

EFFECTIVE METHODS FOR IMPLEMENTING ARTIFICIAL INTELLIGENCE (AI) IN ENHANCING TEACHER EXPERTISE IN LEARNING : SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

This study investigates the integration of artificial intelligence (AI) in education, focusing on its impact on learning processes, teaching methods, and evaluation systems. Utilizing a qualitative research approach through a systematic literature review, the research highlights how AI technologies have evolved from basic computer systems to sophisticated web-based platforms and intelligent tutoring systems. AI's capabilities include mimicking human cognitive functions such as learning and decision-making, which have been increasingly adopted by educational institutions. These technologies enhance teaching efficiency by automating administrative tasks like grading and attendance tracking, allowing educators to concentrate on more complex instructional duties. Furthermore, AI facilitates personalized learning experiences by analyzing individual student data to tailor educational content according to their unique strengths and weaknesses. The findings indicate that AI not only improves the quality of education but also enriches the overall learning experience by fostering greater student engagement and retention of knowledge. As AI continues to develop, its role in education is expected to expand, providing innovative solutions that cater to diverse learning needs and enhancing the effectiveness of teaching methodologies, thereby underscoring its transformative potential in shaping future educational practices.

Keywords: Artificial Intelligence, Teacher Education, Learning System

1. INTRODUCTION

Digitalization in the industrial era 4.0 is a major factor that accompanies life in every sector of human activity. Artificial Intelligence is a part of digitalization that plays a major role in the technological changes and transitions of this era. With its potential to transform various sectors, AI has emerged as a promising tool to enhance the experience in teaching and learning processes [1]. Today, Artificial Intelligence (AI) technology has emerged as a promising solution to improve efficiency and effectiveness in the education system [2]. In the field of education, AI has a lot of potential to increase the effectiveness and efficiency of classroom learning. Particularly in higher education, AI serves as an assistant between teachers and students that promises to support more adaptive, personalized, and effective learning. However, behind this tremendous potential comes a big challenge: how can AI be effectively integrated to bridge the learning needs of both students and teachers?

Teachers play a central role in promoting and sustaining the initiation of school education and, as a result, preparing the future workforce [3]. Understanding teachers' knowledge, perceptions, and attitudes toward AI is crucial for successful integration [4]. Despite current innovations, automation and technological revolutions that continue to influence instruction, the human role and the values teachers provide continue to influence and compel learning to be reinvented.

The use of AI in higher education covers a wide range of aspects, from analyzing learning data to

providing real-time feedback. But the successful implementation of AI goes beyond adopting cutting-edge technologies; it lies in applying relevant and efficient methods that align with the unique needs of each institution, faculty, and students. However, the literature on the best approaches to integrating AI with learning, especially considering the relationship between teachers and students, is limited and fragmented. In mathematics learning, for example, intelligent learning systems now play a key role in personalizing learning paths, predicting outcomes, and recommending resources [5].

Therefore, this research focuses on identifying the most effective methods of integrating the use of AI in higher education learning environments. This approach not only aims to explore existing technologies, but also highlights how AI can create a harmonious synergy between faculty and students, enhancing the overall learning experience. By systematically reviewing the existing literature, this study aims to provide strategic insights on how AI can be optimized to shape a more inclusive, adaptive, and innovative future of higher education.

2. LITERATURE REVIEW

SLR is a research method that aims to collect, analyze, and synthesize relevant literature in a particular field in a systematic and structured manner [6]. This method is often used in scientific research to provide a comprehensive overview of previously conducted research, identify trends, knowledge gaps, and potential areas for further research. This method will link the results of related papers on the

relationship between AI and education with each other. Protocol development is a crucial element in the systematic review process; it ensures that the review is well planned and that all plans are clearly documented before the review begins. This contributes to consistency of execution by the review team, accountability, research integrity, and transparency of the final review results. There is some additional stage to complete the process of data mining, this aims to make a decision whether the data found can be used in SLR research [7]. The database was obtained with the help of Watase Uake software which functions to automatically collect reputable journals. Journal sources were obtained from journal search sites including: Web of Science, which is a major research platform with access to leading academic literature; ScienceDirect, which offers a comprehensive collection of scientific journals; Taylor and Francis, offering a variety of reputable journals that have clear credibility; Springer; Scopus; and IEEE Xplore, and then using other AI assistance such as scite, consensus for more accurate paper topic searches, and scispace for assistance in reviewing the journals that have been obtained. Search terms used included: (“teacher education” OR “pre-service” OR preservice OR “in-service” OR “AI learning methods”) AND (“learning analytics” OR “artificial intelligence” OR “machine learning” OR “deep learning”). These terms were entered into the aforementioned database applications and used as filters for documents that included these search terms in the title, abstract, and/or keywords. In accordance with PRISMA guidelines, the following criteria were applied to select articles to be included in the final revision: (a) articles published between 2014 and 2024; (b) articles published.

2.1. Research Object

- Improving the quality of learning: With modern and up-to-date AI implementation methods, it will increase efficiency in education, be more adaptive, and personalized.
- Improving teaching efficiency for teachers: The explorative methods of AI can improve the teaching efficiency of teachers as students are able to explore what interests them independently, but with regular supervision and guidance.
- Meeting digital challenges: The learning system remains tied to the digitalization 4.0 era. Hence, AI implementation methods in schools and colleges help to keep it relevant and on track with the times.

2.2. Search Process

The search is used to obtain the sources of information needed to answer the research question (RQ) and other references needed. the process is carried out with the help of a search engine (Google Chrome) using the website address <https://watase.web.id/home/sebagai> primary data

sources and <https://www.google.com/sebagai> secondary data sources.

2.3. Inclusion and Eclusion Criteria

Tabel 1. Inclusion and exclusion criteria

Inclusion Criteria	Eclusion Criteria
Published in the last 10 years	Published not in the last 10 years
Journal in english	Not in english
Empirical, included in the main topics	Non-empirical, ecluded from the main topics
Includes active and inactive educators	Not including rules about active and inactive educators
Focusing on AI method topics	Not focusing on AI method topics
Includes K12 and university educators	Not including rules about K12 and university educators
Inclusion Criteria	Eclusion Criteria

Data was collected by extracting and coding information from the 30 selected studies, and identifying various information to organize the data for analysis. Information extracted included authors, year of publication, purpose and objectives of the study, data sources used and their characteristics, digital techniques and tools applied, sample size and type of participants, whether the study obtained informed consent from participants, and study results. The selected papers were analyzed through an inductive and deductive approach, which involved reading and revisiting the data to find relevant themes for analysis. Disagreements that arose were resolved through discussion until agreement was reached. The themes identified are presented in the form of frequency tables, and Table 1 provides a summary of the analysis conducted on the selected studies.

The search process yielded several articles related to education and AI, which were then filtered by title, leaving only those articles deemed to be of potential interest. After applying the inclusion and exclusion criteria, some articles did not show relativity despite having the same title, resulting in 30 articles that have been sorted to be the main material for data collection for the article.

2.4. Quality Assesment

In this SLR method research, the data found will be evaluated based on the following quality assessment criteria questions:

- RQ1: How can AI be used to support lifelong learning for teachers in K12 and higher education?
- RQ2: What are the main challenges in integrating AI to improve teacher expertise, and how can methodological approaches address them?
- RQ3: What is the impact of AI implementation on the effectiveness of teacher teaching methods in higher education based on current literature?

2.5. Quality Assesment

One of the main reasons for the application of AI in education is the ability to make students able to improve their academic level personally [8]. In this realm, education has three perspectives, which include dealing with students, teachers or instructors, and managers or administrators at all levels [9]. What are the opportunities that artificial intelligence can provide in education that can differentiate humans from robots or smart vehicles, while helping humans maintain their emotional and social aspects? These topics may soon be high on the agenda for policy makers and practitioners in education. In fact, the debate on whether AI can actually replace teachers has already begun. There is an assertion that qualified teachers will continue to play a role in the future, with a focus on teaching that aims to develop students' emotional intelligence, creativity and communication skills. They even argue that advances in artificial intelligence and automation will make humans more 'humane'.

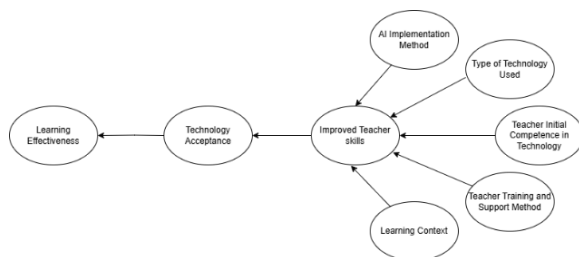


Fig 1. Casualty Diagram

In the figure above, the relationship between variables to achieve success, namely “learning effectiveness”, is explained. Here the five factors at the

rightmost point indicate independent variables that are

Not mutually bound, the five variables affect the dependent variable. This model consists of several constructs, also known as latent variables, which are evaluated through a set of items [10]. The model which is shown in the figure supported with hypothesis.

3. METHOD

The research used descriptive qualitative methods in analyzing the information. Qualitative methods involve collecting descriptive information through observing the words, texts, or behaviors of the subject being monitored. This allows the discovery of a more detailed picture of the way people speak, write, and behave at the individual, group, community, or organizational level. The resulting data is then recorded and analyzed in the context in which it was collected[1]. The method of data collection was structured with SLR, as discussed in the previous chapter. The extraction process was carried out in each journal and will be presented qualitatively descriptively. The subjects in the study were educators and students.

4. RESULTS AND DISCUSSION

4.1. Journal Analyzing Process

The results of the journal analysis process are shown in table 2. They are grouped based on the index and name of the journal that published the article. Furthermore, table 3 explains the results of the discussion contained in the article and then draws conclusions in answering each research question that has been formulated.

Table 2. Journal grouping

No	Authors	Year	Title	Journal	Laya Nan	Cita tion	Journal Rank*
1	Karata?, Fatih; Eriçok, Bar??; Tanrikulu, Lokman	2024	Reshaping curriculum adaptation in the age of artificial intelligence Mapping teachers AI-driven curriculum adaptation patterns	British Educational Research Journal		0	Q1
2	Seo, Kyoungwon; Yoo, Mina; Dodson, Samuel; Jin, Sung-Hee	2024	Augmented teachers K-12 teachers needs for artificial intelligence s complementary role in personalized learning	Journal of Research on Technology in Education		1	Q1
3	Yu, Han; Li, Xinguo; Bligh, Brett	2024	Strategies of Improving Information Literacy of College Foreign Language Teachers Under the Background of Artificial Intelligence	International Journal of Web-Based Learning and Teaching Technologies		1	Q3
4	Cabero-Almenara, Julio; Palacios-Rodríguez, Antonio; Loaiza-Aguirre,	2024	Acceptance of Educational Artificial Intelligence by Teachers and Its Relationship with	Education Sciences		2	Q2

No	Authors	Year	Title	Journal	Laya Nan	Cita tion	Journal Rank*
	María Isabel; Rivas-Manzano, María del Rosario de		Some Variables and Pedagogical Beliefs				
5	Lu, Jianshun	2024	The Construction of a Network Alliance of Foreign Language Teacher Development Communities in the Age of Artificial Intelligence	Applied Mathematics and Nonlinear Sciences		0	Q1
6	Bower, Matt; Torrington, Jodie; Lai, Jennifer W. M.; Petocz, Peter; Alfano, Mark	2024	How should we change teaching and assessment in response to increasingly powerful generative Artificial Intelligence Outcomes of the ChatGPT teacher survey	Education and Information Technologies		15	Q1
7	Delcker, Jan; Heil, Joana; Ifenthaler, Dirk	2024	Evidence-based development of an instrument for the assessment of teachers self-perceptions of their artificial intelligence competence	Educational technology research and development		0	Q1
8	Saimon, Musa; Mtenzi, Fredrick; Lavicza, Zsolt; Fenyvesi, Kristóf; Arnold, Maik; Diego-Mantecón, José Manuel	2024	Applying the 6E learning by design model to support student teachers to integrate artificial intelligence applications in their classroom	Education and Information Technologies		0	Q1
9	Chiu, Thomas K. F.; Ahmad, Zubair; Çoban, Murat	2024	Development and validation of teacher artificial intelligence (AI) competence self-efficacy (TAICS) scale	Education and Information Technologies		0	Q1
10	Kitcharoen, Pornchai; Howimanporn, Suppachai; Chookaew, Sasithorn	2024	Enhancing Teachers AI Competencies through Artificial Intelligence of Things Professional Development Training	International Journal of Interactive Mobile Technologies (IJIM)		5	Q3
11	Brandão, Anabela; Pedro, Luís; Zagalo, Nelson	2024	Teacher professional development for a future with generative artificial intelligence - an integrative literature review	Digital Education Review		1	Q2
12	Li, Mao	2024	Integrating Artificial Intelligence in Primary Mathematics Education Investigating Internal and External Influences on Teacher Adoption	International Journal of Science and Mathematics Education		0	Q1
13	Ramnarain, Umesh; Ogegbo, Ayodele Abosede; Penn, Mafor; Ojetunde,	2024	Pre-Service Science Teachers Intention to use Generative Artificial Intelligence in Inquiry-	Journal of Science Education and Technology		0	Q1

No	Authors	Year	Title	Journal	Laya Nan	Cita tion	Journal Rank*
	Segun; Mdlalose, Noluthando		Based Teaching				
14	Pont-Niclos, Isabel; Echegoyen-Sanz, Yolanda; Orozco- Gómez, Patricia; Martín-Ezpeleta, Antonio	2024	Creativity and artificial intelligence A study with prospective teachers	Digital Education Review		0	Q2
15	Zhang, Xinhua; Wareewanich, Thitinant	2024	A Study of the Factors Influencing Teachers Willingness to Use Generative Artificial Intelligence Based on the UTAUT Model	International Journal of Interactive Mobile Technologies (iJIM)		2	Q3
16	Zhong, Yongjun	2024	An Analysis on English Teachers Effective Classroom Discourse and Its Interactive Model Innovation with the Assistance of Artificial Intelligence	Applied Mathematics and Nonlinear Sciences		1	Q1
17	Aljemely, Yousef	2024	Challenges and best practices in training teachers to utilize artificial intelligence a systematic review	Frontiers in Education		0	Q2
18	Qin, Yang	2024	Artificial Intelligence Technology-Driven Teacher Mental State Assessment and Improvement Method	International Journal of Information and Communication Technology Education		0	Q3
19	Jatileni, Cloneria Nyambali; Sanusi, Ismaila Temitayo; Olaleye, Sunday Adewale; Ayanwale, Musa Adekunle; Agbo, Friday Joseph; Oyelere, Peter B.	2023	Artificial intelligence in compulsory level of education perspectives from Namibian in-service teachers	Education and Information Technologies		8	Q1
20	Sanusi, Ismaila Temitayo; Ayanwale, Musa Adekunle; Chiu, Thomas K. F.	2023	Investigating the moderating effects of social good and confidence on teachers intention to prepare school students for artificial intelligence education	Education and Information Technologies		10	Q1
21	Velander, Johanna; Taiye, Mohammed Ahmed; Otero, Nuno; Milrad, Marcelo	2023	Artificial Intelligence in K-12 Education eliciting and reflecting on Swedish teachers understanding of AI and its implications for teaching & learning	Education and Information Technologies		20	Q1
22	Nja, Cecilia Obi; Idiege, Kimson Joseph; Uwe, Uduak	2023	Adoption of artificial intelligence in science teaching From the	Smart Learning Environments		12	Q1

No	Authors	Year	Title	Journal	Laya Nan	Citation	Journal Rank*
	Edet; Meremikwu, Anne Ndidi; Ekon, Esther Etop; Erim, Costly Manyo; Ukah, Julius Ukah; Eyo, Eneyo Okon; Anari, Mary Ideba; Cornelius-Ukpepi, Bernedette Umalili		vantage point of the African science teachers				
23	Park, Joonhyeong; Teo, Tang Wee; Teo, Arnold; Chang, Jina; Huang, Jun Song; Koo, Sengmeng	2023	Integrating artificial intelligence into science lessons teachers experiences and views	International Journal of STEM Education		18	Q1
24	Zhang, Chengming; Schießl, Jessica; Plöchl, Lea; Hofmann, Florian; Gläser-Zikuda, Michaela	2023	Acceptance of artificial intelligence among pre-service teachers a multigroup analysis	International Journal of Educational Technology in Higher Education		52	Q1
25	Lei, Ling; Li, Junfeng; Li, Wenrui	2023	RETRACTED ARTICLE Assessing the role of artificial intelligence in the mental healthcare of teachers and students	Soft Computing		9	Q2
26	Jiang, Ruihong	2022	How does artificial intelligence empower EFL teaching and learning nowadays A review on artificial intelligence in the EFL context	Frontiers in Psychology		0	Q3
27	Liu, Yi; Chen, Lei; Yao, Zerui	2022	The application of artificial intelligence assistant to deep learning in teachers teaching and students learning processes	Frontiers in Psychology		13	Q1
28	Kuleto, Valentin; Ili?, Milena P.; Bucea-Manea-?oni?, Rocsana; Ciocodeic?, David-Florin; Mih?lcescu, Horia; Mindrescu, Veronica	2022	The Attitudes of K-12 Schools Teachers in Serbia towards the Potential of Artificial Intelligence	Sustainability		13	Q1
29	Celik, Ismail; Dindar, Muhterem; Muukkonen, Hanni; Järvelä, Sanna	2022	The Promises and Challenges of Artificial Intelligence for Teachers a Systematic Review of Research	TechTrends		176	Q1
30	Yau, King Woon; CHAI, C. S.; Chiu, Thomas K. F.; Meng, Helen; King, Irwin; Yam, Yeung	2022	A phenomenographic approach on teacher conceptions of teaching Artificial Intelligence (AI) in K-12 schools	Education and Information Technologies		54	Q1

Table 3. Journal Reviews

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
1 st journal	• The study explores teachers' needs for AI in K-12 education. • Eight key roles for AI in classrooms were identified. • Teachers prefer AI support based on school levels. • AI can enhance personalized learning and administrative efficiency. • Ongoing communication between teachers and AI is essential.	• Teachers expect AI to augment eight key roles in education. • Foundational learning support is prioritized across all school levels. • Elementary teachers focus on student assessment and management. • Middle and high school teachers emphasize self-reflection and career guidance. • AI should align with teachers' long-term educational goals. • Ongoing communication between teachers and AI is essential.	• Conducted focus group interviews with 15 teachers. • Analyzed qualitative data through thematic analysis. • Distributed online questionnaires to 128 teachers.		
2 nd journal	• The paper explores K-12 teachers' attitudes towards AI in Serbia. • It identifies teachers' knowledge and implementation potential of AI. • A survey was conducted with 109 teachers	• The research verified insufficiently known science in education. • Higher teacher awareness facilitates AI implementation in K-12 schools. • The study had	• A survey was anonymously administered to K-12 teachers. • Confirmatory analysis in PLS-SEM was utilized. • The study evaluated teachers' knowledge and opinions on AI.	• Opinion on AI utility in K-12 schools. • Implementation of AI in educational processes.	• Opportunity (Opp) with seven subfactors. • AI opinion (AIopinion) with four subfactors.

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	from LINK Educational Alliance. • Higher awareness leads to better AI implementation willingness. • The study serves as a pilot for national research.	limitations due to small sample size. • Future research has excellent potential for national population insights.	• Factors influencing AI implementation were examined.		
3 rd journal	• The paper studies improving information literacy of foreign language teachers. • It establishes an evaluation index system using analytic hierarchy process. • Foreign language teachers' information literacy is above average level. • Significant differences exist based on professional titles and ages. • A unified evaluation standard for college teachers is necessary.	• The study evaluates foreign language teachers' information literacy levels. • Information literacy levels are above average but inconsistent across dimensions. • Significant differences exist based on professional titles and ages. • No official evaluation standard for college teachers' information literacy exists. • A unified standard for evaluating information literacy is necessary.	• Analytic Hierarchy Process (AHP) for evaluation index system. • Fuzzy evaluation model for information literacy assessment.	• Willingness to act is the dependent variable.	• Performance expectation • Effort expectation • Attitude towards information technology use • Community influence • Convenience • Self-efficacy • Anxiety
4 th journal	• The paper explores AI in autism education for	• Artificial intelligence can enhance teacher communicati	• Structured classroom observations over 20 sessions.	• Student's observed emotional state.	• Student identifier • Time stamp • Teaching objective • Teaching type

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	teacher strategies. - It analyzes 5460 teacher-student interactions for effective communication. - Machine learning predicts student responses based on communication types. - Emotional states of students are considered in the analysis. - The study is exploratory with a small sample size.	on strategies in autism education. - Different communication strategies yield varying student responsiveness. - Machine learning models can predict student responses effectively. - The study highlights the importance of emotional context in interactions.	- Coding protocol developed for teacher-student interactions. - Machine learning classification for student response prediction. - Logistic regression with elastic net regularization. - Random forest with 2000 decision trees. - Gaussian Process with composite covariance function.	- Teacher's communication strategy. - Corresponding student response (outcome).	- Context for teaching type - Student's observed emotional state - Teacher's communication strategy - Corresponding student response (outcome) - Type of activity (e.g., yoga)
5 th journal	- The paper explores integrating AI into science lessons. - Teachers piloted an AI-integrated science lesson package. - Findings reveal teachers' perceptions and challenges in implementation. - AI and science are seen as complementary in problem-solving. - Lack of confidence in content mastery is a major challenge.	- The study provides an empirical case for AI-integrated curricula. - It suggests refining the AI-integrated TPACK framework. - AI literacy is essential for future educational skills. - Integration of AI into existing disciplines needs exploration. - Teachers perceived AI and science as complementary in	- The study adopted an instrumental case study design. - It focused on teachers' experiences and views. - Qualitative analysis was used for data interpretation.		

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
		problem-solving.			
6 th journal	- The paper explores AI integration in science education. - Teachers piloted an AI-integrated science lesson package. - Findings reveal teachers' perceptions and challenges in implementation. - Recommendations include providing comprehensive AI resources for teachers. - The study informs curriculum design for AI in education.	- The study provides an empirical case for AI-integrated curricula. - It suggests refining the AI-integrated TPACK framework. - AI literacy is essential for future educational skills. - Integration of AI into existing disciplines needs exploration. - Teachers perceived AI and science as complementary in problem-solving.	- The study adopted an instrumental case study design. - It focused on teachers' experiences and views. - Qualitative analysis was used for data interpretation.		
7 th journal	- Study investigates AI usage by science teachers in Nigeria. - Utilizes Technology Acceptance Model (TAM) for analysis. - Sample includes 79 science teachers from Calabar Education Zone. - High approval for AI usage with mean score of 3.00. - Ease of use is the strongest	- Science teachers showed high approval for AI utilization. - Self-esteem significantly influenced teachers' intent to use AI. - Ease of use and expected benefits impacted AI adoption. - Workshops are recommended for training teachers on AI usage.	- Descriptive and analytical research design was employed. - A questionnaire named AAITEQ was utilized for data collection. - Simple random sampling technique was used for selecting participants. - Data analysis involved means, standard deviations, and ANOVA.	- Behavioral intention - Attitude towards AI usage - Ease of usage	- Age of science teachers. - Sex of science teachers. - Residence type of science teachers.

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	predictor of behavior intent. Teachers' demographics did not significantly influence AI utilization intentions.	AI should be integrated into teacher training programs.			
8 th journal	- The study assesses teachers' AI competence perceptions. - It identifies six dimensions of AI competence. - Professional learning opportunities are needed for teachers. - The instrument measures perceived AI competence effectively. - Findings suggest uneven development of AI competence among teachers.	- Teachers' perceived AI competence is multi-dimensional. - Professional development opportunities are essential for AI competence growth. - Current teacher education lacks AI theory and tools. - Attitudes towards AI influence competency development.	- A quantitative study using convenience sampling method was conducted. - Data were analyzed anonymously following standard data-protection practices. - Confirmatory Factor Analysis (CFA) was employed for construct validity. - Exploratory Factor Analysis (EFA) was also utilized for data relationships. - Fit indices like RMSEA, CFI, and TLI were applied.		
9 th journal	- The study examines pre-service teachers' AI usage intentions. - It employs the Theory of Planned Behavior framework. - Survey data indicates significant factors influencing AI usage intentions.	- The study clarifies pre-service teachers' intentions to use AI. - AI can enhance inquiry-based teaching in classrooms. - Subjective norm is a strong predictor of AI usage intention.	- The research used a sequential explanatory mixed methods design. - Quantitative data were collected through a questionnaire survey. - Qualitative data were gathered using focus group interviews.	- Behavioral intention (BI) to use AI in teaching. - Attitude (ATT) towards using AI. - Perceived usefulness (PU) of AI. - Perceived behavioral control (PBC) regarding AI use. - Perceived skills readiness (PSR) for using AI.	- AI literacy (AIL) - Attitude (ATT) - Subjective norm (SN) - Perceived behavioral control (PBC) - Perceived usefulness (PU) - Perceived skills readiness (PSR) - Concerns about generative AI (CGAI)

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	- Concerns about AI's accuracy and over-reliance were noted. - Mixed methods approach combined quantitative and qualitative data collection. - Findings inform teacher educators on AI integration in teaching.	- Findings inform teacher educators on AI integration discussions. - Limitations include small sample size and initial instrument reliability.		Artificial intelligence literacy (AIL).	
10 th journal	- The study develops the TAICS scale for teacher AI competence. - It includes six dimensions: AI knowledge, pedagogy, assessments, ethics, engagement. - The scale was validated with 434 K-12 teachers. - It addresses gender and subject differences in AI competence. - The Delphi method was used for scale development. - The scale aids in teacher professional development and policy-making.	- The TAICS scale assesses teacher AI competence effectively. - It includes six dimensions relevant to AI education. - The scale is suitable for K-12 and higher education. - It enhances understanding of teaching skills in AI settings. - The scale was validated through a Delphi study.	- Delphi method utilized for developing teacher AI competencies. - Three rounds of Delphi for consensus building. - Confirmatory factor analysis (CFA) for scale validation. - Panel of K-12 teachers with AI expertise. - Likert scale used for rating competencies.	The study does not specify dependent variables.	- Gender of teachers (male vs. female) - Major teaching subject (science vs. non-science)
11 st journal	- The paper explores the 6E LbD model for AI integration. - It supports student	- The 6E LbD model supports AI integration in classrooms. - Modeled activities	- Data collected through observation of student teachers in classrooms. - Document analysis of	- Integration of AI in classroom practices. - Development of competence among student teachers.	- The 6E Learning by Design model. - Integration of AI applications in classrooms.

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	teachers' competence in using AI tools. • Data collected from 35 student teachers through various methods. • Findings indicate effective learning activities in the 6E LbD model. • The model enhances pedagogical practices for integrating AI in classrooms. • The study fills a gap in existing research on AI integration.	enhance student teachers' competence with AI. • Teacher educators should adopt the 6E LbD model. • Further research is needed on LbD models for AI integration.	lesson plans and reflective journals. • Reflective journals maintained by student teachers. • Participatory Action Research approach implemented in two cycles.	• Skills to interact with AI tools.	
12 nd journal	• The study examines educators' views on generative AI's impact. • Majority believe AI will significantly affect teaching and assessment. • Awareness of AI correlates with perceived impact on education. • Teachers seek changes in curriculum, pedagogy, and assessment methods. • Motivations for change include enhancing student	• Generative AI significantly impacts teaching and assessment perceptions. • Teacher motivations for change are crucial for professional learning design. • No singular answer exists for AI's educational impact; context matters. • Teachers agree on necessary changes in teaching and assessment practices.	• A mixed methods approach was adopted for the study. • A purposefully designed survey was used for data collection. • Qualitative analysis followed quantitative analysis for deeper insights.	• Perceived impact of generative AI on teaching and assessment. • Changes needed in curriculum, pedagogy, and assessment. • Teacher motivations for changing teaching and assessment practices.	• Teaching level • Experience level • Discipline area • Region • Gender

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	performance expectancy.				
13 rd journal	- The study investigates teachers' perspectives on teaching AI in Namibia. - It sampled 159 in-service teachers using structural equation modeling. - Key factors include AI relevance, attitude, and confidence in teaching AI. - AI Anxiety and readiness did not influence teaching intentions. - The research highlights the need for AI education in developing countries.	- Teachers' intention to teach AI is influenced by multiple factors. - AI Anxiety and readiness do not affect teaching intention. - Conference in AI significantly impacts attitude towards using AI. - Future research directions were suggested based on findings.	- The study utilized a quantitative research approach. - Structural Equation Modeling was employed for data analysis. - A 7-factor scale assessed various AI-related constructs. - Data was collected from 159 in-service teachers in Namibia.	- AI Anxiety - AI Readiness - AI Relevance - Attitude towards using AI - AI for Social Good - Confidence in AI - Behavioral Intention to teach AI.	- AI Anxiety - AI Readiness - AI Relevance - Attitude towards using AI - AI for Social Good - Confidence in AI - Behavioral Intention
14 th journal	- The paper investigates teachers' intentions to teach AI. - It explores factors like AI anxiety and perceived usefulness. - AI for social good and confidence are key moderators. - A quantitative methodology using structural equation modeling was employed. - Data was collected from 320 in-service teachers.	- Teachers' perceptions impact intention to teach AI. - AI relevance is the strongest predictor of teaching intention. - AI anxiety does not influence perceived usefulness. - AI readiness does not affect behavioral intention to teach AI. - AI for social good moderates several	- A quantitative methodology was employed. - Variance-based structural equation modeling (VB-SEM) was utilized.	- Attitude towards AI (AT) - Behavioral intention (BI) - Perceived usefulness (PU) - AI readiness (RA) - Relevance (RE)	- AI anxiety (AN) - Perceived usefulness (PU) - Attitude towards AI (AT) - AI relevance (RE) - AI readiness (RA)

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	Findings highlight the importance of teacher perceptions on AI education.	relationships in the model.			
15 th journal	- The paper explores teachers' understanding of AI in K-12 education. - It highlights the need for AI literacy among teachers. - Teachers often have misconceptions about AI and its implications. - Emotional responses affect teachers' engagement with AI education. - The study aims to inform teacher education and professional development.	- Teachers' understanding of AI is often superficial and vague. - Emotional responses affect teachers' engagement with AI literacy. - Misconceptions about AI are prevalent among teachers and educators. - Teachers' TPACK is crucial for effective AI integration in education. - Discrepancies exist between policy, curriculum, and teacher education.	- Anonymous questionnaires were employed for data collection. - Focus group discussions were conducted for qualitative insights. - Qualitative content analysis was used for data analysis. - A deductive and inductive approach was applied in analysis.		
16 th journal	- The study explores teachers' views on AI education in K-12. - Twenty-eight teachers from Hong Kong participated in interviews. - Six categories of teacher conceptions about AI teaching were identified.	- Teachers' perspectives are vital for curriculum development. - Teacher training is essential for quality AI education. - Six categories of teachers' conceptions of AI education were identified.	- The study employed a phenomenographic research method. - Interviews were conducted with 28 in-service teachers. - Teachers' conceptions were categorized into six hierarchical categories. - The project involved co-		

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	- Categories include technology bridging, ethics, and capability cultivation. - Findings suggest learning paths for technical and non-technical teachers.	- Findings inform design and implementation of AI programs. - Study highlights limitations and suggests further research is needed.	designing an AI curriculum.		
17 th journal	- The article has been retracted by the publisher. - Concerns included compromised editorial handling and peer review. - The authors did not respond to retraction correspondence. - The article was part of a guest-edited issue. - Publisher lost confidence in the article's results and conclusions.	- The article has been retracted due to multiple concerns. - The publisher lacks confidence in the article's results and conclusions. - Authors did not respond to correspondence regarding the retraction.	The paper has been retracted and does not specify methods.	The contexts do not provide information on dependent variables.	The contexts do not provide information on independent variables.
18 th journal	- The paper reviews challenges in training teachers for AI utilization. - It synthesizes findings from 10 relevant studies. - Lack of motivation is a major challenge for teachers. - Training programs should be	- AI adoption in education remains a debated topic. - Lack of motivation is a key challenge for trainers. - Customized training programs are essential for effective teacher training.	- Systematic literature review approach was adopted. - Qualitative studies were assessed for data evaluation. - Inclusion and exclusion criteria were established for study selection. - Manual checks ensured relevance and		

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	customized and motivating.	- Trainers should highlight AI benefits to motivate teachers. - Future studies should explore motivation's impact on AI training.	language of articles.		
19 th journal	- The study explores AI's impact on curriculum adaptation. - Teachers adapt curricula based on their unique classroom needs. - AI tools, especially ChatGPT, enhance lesson personalization. - Curriculum adaptation practices improve with teachers' professional experience. - Findings reveal significant differences in adaptation across disciplines. - The research contributes to understanding AI in educational practices.	- AI tools like ChatGPT transform curriculum adaptation processes. - Education becomes more engaging, relevant, and personalized through AI. - Teachers view AI positively for curriculum adaptation. - Further research is needed on traditional and AI-enhanced approaches. - A coordinated effort is required for effective AI integration.	- Mixed-methods research design was employed. - Quantitative data collected using the Curriculum Adaptation Patterns Scale. - Qualitative data gathered through semi-structured focus group interviews. - One-way ANOVA tests analyzed curriculum adaptation patterns. - Demographic information collected via a Personal Information Form.	- Teachers' curriculum adaptation patterns. - Extending dimension of curriculum adaptation. - Omitting dimension of curriculum adaptation. - Replacing dimension of curriculum adaptation	- Professional seniority - Branch - School level - Educational level
20 th journal	- The study explores teachers' needs for AI in K-12 education. - Eight key roles for AI in classrooms	- Teachers expect AI to augment eight key roles in education. - Foundational learning	- Conducted focus group interviews with 15 teachers. - Analyzed preferences of 128 teachers		- Teacher preferences for AI roles in classrooms. - School levels: elementary, middle, and high school.

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	were identified. - Teachers prefer AI support based on school levels. - AI should complement teachers, not replace them. - Ongoing communication between teachers and AI is essential.	support is prioritized across all school levels. - Elementary teachers focus on student assessment and management. - Middle and high school teachers emphasize self-reflection and career guidance. - AI should align with teachers' long-term educational goals.	via an online questionnaire. - Employed MANOVA analysis to examine differences across school levels. - Developed an interview questionnaire to gather teachers' perspectives.		- Gender of the teachers. - Years of teaching experience.
21 st journal	- The paper focuses on teacher mental state assessment using AI. - Multi-physiological signals are used for emotion recognition. - WESAD dataset aids in recognizing human mental states. - Models show correlation between teachers' emotions and network behavior.	- Emotion recognition models were constructed using WESAD and ECG data. - Three mental states were effectively recognized: baseline, recreation, tension. - Feature extraction significantly impacts model performance. - Teachers' emotional states correlate with their network behavioral features.	- Emotion recognition using multi-physiological signals. - Feature extraction and selection methods. - Fusion techniques for physiological assessments. - Anonymization and data security measures. - EMD algorithm for signal decomposition. - Genetic algorithm for feature extraction.	- The study uses physiological signals as dependent variables. - These include ECG, EDA, EMG, TEMP, RESP, and ACC.	- Total dimension of sample points. - Physiological signals: ECG, EDA, EMG, TEMP, RESP, ACC

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
22 nd journal	- The paper presents a multimodal English teaching model. - It utilizes advanced computational techniques for classroom discourse analysis. [1] - The model identifies semantic key frames in teaching videos. - It incorporates a composite convolutional neural network for feature merging. - Classroom discourse duration averages 14 to 19 minutes per session. - Teachers posed an average of 73.17 questions per lesson.	- A multimodal metaphorical teaching interaction model was designed. - Total discourse length of teachers was 164 minutes. [1] - Teachers used various modal resources for enhanced communication. - Pure language was the most frequently used resource. - Questioning techniques were employed 416 times in classrooms.	- A dual threshold extraction algorithm for keyframe identification. - Composite convolutional neural network for spatio-temporal feature analysis. - Pre-interactive LSTM decoder for video and text feature fusion. - Questionnaire on English teaching status distributed to students. - SPSS used for data analysis of collected questionnaire responses.	- Duration of classroom discourse per session. - Number of questions posed by teachers per lesson.	
23 rd journal	- The paper explores AI's role as a virtual language teacher. - AI enhances language learning through personalized, interactive methods. - It provides real-time feedback and adapts to learners' paces. - AI reduces language barriers and increases	- AI significantly improves language learning efficiency and accessibility. - AI tools provide real-time feedback and personalized learning experiences. - Integration of AI reduces language	- AI corrects mistakes immediately for effective learning. - AI creates conversations to enhance conversational skills. - Personalized instruction based on learners' current abilities. - Realtime feedback for immediate		

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	accessibility to resources. • The study emphasizes the effectiveness of AI in education.	barriers for learners. • AI fosters a more inclusive and effective learning environment.	corrections and explanations. • Flexible learning environment allowing self-paced progress. • AI translates between Hungarian and English efficiently.		
24 th journal	• The paper reviews teacher professional development for generative AI. • It emphasizes ethical and safe use of AI tools. • AI literacy is a key component of teacher training. • Hands-on activities engage teachers in using AI tools. • TPD improves teachers' confidence in integrating AI into education. • Long-term TPD has a greater impact on teaching practices.	• GenAI tools are integral to daily life and education • Teachers need professional development for effective GenAI integration. • TPD should include AI literacy and ethical understanding. • Teachers must develop lesson plans incorporating GenAI tools. • Joint reflections in TPD sessions enhance teaching strategies	• An integrative literature review was conducted. • SCOPUS and Web Of Science databases were utilized. • Keywords were used with boolean operators for article selection. • Articles were analyzed based on language and access criteria. • Ethical problems in literature were mapped for justification.		
25 th journal	• The study explores AI's role in enhancing creativity in education. • Focuses on prospective teachers' storytelling abilities using AI tools. • Combines qualitative and	• AI tools enhance creativity in educational settings. • Students express mixed feelings about using AI tools. • Guidance on AI tool usage	• Mixed experimental research using qualitative and quantitative methods. • Adapted version of the Global Students Survey (GSS) was utilized. • Students created stories using Story	• Students' storytelling capabilities. • Use of generative AI tools. • Students' concerns about AI implications. • Creative metacognition.	• Use of AI generative tools in storytelling. • Prospective teachers' concerns about AI implications. • Students' creativity and metacognition levels.

Files (30)	TL;DR	Conclusions	Methods Used	Dependent Variables	Independent Variables
	quantitative methods for data collection. • Students express mixed feelings about AI's educational implications. • Emphasizes the need for guidance on AI tool usage. • Highlights AI's potential in self-assessment and co-evaluation processes.	is necessary for students. • AI tools should supplement, not replace, critical thinking. • Future research will focus on metacognitive reflection in creativity. • Storytelling is effective for developing creative abilities.	Cubes in groups. • Students compared original stories with AI-generated versions. • Essays justifying decisions on story versions were written.		
26 th journal	• The paper assesses AI's impact on teacher training in ODeL. • It employs a quantitative research design with 115 respondents. • AI implementation presents both opportunities and limitations in training. • Ethical issues must be considered before AI implementation. • The study recommends a mixed-method approach for future research.	• The study assessed AI's impact on teacher training. • AI is effective in Open Distance and Electronic Learning. • AI presents both positive and negative impacts in teacher training. • Ethical implications must be considered before AI implementation. • AI can enhance teacher training methods significantly.	• A quantitative approach was employed for data collection. • A survey with electronically distributed questionnaires was utilized. • Random sampling strategy was applied to select respondents. • Closed-ended questions were used in a Likert scale questionnaire. • Data analysis was conducted using SPSS software.		

4.2. Journal Analyzing Process

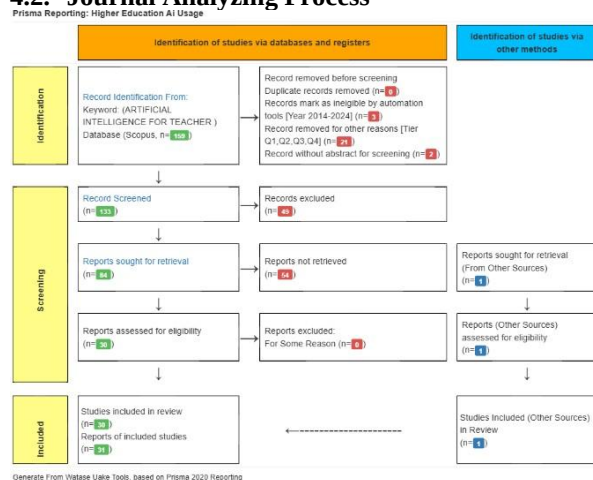


Fig 2. PRISMA Table
(Source: Watase Uake)

In the PRISMA table presented above, it is shown in sequence how the journal collection process is carried out. In the identification section, the keyword “Higher Education AI Usage” is inputted, then the web will display the results of the journals that have been obtained, namely 159 articles. Next, an automatic selection process was carried out, 3 articles were excluded because they did not meet the criteria for the year range, 21 articles were not included because they were not indexed by Scopus Q1-Q4. The next stage is screening to see the abstract of each journal that has been obtained, if it does not match or is not relevant to the scope of the discussion, it will be excluded from the criteria, if it is relevant, then the journal will automatically be included in the next stage.

4.3. Results

The results were obtained by comparing each of the conclusions from thirty articles reviewed to answer the research question. Then it is elaborated to get an interpretation that can be digested more easily. The description of the answer to the research question is as follows:

RQ 1: How can AI be used to support lifelong learning for teachers in K12 and higher education?

1. With the AIoT-PD (AI of Things- Professional Development) training successfully improving teachers' competency in AI, it shows that this technology can be an effective tool to support lifelong learning. In this case, the AI-based training not only hones teachers' technical skills, but also empowers them to keep evolving in the midst of rapid technological change. AI is proven to help teachers' competency in mastering new skills throughout their careers through training programs tailored specifically to their needs. This is in line with the concept that AI can be a reference in everyday education.
2. The positive trend towards AI perspectives after the training shows that AI has great potential to inspire teachers to increase their interest in the

teaching and learning process continuously. Thus, AI technology can be utilized in enhancing learning experiences that take personal preferences into account.

RQ 2: What are the main challenges in integrating AI to improve teacher expertise, and how can methodological approaches address them?

1. One of the main challenges is how teachers from different disciplines can integrate AI tools into their curriculum. Research shows that there are clear differences in the ability of teachers from different fields to adapt the curriculum to AI technologies. This suggests that the learning needs and contexts in each discipline require different approaches.
2. Teachers are often faced with the challenge of customizing the curriculum according to the unique needs of the students in their classrooms. However, not all AI tools, including for example ChatGPT, are designed to understand the local and specific nuances of such needs. This creates a gap between the capabilities of AI technology and the real-life needs that teachers face in the field. Curriculum adaptation is the answer to ensure that learning experiences are relevant and useful for students. Research shows that teachers have the flexibility to choose learning tools that match students' characteristics and interests, but current AI tools are not sufficient to meet these needs.

RQ 3: What is the impact of AI implementation on the effectiveness of teacher teaching methods in higher education based on current literature?

1. The integration of AI in science lessons shows that this technology can be a supportive tool that enriches traditional teaching methods. Teachers are utilizing AI to support problem-based learning, which in turn helps students develop critical thinking skills and solve more complex problems.
2. Teachers who implement AI-based lesson plans can customize learning materials according to students' needs, especially in science, where an adaptive approach is crucial. In this way, they can create more relevant learning experiences and support students' understanding more effectively. With AI support, teachers can tailor teaching materials according to the needs of individual students, which in turn optimizes learning outcomes and increases the relevance of teaching.

5. CONCLUSION

The results show that the application of artificial intelligence (AI) significantly supports continuous learning for teachers, increases learning effectiveness, and helps overcome technology integration challenges. Through AI-based training, such as AIoT-PD, teachers can develop new skills and improve their technical competencies. However, the main challenges

are the differences in teachers' ability to adapt curriculum to AI and the limitations of AI tools in understanding students' general needs. The approach of curriculum personalization and flexibility of AI tools can be a solution to these problems. By personalizing subject matter, especially in science, teachers can create more relevant learning experiences. Overall, AI has great potential to revolutionize education and improve teacher professionalism, but its success depends on proper training and the development of tools that fit the educational context.

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