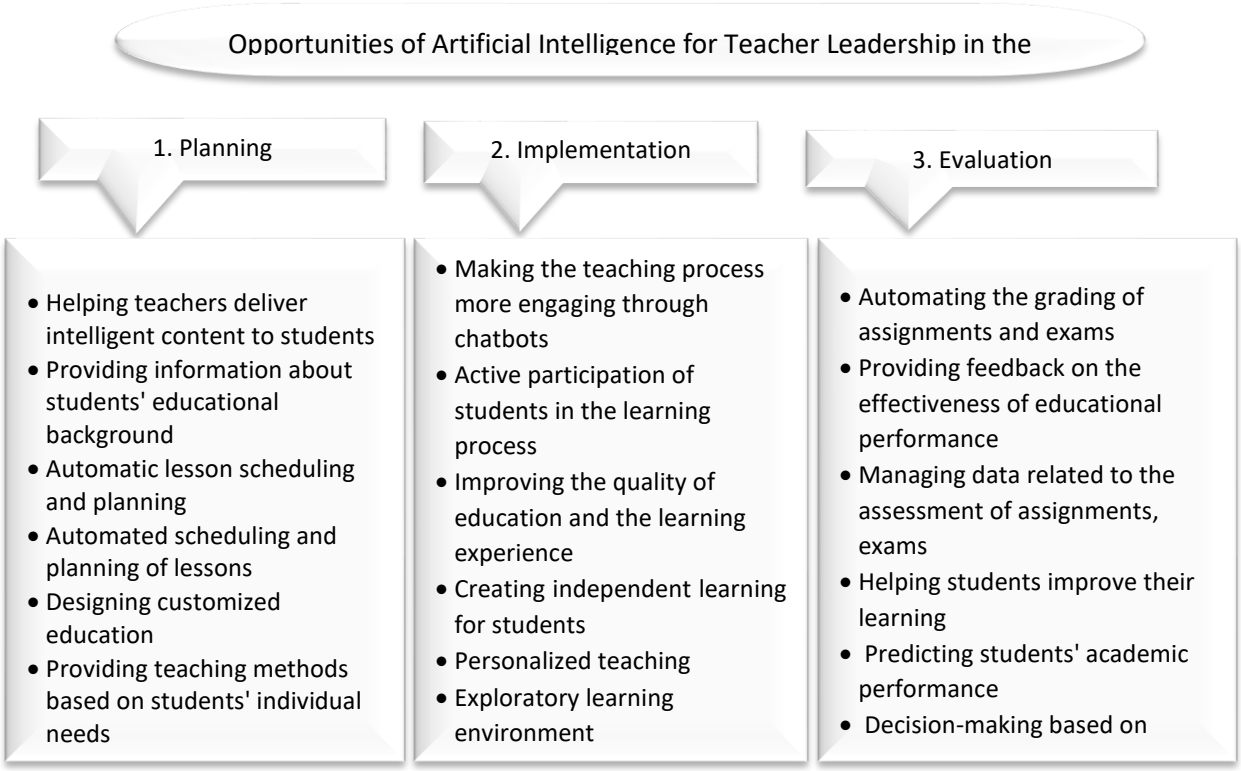

Fig. 1: Artificial Intelligence Opportunities for Teacher Leadership in Education

- Providing Intelligent Content: AI can help teachers provide appropriate and up-to-date educational content for students. This intelligent content can be designed to match the learning needs of each student.
- Providing information about students' educational background: Using AI data, teachers can have accurate information about each student's educational background, which helps them personalize instruction for the best possible results.
- Automated Planning and Scheduling: With AI-based tools, teachers will be able to intelligently schedule and plan lessons. This can lead to greater efficiency and reduce the stress associated with organizing lessons.
- Designing Customized Instruction: One of the important features of AI is the ability to design personalized training courses for each student based on their individual abilities and needs.
- Providing teaching methods based on individual student needs: AI can enable teachers to design teaching methods appropriate to each student's specific needs.
- Providing intelligent platforms for self-learning**:** Intelligent platforms can help students learn independently and autonomously, which can be very effective in developing self-directed learning skills.

AI offers significant potential to enhance educational planning by providing tools for teachers to create more effective and personalized instruction. It can facilitate access to intelligent content, offer insights into students' backgrounds, automate lesson scheduling, and enable customized learning paths. Ultimately, these AI capabilities aim to empower teachers to cater to diverse student needs and foster self-directed learning. This ultimately leads to a more efficient and less stressful teaching experience [24-26-32].

Chelik et al. [30], noted that artificial intelligence provides teachers with valuable opportunities to enhance educational planning, implementation, and assessment**.** This

technology improves teaching quality by identifying students' needs, informing teachers about these needs, and enabling rapid feedback and targeted interventions. Furthermore, by automating exam grading, it simplifies the evaluation process. Such solutions help teachers optimize their teaching methods and strengthen students' learning outcomes.

Cooper [29], also considers artificial intelligence to be a fundamental transformative factor in global education. He notes that technologies such as ChatGPT have significant potential to enhance various aspects of education, including the learning process, teaching, educational innovations, assessment, and educational management. This potential can be realized through intelligent educational systems, chatbots, robots, learning analytics dashboards, adaptive learning systems, and automated assessments.

Furthermore, Filgueiras [24], emphasizes in their research that AI technologies, by leveraging big data, enable increased customization and targeting of educational needs at the individual level. These technologies contribute to improving the learning process by adapting curricula and understanding the educational needs of each student. The use of educational platforms, while improving the relationship between teachers and students, guides the learning process based on the individual characteristics of each student. Additionally, these technologies help teachers align educational content with the needs of the school and increase student participation in school activities

Implementation

The advancements in the planning phase create an optimal foundation for effective implementation, where AI dynamically enhances classroom interactions and enriches learning experiences. Such as:

- Making the teaching process more engaging through chatbots: The use of chatbots and AI systems for increased interaction with students can add more engagement to classroom activities. Chatbots serve as interactive tools that encourage students to ask questions and engage with educational content.
- Active participation of students in the learning process: AI can assist teachers in creating interactive environments and educational challenges where students actively participate in the learning process.
- Improving the quality of education and learning experience: AI tools enable teachers to optimize the learning process for each student, enhancing the overall quality of education.
- Creating independent learning for students: By providing intelligent resources and tools, students can take control of their learning process and learn independently from the teacher.
- Personalized teaching: AI can empower teachers to tailor their instruction for each student and offer teaching methods that align with individual learning needs.
- Exploratory Learning Environment: AI can provide tools to create exploratory learning environments where students can actively gain new educational experiences.

These applications of AI not only foster a more engaging classroom atmosphere but also empower students to take charge of their learning, promoting a deeper understanding and retention of knowledge. As teaching evolves with the integration of AI technologies, the role of the teacher transforms into that of a facilitator who guides students through their personalized learning journeys. The findings of

studies by Gamrawi [18] and Chen et al. [6], have pointed to some of these issues.

In their research, Thomas et al. [25] define Artificial Intelligence in Education as the application of AI technologies, including intelligent tutoring systems, chatbots, automated assessment, and all digital tools that support and enhance education. They believe that AI in education has significant potential to improve learning, teaching, assessment, and educational management by providing learners with more personalized and adaptive learning experiences, enhancing teachers' understanding of the learning process, and enabling instant question-and-answer support with machine assistance.

As Khabareh [26] has demonstrated in his research, artificial intelligence technologies possess numerous capabilities in the field of education. These capabilities include providing customized educational content, supporting professional development for educators, personalized instruction, the use of intelligent teaching methods, personalized and adaptive learning, conversational robots, automatic grading of assignments and exams, assessing teaching methods, delivering personalized feedback, time management, international collaboration among educational systems utilizing artificial intelligence, and automating administrative tasks.

Artificial intelligence and new technologies provide students and teachers with access to a variety of rich educational resources such as educational videos, educational software, electronic books, and educational articles. These technologies, by creating interactive opportunities, facilitate the learning process and encourage students to participate more actively in this process [34].

Evaluation

The valuable data generated during the implementation process flows into the evaluation phase—a stage where AI elevates outcome quality by optimizing both assessment procedures and feedback systems. Such as:

- Automating the grading of assignments and exams: AI has the ability to automatically grade assignments and exams. This can reduce the workload for teachers and increase the accuracy and speed of evaluations.
- Providing feedback on the effectiveness of educational performance: AI systems can provide detailed feedback on the effectiveness of teachers' teaching methods, helping them make necessary improvements in their instructional strategies.
- Managing data related to the assessment of assignments, exams: Collecting and analyzing data related to assignment and exam evaluations can help teachers identify patterns and trends in student performance, enabling better decisions about instruction.
- Helping students improve their learning
- Predicting students' academic performance: AI can use existing data to predict students' academic performance. These predictions can help teachers address issues before they escalate.
- Decision-making based on assessment data: AI helps teachers make decisions based on accurate data and intelligent analysis, which can improve educational processes and academic outcomes.

These applications of AI in evaluation can create a more efficient, fair, and insightful assessment process. Teachers can utilize the data and feedback provided by AI systems to better understand student learning patterns and adapt their instruction to meet individual needs. Furthermore, the predictive capabilities of AI can help in identifying students at risk and providing early interventions, ensuring that all students have the opportunity to succeed, which aligns with the findings of Zhang and Mao [21], Hashem Mahmoud [22].

According to the research by Rezaei and Abdollahi [34], the applications of artificial intelligence in the education process include: personalized learning, suggesting suitable content, analysis, and prediction of student performance. Additionally, chatbots and virtual assistants, adaptive testing, automated content generation, global access, intelligent content creation, and task automation through process automation are also among the applications.

This is a finding that comes parallel to many of the revised studies, such as Bertolin and Da Rin [12], Shen et al. [9], and Zhai et al. [16]. These teachers saw AI as empowering them to make informed decisions based on data, create engaging and student-centered learning experiences, and amplify their impact on student learning outcomes.

Additionally, Al-Masri's [31] research has concluded that AI-based tools can enhance the learning environment. These tools can design tests more efficiently, provide more accurate assessments of student performance, and even predict their academic success. By analyzing educational data and offering instant feedback, artificial intelligence can improve the quality of student learning and assist teachers in tailoring their teaching methods to meet the specific needs of each student.

The limitations of this research include the reliance solely on research articles for data collection. While interviews with experts would have provided valuable insights, this was not possible due to a lack of access to such individuals. Furthermore, considering the importance of artificial intelligence in education in the last decade and the research conducted in this field, and also considering the nature of the narrative review method and the objective of examining a limited number of studies, data collection has focused on foreign research within the timeframe of 2019 to 2024. This limitation may affect the perspectives presented in the research.

The following recommendations are presented for future researchers in the field of artificial intelligence applications in education:

- Conduct longitudinal studies to evaluate the effects of artificial intelligence usage on students' academic progress, critical thinking skills, and lifelong learning over time.
- Perform comparative studies to analyze the achievements of students who have extensively utilized artificial intelligence in the educational process, in contrast to those who have employed traditional educational methods.
- Encourage and promote collaboration among researchers in the fields of educational sciences, computer science, psychology, and other related disciplines to conduct comprehensive and multifaceted research.
- Employ quantitative research methods to assess the effectiveness of artificial intelligence tools and utilize qualitative research methods to gain a deeper understanding of the experiences and perspectives of students and teachers.
- Investigate and study how the role of teachers is changing in classrooms equipped with artificial intelligence and identify the new skills that teachers need to effectively utilize these technologies.
- Develop training programs and empower teachers to optimally use artificial intelligence tools in teaching, assessment, and providing feedback.
- Conduct research on the challenges and issues related to the use of artificial intelligence in education, including the privacy of student information, algorithmic biases, and the impact of artificial intelligence on educational equity and equal access to learning opportunities.

Conclusions

This research investigated the potential of artificial intelligence (AI) to enhance teacher leadership within the educational process. A review of 30 articles identified key opportunities across three main domains: planning, implementation, and evaluation. In the planning phase, AI provides teachers with tools to optimize instructional design. These include intelligent platforms for self-learning, personalized content tailored to individual student needs, automated scheduling to streamline lesson planning, and data-driven insights to customize teaching methods effectively. In the implementation, AI enhances the quality and engagement of the learning experience. It supports exploratory learning environments, facilitates personalized teaching approaches, promotes independent learning opportunities for students, encourages active participation through interactive tools like chatbots, and enriches the overall educational environment. In the evaluation phase, AI streamlines assessment and feedback mechanisms. It enables data-driven decision-making through the automated grading of assignments and exams, provides predictive analytics to forecast student academic performance, and offers feedback on teaching effectiveness, allowing for continuous improvement.

Based on the research, AI applications in education are diverse and transformative. They encompass personalized learning pathways, adaptive content delivery based on student data analysis, predictive analytics to provide targeted feedback, virtual assistants for educational support, adaptive testing adjusted to student knowledge levels, automated content generation, enhanced access to global educational resources, and automation of repetitive tasks. These applications demonstrate AI's substantial capacity to optimize and improve the educational process. AI offers innovative solutions for personalizing education and providing immediate feedback, which can significantly increase student motivation and engagement. Traditional teaching methods often struggle to adapt to the demands of new generations and the rapid pace of scientific advancements. AI presents a vital solution for enhancing educational quality and providing valuable professional guidance to teachers. In a context requiring structural changes, integrating AI can optimize learning experiences and lead to fundamental improvements in educational systems.

Ultimately, emphasizing active and digital learning through the strategic integration of AI can drive transformative changes in education. Achieving this requires collaboration among researchers, educators, and policymakers to fully leverage AI's potential, shifting from conventional approaches toward the adoption of innovative, intelligent tools aligned with the evolving needs of students and scientific progress.

Based on the findings of the research, the following practical recommendations are offered:

- Participate in training courses and workshops that familiarize teachers with the applications of artificial intelligence in education. This will help them stay informed about the latest developments and AI tools in education.
- Provide financial and technical resources to implement AI tools in schools. This includes purchasing software, hardware, and staff training.
- Create an encouraging environment for teachers to use AI tools in creative and innovative ways.
- Establish policies that protect student privacy when using AI tools.

- Foster collaboration between universities and industry: Encourage collaboration between universities and technology companies to develop and commercialize AI tools in education.
- Use AI for translation and localization of educational content and access to international educational resources.
- Utilize intelligent educational platforms that adapt educational content and teaching methods based on the needs and knowledge level of each student.
- Provide specialized training courses for teachers to familiarize them with AI concepts and how to use AI-based tools in teaching and assessment.

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Conflict of Interest

The authors declare that there is no conflict of interest

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