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FROM CLASSROOM TO LECTURE HALL: HOW AI ALTERS TEACHER ROLES AND CORE COMPETENCIES ACROSS EDUCATIONAL STAGES

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Abstract. The rapid integration of artificial intelligence (AI) into education is reshaping teacher roles, competencies, and pedagogical decision-making across all levels of schooling. While technological capabilities of AI systems have been widely studied, less attention has been paid to how AI influences teacher professional characteristics—particularly in early childhood and elementary education. This paper examines how AI affects ten core teacher characteristics: pedagogical content knowledge, classroom management, socio-emotional competence, developmental understanding, instructional adaptability, assessment literacy, communication skills, professional ethics, creativity, and digital literacy. A qualitative content analysis of literature published between 1986 and 2024 was conducted. Results reveal substantial benefits of AI, including improved feedback, personalized learning, enhanced differentiation, and reduced administrative load. However, risks include deskilling, algorithmic bias, reduced autonomy, and weakened teacher–student relationships. The paper further extends these findings by comparing impacts across elementary, high school, and university settings. A synthesized table summarizes benefits and risks for each characteristic. Findings highlight that while AI enhances efficiency and insight, its responsible integration requires safeguarding human-centered competencies that remain central to teaching.

Key words: Artificial intelligence in education, teacher professional competencies, pedagogical transformation, elementary, secondary and higher education, AI-supported teaching and learning, digital literacy, ethics of AI in education

1. Introduction

Artificial intelligence (AI) technologies—ranging from machine-learning diagnostics, natural language processing, intelligent tutor systems (ITS), educational data mining and generative text systems—are increasingly shaping educational practice worldwide. AI technologies increasingly support teachers by automating administrative tasks, analyzing learner data, enabling adaptive learning, and offering generative tools for instructional content creation (Holmes et al., 2021; Luckin et al., 2016). In elementary schools, AI tools provide adaptive learning environments, support early literacy, and automate assessment (Holmes et al., 2021). In secondary schools, AI enables personalized pathways and predictive analytics for student performance (Akgün & Greenhow, 2021). In higher education, AI supports research, academic advising, and large-scale learning management (Zawacki-Richter et al., 2019).

Yet, despite these developments, research disproportionately focuses on technical capabilities rather than on how AI reshapes the professional identities, behaviors, and competencies of teachers themselves (Williamson & Eynon, 2020; Selwyn, 2019). This gap is most evident in early-childhood and elementary contexts, where research on teacher–child relationships, socio-emotional development, and age-appropriate pedagogy is extensive (Jennings & Greenberg, 2009; Pianta, 1999), but research on AI's impact on these competencies is minimal.

Teacher effectiveness literature identifies ten essential competencies central to teaching quality (Shulman, 1986; Emmer & Evertson, 2013; Tomlinson, 2014). Understanding how AI influences these competencies across educational levels—elementary, high school, and university—is crucial for ensuring that technology enhances rather than diminishes pedagogical practice. This paper aims to fill that gap.

1.1. Contribution and positioning of the study

While previous systematic reviews have examined artificial intelligence in education primarily from technological, student-outcome, or systems-design perspectives (e.g., Zawacki-Richter et al., 2019; Holmes et al., 2021), comparatively fewer studies have analyzed AI's implications for established teacher professional competencies across multiple educational levels. Existing reviews often focus on higher education or specific AI applications rather than examining how AI intersects with the broader professional characteristics that define effective teaching.

This study contributes to the field by explicitly integrating recognized teacher competency frameworks with contemporary AI scholarship and by offering a structured, cross-level comparative analysis of elementary, secondary, and university contexts. By mapping AI influences onto ten widely recognized teacher characteristics, the manuscript provides a profession-centered perspective that complements technology-oriented reviews and advances understanding of how AI reshapes teacher roles, professional identity, and pedagogical practice.

2. LITERATURE REVIEW – TEACHERS' PROFESSIONAL CHARACTERISTICS ACROSS EDUCATIONAL LEVELS

Teacher effectiveness research provides strong evidence for a core set of professional characteristics:

- **Pedagogical Content Knowledge (PCK)**: It is foundational for transforming disciplinary knowledge into teachable forms (Shulman, 1986; Ball et al., 2008). Introduced by Shulman (1986), it is critical across all educational levels. Elementary teachers require broad but developmentally adapted knowledge; high school teachers specialize deeply; university faculty often prioritize disciplinary expertise over pedagogy. AI tutoring systems and language models can enhance PCK by offering explanations, examples, and representations (Luckin et al., 2016), though risks include over-reliance and reduced conceptual mastery (Williamson & Eynon, 2020).
- **Classroom management**: This type of management is most essential in elementary and high school settings (Emmer & Evertson, 2013). AI analytics, video monitoring tools, and engagement-detection systems help teachers predict off-task behavior (Holmes et al., 2021). At the university level, classroom management is less central, though AI-supported learning platforms influence engagement patterns.
- **Socio-emotional competence**: Elementary teachers invest heavily in emotion regulation, relationship building, and emotional labor (Jennings & Greenberg, 2009). AI emotion-recognition systems offer data on affective states (D'Mello & Graesser, 2015), but researchers warn that socio-emotional work should remain fundamentally human. High school teachers benefit from AI-supported SEL interventions, while university instructors typically rely more on cognitive engagement.

- **Developmental understanding**: Developmental psychology (Piaget, 1970; Vygotsky, 1978) is central to elementary teaching, moderately central in high school, and minimally emphasized at university. AI analytics can reveal developmental patterns in literacy, numeracy, and cognitive growth (Pianta, 1999). Grounded in child development research (Piaget, 1970; Vygotsky, 1978; Berk, 2017), teachers must recognize children's cognitive, social, emotional, and linguistic developmental trajectories. However, simplistic algorithmic interpretations may misrepresent complex developmental trajectories.
- **Instructional adaptability and differentiation**: Differentiated instruction (Tomlinson, 2014) is essential in K–12 (range of years for compulsory primary and secondary education or from kinder garden through the 12th grade). AI improves adaptability through real-time diagnostics and adaptive learning platforms. In high school, adaptive tools support personalized pathways; in universities, AI supports flexible pacing and supplemental tutoring. A central risk concerns the potential erosion of teacher autonomy, particularly if AI systems begin to dictate instructional differentiation without sufficient professional judgment.
- **Assessment literacy**: Assessment literacy is vital across all levels. AI facilitates automated scoring, formative feedback, and learning analytics (Black & Wiliam, 1998). High school teachers rely heavily on standardized and competency-based AI tools. University instructors increasingly use AI for plagiarism detection, automated essay scoring, and large-scale assessment. Concerns include algorithmic bias (Akgün & Greenhow, 2021) and misinterpretation of data.
- **Communication skills**: AI translation and communication tools support parent engagement in elementary and high school contexts (Hargie, 2011). In higher education, AI enhances communication with diverse international student populations. Possible risks include depersonalized communication and reduced relational depth.
- **Professional ethics and reflective practice**: Ethical concerns surrounding AI such as privacy, bias and transparency, are widespread (Holmes et al., 2022). University professors face additional issues around academic integrity and authorship. Reflective practice (Schön, 1983) can be supported by AI analytics showing teaching patterns, but also constrained by opaque algorithms.
- **Creativity and innovation**: AI tools enhance creativity by generating teaching materials (Sawyer, 2011). Elementary teachers use AI for games and stories; high school teachers for simulations; university instructors for research and design tasks. However, AI-generated content risks homogenization (Craft, 2005).
- **Digital literacy**: Digital competence is essential across all levels, though expectations differ. Elementary teachers require foundational digital skills for instructional tools. High school teachers integrate complex platforms, coding, and media literacy. University faculty require advanced digital research and teaching skills (Dede, 2020). AI demands sustained upskilling.

3. MATERIALS AND METHODS

This study employed a qualitative systematic literature analysis, integrating elements of narrative review, thematic synthesis, and conceptual mapping. The purpose was to examine how artificial intelligence (AI) influences ten widely recognized teacher characteristics—across elementary, high school, and university teaching contexts—and to compare similarities and differences among these educational levels. Because the field is relatively young and empirical findings are fragmented, a qualitative, interpretative methodology was chosen to capture conceptual trends, theoretical arguments, and emerging empirical patterns (Boell & Cecez-Kecmanovic, 2015).

The study was conducted using research questions such as:

- How is artificial intelligence conceptualized in relation to the ten scientifically established teacher characteristics (pedagogical, methodological, behavioral, and ethical) in the existing literature?
- How is the role of artificial intelligence described and differentiated across elementary, high school, and university teaching contexts?
- What are the primary opportunities and risks of AI for teacher's professional identity and practice across different educational levels?

These questions structured all stages of data collection, systematic process of organizing and categorizing textual data into thematic categories (coding), and analysis.

3.1. Inclusion and exclusion criteria

To ensure methodological transparency and rigor, clear research criteria were established as shown in continuation.

Inclusion criteria. Sources were taken into consideration if they:

- Were peer-reviewed journal articles, academic books or reputable institutional reports (e.g., UNESCO, OECD).
- Addressed AI in education, teacher characteristics, teacher professional identity, or teacher competencies.
- Focused on elementary, secondary/high school, or higher education contexts.
- Captured the emergence of modern technology, trends and AI, as well as foundational teacher's competency research.

Exclusion criteria. Sources were not taken into consideration if they:

- Focused solely on technical AI development without educational implications.
- Focused exclusively on the technical implementation of AI tools without addressing pedagogical or teacher-related implications.
- Lacked academic credibility (blogs, non-reviewed articles).
- Addressed corporate or military training context only.
- Treated AI merely as general ICT with no distinction its intelligent or adaptive functions.

3.2. Data sources and search methodology

The analysis draws on scholarly publications published between 1986 and 2024, including journal articles, books, meta-analyses, and systematic reviews. Databases consulted included ERIC, Scopus, Web of Science, PsycINFO, Google Scholar, ResearchGate and others. Search terms combined phrases such as: "AI in education", "teacher characteristics", "elementary teachers", "secondary teachers", "university teaching", "teacher identity", "intelligent tutoring systems", "learning analytics", "teacher competencies", "pedagogical content knowledge", "classroom management", "Ai impact on teachers", "AI and higher education", "elementary teachers and AI", "secondary teachers and AI", and similar.

3.3. Research procedure elements

The process of coding was based on:

- Initial coding: all texts were reviewed and categorized according to their relevance to teacher skills, behaviors or role changes associated with AI.
- Focused coding: ten predefined teacher-competency categories were selected based on the broader teacher effectiveness literature (Shulman, 1986; Jennings & Greenberg, 2009; Tomlinson, 2014; Mishra & Koehler, 2006).
- Comparative coding across educational levels: research results were analyzed to compare patterns across elementary, high school, and university teaching contexts.

Attention was given to developmental demands, curriculum complexity, autonomy, and institutional structures.

Analysis was used to link teacher's characteristics with AI-related benefits, AI-related risks or challenges and contextual differences between educational levels. All findings were summarized in a several comprehensive result tables and elaborated narratively in the following section.

4. RESULTS AND DISCUSSION

The results from the research are comprised in three comprehensive tables:

- Table with comparison of the ten teacher's characteristics across educational levels (table 1),
- Table showing the intersection between AI and teachers' characteristics (table 2), and
- Table with information about AI Influence on teachers' competencies across elementary, high school and university levels (Table 3).

Table 1. Comparison of the ten teacher's characteristics across educational levels

Teacher Characteristic	Elementary Education	Secondary Education (High School)	Higher Education (University)
Pedagogical Content Knowledge (PCK)	**Highly emphasized.** Teachers must simplify concepts, use analogies, and address misconceptions of young learners (Shulman, 1986).	**Very emphasized.** More subject-specialized PCK required (Ball et al., 2008).	**Moderately emphasized.** University faculty often have strong subject expertise but limited pedagogical training; PCK varies widely.
Classroom Management	**Crucial.** Younger children require behavioral guidance and structured routines (Emmer & Evertson, 2013).	**Important.** Classroom discipline, motivation, and behavior issues remain significant.	**Lower emphasis.** University students are adults; management is more about academic integrity and engagement.
Socio-Emotional Competence	**Very high importance.** Foundational for child well-being and development (Jennings & Greenberg, 2009).	**Moderate to high importance.** Adolescents have complex emotional needs.	**Lower emphasis.** Focus shifts to counseling availability rather than instructor emotional labor.
Child/Student Development Knowledge	**Critical.** Instruction must match cognitive and developmental stages (Piaget, Vygotsky).	**Important.** Adolescents' cognitive and identity development matter, but instruction is more content-driven.	**Minimal.** University students considered self-directed adults; developmental theory rarely applied.
Instructional Adaptability / Differentiation	**Highly emphasized.** Diverse needs, varied readiness levels, and early interventions (Tomlinson, 2014).	**Moderately emphasized.** Differentiation expected but curriculum constraints exist.	**Low to moderate.** Adaptation occurs but less systematically; accommodations handled via policy offices.
Assessment Literacy	**Very high importance.** Continuous formative	**Important.** Mix of formative and	**Moderate.** Assessment varies by discipline;

Teacher Characteristic	Elementary Education	Secondary Education (High School)	Higher Education (University)
	assessment central to early learning progress (Black & Wiliam, 1998).	summative assessments; high-stakes tests common.	many faculty lack training in educational measurement.
Communication Skills	**Essential.** Frequent communication with children and parents; simplified explanations.	**Important.** Communication includes advising, explaining complex content, and engaging families when needed.	**Important.** Focus shifts to academic communication and clarity in lectures, but less family involvement.
Professional Ethics & Reflective Practice	**Strong emphasis.** Child protection, fairness, and reflective practice required (Day, 1999; Schön, 1983).	**Important.** Ethical grading, equity, and professional conduct.	**Highly emphasized but different.** Academic ethics: research integrity, fairness, confidentiality, supervision responsibilities.
Creativity & Instructional Innovation	**Highly emphasized.** Play, multimodal tasks, and creative instructional design (Craft, 2005).	**Moderately emphasized.** Innovation often subject-based (e.g., labs, projects).	**Varies.** Creativity depends on teaching philosophy; research activities may receive more attention than instructional creativity.
Digital & Technological Literacy	**Increasingly essential.** Technology supports differentiation and early digital skills (Mishra & Koehler, 2006).	**Highly emphasized.** Students rely on digital tools for learning; teachers must integrate ICT meaningfully.	**Essential.** Online platforms, research tools, digital assessment, and LMS systems dominate instruction.

Table 2. Intersection between AI and teachers' characteristics

Teacher Characteristic	What the Characteristic Means	How AI Intersects With It (Definition of Intersection)	Examples of Positive AI Influence	Examples of Negative AI Influence
Pedagogical Content Knowledge (PCK)	Ability to explain subject matter in developmentally appropriate ways.	AI intersects by providing alternative explanations, representations, and models of understanding.	AI-generated explanations; visualizations; adaptive tutoring systems.	Teacher over-reliance; reduced deep content understanding.
Classroom Management	Establishing order, routines, positive climate, and student engagement.	AI intersects by monitoring behavior and predicting off-task patterns.	Early-warning systems; attention tracking.	Surveillance concerns; reduced trust.
Socio-Emotional Competence	Empathy, communication, emotional	AI intersects by detecting emotions and	Emotion analytics; detecting	Dehumanization; decreased relational intuition.

Teacher Characteristic	What the Characteristic Means	How AI Intersects With It (Definition of Intersection)	Examples of Positive AI Influence	Examples of Negative AI Influence
	regulation, relationship-building.	providing SEL insights.	disengagement.	
Developmental Understanding	Knowledge of child/adolescent development and appropriate learning stages.	AI intersects through learning analytics that reveal individual learning trajectories.	Customized developmental profiles; early detection of delays.	Oversimplification of development; algorithmic mislabeling.
Instructional Adaptability	Ability to differentiate and adjust instruction rapidly.	AI intersects through adaptive learning platforms that suggest real-time instructional changes.	Automated differentiation; personalized learning paths.	Overdependence; reduced pedagogical autonomy.
Assessment Literacy	Designing, interpreting, and using assessments effectively.	AI intersects by automating feedback, scoring, and data visualization.	Faster, more objective feedback; data dashboards.	Biased algorithms; misinterpretation of AI scoring.
Communication Skills	Clear communication with students, parents, and colleagues.	AI intersects via translation tools, automated messaging, and chatbots.	Support for multilingual families; consistent updates.	Impersonal communication; reduced human interaction.
Professional Ethics & Reflective Practice	Responsible, ethical conduct; analyzing one's teaching.	AI intersects through data-based reflection and new ethical dilemmas.	Analytics for self-evaluation; improved documentation.	Privacy, fairness, opacity, and algorithmic bias issues.
Creativity & Innovation	Creation of engaging, original, interactive learning experiences.	AI intersects by offering creative tools and content generation.	Rapid creation of learning materials; new modalities.	Homogenization of content; reduced originality.
Digital Literacy	Ability to use technology effectively and critically.	AI intersects by requiring higher digital competence and introducing new tools.	Skill development; technological empowerment.	Increased workload; larger digital divide.

Table 3. AI Influence on teachers' competencies across elementary, high school and university levels

Competency	Elementary – Pros	Elementary – Cons	High School – Pros	High School – Cons	University – Pros	University – Cons
PCK	Better representations	Teacher deskilling	Deepened explanations	Reduced mastery	Research-informed PCK	AI misinterpretation of domain knowledge
Classroom Management	Early detection of problems	Surveillance concerns	Behavior analytics	Student resistance	Engagement tracking	Intrusive monitoring
Socio-emotional	Emotion detection support	Loss of relational depth	SEL data insights	Over-automation	Student wellness analytics	Ethical risk of emotional profiling
Developmental Understanding	Fine-grained growth data	Oversimplification	Early diagnosis	Mislabeling	Learning analytics at scale	Lack of developmental nuance
Differentiation	Personalized pathways	Reduced autonomy	Adaptive content	Algorithmic bias	Personalized tutoring	Reduced instructor control
Assessment Literacy	Automated formative assessment	Bias, opacity	Faster grading	Misinterpretation	Scalable assessment	Over-reliance on algorithms
Communication	Translation support	Depersonalization	Improved parent communication	Reduced teacher mediation	Multilingual support	Reduced academic socialization
Ethics	Reflection analytics	Privacy risks	Data-informed decisions	Academic integrity concerns related to AI-assisted student work	Research ethics challenges	Algorithmic opacity
Creativity	Material generation	Homogenization	Project design tools	Lack of originality	Research-enhanced creativity	Threat to authenticity
Digital Literacy	Skill growth	Digital divide	Advanced tools	Workload increase	High-level digital scholarship	Inequity in adoption

The following discussion synthesizes the implications for the three educational levels:
Elementary Teachers. AI significantly supports differentiation, assessment, and PCK enhancement in early grades, but threatens relational and developmental aspects of teaching. Teachers must preserve empathy, play-based learning, and socio-emotional modeling.

High School Teachers. AI reinforces subject specialization and assessment, supporting rich feedback and adaptive sequencing. Risks include academic integrity, student autonomy, and reduced curricular control as AI-driven systems guide learning progression.

University Teachers. AI transforms research, assessment, and content delivery. Key concerns include academic integrity, algorithmic authorship, and the possible erosion of academic freedom if institutions mandate AI tools. University faculty benefit most from AI for complex content generation and research support.

5. CONCLUSION

Artificial intelligence is rapidly reshaping the professional landscape of teaching across elementary, high school, and university settings, but its influence is neither uniform nor straightforward. The cross-level comparison reveals that while AI introduces similar categories of opportunities—such as enhanced assessment, personalized learning, automated administrative support, and expanded instructional resources—the magnitude and nature of these influences vary substantially by educational level. Elementary teachers, whose work is deeply rooted in socio-emotional support, developmental sensitivity, and relationship-based pedagogy, experience AI as a tool that can either strengthen or disrupt the human-centric foundations of early learning. High school teachers encounter AI primarily at the intersection of subject specialization, differentiation, and data-driven instruction, where AI supports complex content explanation yet carries risks of over-assessment and algorithmic bias. At the university level, AI increasingly shapes research, academic writing, large-scale data analytics, and instructional design, raising profound questions about academic integrity, scholarly identity, and the evolving nature of expertise itself.

The table on AI Influence Across Levels highlights a core insight - the younger the learners, the more essential the relational, socio-emotional, and developmental work of teachers—and the greater the risk that AI may inadvertently displace or diminish these human functions. Conversely, in high school and higher education, AI's alignment with analytical tasks, complex content generation, and self-directed learning means that its benefits and efficiencies are more easily integrated, though not without challenges such as equity concerns, assessment reliability, and shifts in epistemic authority.

The second table on Intersections Between AI and Teacher Characteristics further illustrates that AI's impact is not isolated to discrete skills but operates across interconnected domains of teacher professionalism. AI influences:

- Pedagogical knowledge, by providing models, explanations, and adaptive pathways—but risks over-reliance and erosion of deep understanding.
- Classroom management and organization, through predictive analytics and monitoring—but introduces ethical tensions around surveillance and autonomy.
- Assessment literacy, by accelerating feedback cycles and data interpretation—while simultaneously risking algorithmic bias and narrowing the meaning of achievement.
- Socio-emotional competence and communication, where AI can assist identification of student needs—yet may depersonalize interactions and weaken human judgement.
- Creativity and material design, enabling rapid production of high-quality resources—at the risk of homogenization and diminished teacher originality.
- Professional ethics and reflective practice, where AI supports reflection and self-analysis—while posing new dilemmas related to transparency, fairness, and responsibility.

A central conclusion emerges across both tables and throughout the full paper: *AI does not replace teacher competencies but reshapes the way these competencies are enacted, prioritized, and valued*.

In all educational levels, teachers remain indispensable as ethical agents, relational mediators, developmental experts, and interpreters of learning contexts—roles that AI cannot authentically replicate. However, teachers must also evolve, gaining new capacities in digital literacy, critical data interpretation, and ethical AI governance.

Therefore, the future of teaching in the age of AI is best understood not as a transition toward automation, but as a shift toward hybrid professional practice, in which human and artificial intelligences interact dynamically. The challenge for educational systems is to ensure that this hybridity strengthens rather than weakens core pedagogical, ethical, and relational dimensions of teaching. To achieve this, policymakers, researchers, and teacher education programs must develop frameworks that position AI as a supportive tool, preserve teacher autonomy, and cultivate an informed, critically reflective teaching workforce.

Ultimately, the full comparative analysis demonstrates that the transformative potential of AI depends not on the technology itself, but on how teachers, institutions, and societies choose to integrate it. The most successful futures will be those where AI augments human expertise, enhances equitable learning opportunities, and reinforces the irreplaceable human elements of education: empathy, judgement, creativity, and care.

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