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ARTIFICIAL INTELLIGENCE AND THE TRANSFORMATION OF ONLINE EDUCATION: A CASE STUDY OF "*MASTER OF STUDIES IN DIGITAL EDUCATION*" PROGRAM OF UNIVERSITY OF GUANAJUATO

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Abstract. *The integration explores the impact of artificial intelligence (AI) on the transformation of online education through a case study of a master's program in Digital Education at the University of Guanajuato. The study examines the theoretical foundations for integrating AI into the educational process. It analyses the potential of AI to personalize learning, automate routine tasks, create intelligent learning systems, and improve the digital competencies of program graduate's students. The* ***objective*** *is to examine the potential for applying AI technologies in the master's program in Digital Education at the University of Guanajuato, including the adaptation of educational content, the use of generative AI to support students and assessment tools, and the development of appropriate strategies, teacher training, and the creation of assessment systems that take into account the specificities of AI use. Along with the benefits, the paper also details the challenges and risks associated with introducing AI into online education, such as ethical dilemmas, academic integrity issues when using generative AI, the need to develop critical thinking, and adapt the role of the teacher. The paper concludes by offering recommendations for the effective and ethical integration of AI technologies into online education, emphasizing the importance of teacher training, the development of appropriate policies, and maintaining a balance with traditional teaching methods to ensure a quality educational experience.*

Key words: *ONLINE EDUCATION, ARTIFICIAL INTELLIGENCE, MASTER'S PROGRAM IN DIGITAL EDUCATION.*

Introduction

Education, as a continuous and comprehensive process, has positioned itself globally as a central tool for prosperity, as it promotes growth opportunities and develops the basic skills needed to function in society. Ajay Banga, president of the World Bank, describes education as a factor that stimulates innovation, strengthens institutions, and promotes social cohesion [3]. For young people, schooling fosters employment, increases income, and contributes to poverty reduction.

Information and communication technologies continue to be an essential means of achieving quality education in the 21st century. Both internationally and in Mexico, their potential to transform education systems is recognized, provided they are implemented in an equitable, inclusive manner, and focused on student well-being as a path to quality education [8].

Speaking about higher education, university represents a special value-communicative reality in which the influx, expansion and transformation of knowledge occurs. The very concept of *university* characterizes a stable institutional organizational form of a multidisciplinary educational and scientific institution, where various options for interaction between education stakeholders are implemented. At the same time, the forms of interaction between teachers and students – traditional subjects of the university environment – in modern conditions are much broader and more diverse than the unchanging functions of transferring and acquiring knowledge.

In the report "*Current Status of Educaional technologies in higher education institutions in Mexico"* prepared by ANUIES, the use of ICTs and the creation of virtual universities are seen as ways to bridge gaps and establish high-quality education systems, thus fostering social and economic progress and democratization, as well as other important social priorities. It is argued that technology plays a decisive role in the effort to improve the quality of higher education to adapt it to the demands of 21st-century knowledge societies [2].

The space of interaction of the university in society is extremely wide, multifaceted and complex due to the multitude of its internal and external connections. In turn, interaction is an important condition for obtaining real and creative knowledge. Modern knowledge has a social nature: it is created, exists and accumulates in a team in the process of communication, representing connective, network knowledge, characterized by autonomy, openness and interactivity, as well as internal diversity. Such a space has coordinate axes – cognition, development and improvement – subjects of interaction. In these planes, there are increases and intensification of the value-communicative flow of knowledge both within the university and in interaction with the external environment. Thus, interaction in the university environment is not static, it is characterized by qualitative dynamics.

The dynamics of interaction between subjects of the university educational process is considered as a characteristic of joint activities of students and teachers aimed at developing their competencies (acquiring new knowledge, mastering new methods of activity and finding new meanings) [9]. Such development ensures mutual change and mutual enrichment of the intellectual, informational, emotional-value and operational spheres of subjects based on the organization of joint actions. The content of interaction is the exchange of information and project activities, values, expansion of the value circle of knowledge, actualization of personal freedom of subjects of educational activity. However, challenges such as the need to strengthen the institutional digital culture and promote pedagogical innovation through the effective use of ICTs must be highlighted. The use of information technologies is one of the highly sought-after trends that significantly changes the nature of educational interaction. Furthermore, the *National Development Plan 2025-2030* recognizes the importance of ICTs in expanding coverage and improving the quality of higher education in Mexico. The program emphasizes the need to reverse inequalities in access to and retention in educational services, as well as to strengthen the relevance of educational offerings to the needs of communities, with an intercultural and territorial perspective. This trend has led to the establishment of virtual campuses by various higher

education institutions, such as the Open University and Distance Education System (SUAyED) of the Autonomous University of Mexico (UNAM), the Veracruz Virtual University and the Virtual University System of the University of Guadalajara (UDGV), and the Virtual University of the State of Guanajuato (UVEG).

The purpose and objectives of the research

The purpose of this research is to comprehensively explore the integration of generative artificial intelligence into the educational process of a master's program of University of Guanajuato to understand its transformative potential and implications.

To achieve this goal, the following tasks need to be solved:

– creation of educational content in diverse formats, including text, images, videos, tests, quizzes, and assignments;

– implementation of adaptive learning, with personalized content tailored to individual student profiles, habits, and preferences;

– integration of conversational interfaces to foster an engaging and customized learning experience;

– support for teachers in tasks such as assessment and administrative activities, allowing them to focus more on student development;

– analysis of the benefits of generative artificial intelligence for both students (e.g., enhancing curiosity, improving questioning skills, and providing research support) and teachers (e.g., generating materials, facilitating assessment, and saving time), with an emphasis on advantages not offered by traditional systems.

Main part

From online high education paradigm to multimodal education

Online education or e-learning or remote learning is defined as an educational modality based on a technological mediation framework that can be asynchronous or synchronous and is usually include virtual classrooms, online courses, and other learning platforms. Specialized teaching materials are essential; its implementation is systemic, centralized, and long-term; learning is autonomous, individual, and can be personalized; and mastery of information technologies is required. This modality was conceived to expand educational coverage, serving the population of ages not typically eligible for higher education.

During the 2018-2024 period, the Mexican government's higher education policies focused on increasing coverage and equity in access to education. Among other actions to achieve this goal, the development and strengthening of distance learning programs was promoted, particularly by higher education institutions, as a key strategy for expanding access to higher education throughout the country [5].

The need to shift the perspective from implementation information technologies as final goal to use the technology as a medium for developing activities became evident. Therefore, awareness of the concept of educational technology was raised.

This is defined as the way of planning and implementing education, configuring learning processes, their resources, spaces, and times, based on well-defined intentions. This implies a pedagogical reflection on the use of technology. Given this, the paradigm of educational multimodality is presented, a concept that emerges from the study of the educational phenomenon presented by the integration of information technologies through educational technology in a university environment [1]. Its approach implies that the integration of technologies goes beyond isolated modalities, as what is relevant is how they are used in education.

Needs of the educational program *Master of Studies in Digital Education*

Online learning is becoming increasingly widespread in the higher education system, due to that educational organizations are creating a qualitatively different online learning environment – a digital one, that has greater information capabilities but requires more developed competencies in the field of information analysis and communication. The digital educational environment is today considered an important approach to teaching in educational organizations of higher professional education, including in the training of future teachers, since, among other things, it can overcome the limitations associated with training [4]. However, the advantages of information educational environments for future teachers cannot be fully realized if students do not have the necessary level of competencies: knowledge, skills, abilities, value orientations in the field of using information and communication through information technologies.

The *European Commission's Digital Competence Framework for Educators* outlines essential digital competences for educators, presents six main areas [7], ranging from professional communication and the use of digital resources to teaching, assessment, and supporting student learning (Figure 1). It emphasizes the importance of empowering students and facilitating development of their own digital skills.

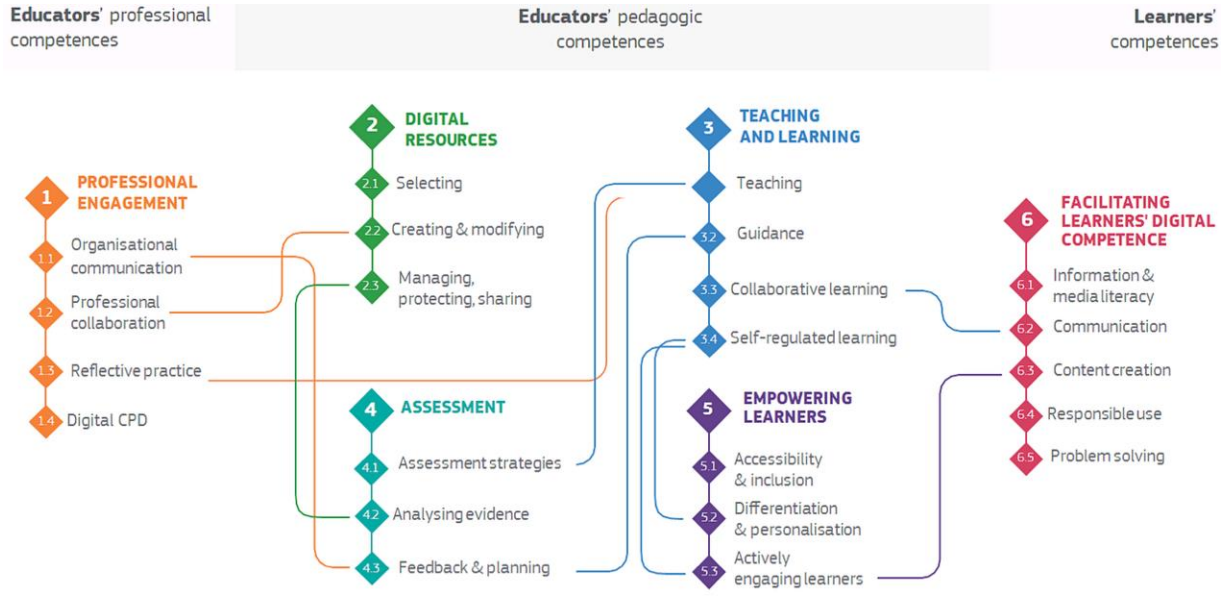

Figure 1 – Digital Competence Framework for Educators, Source: DigCompEdu 2025 https://joint-research-centre.ec.europa.eu/digcompedu

The competency areas are linked to the six proficiency levels used by the *Common European Framework of Reference* ranging from A1 to C2. To encourage educators to use the framework as a professional development tool, the CEFR levels were coupled with motivating role descriptors, from Beginner (A1) to Leader (C2).

The progression follows the logic inherent in each individual competency. It is inspired by Bloom's revised taxonomy that explains the subsequent cognitive stages of learning progress. The six progression levels are described and differentiated below.

1. Beginner (A1) – Newcomer: Beginners are aware of the potential of digital technologies to enhance pedagogical and professional practice but have had very little exposure to them. They primarily use them for lesson preparation, administration, or organizational communication. They need guidance and encouragement to expand their repertoire and apply their existing digital competence in pedagogical settings. This level is largely described by the absence of certain competencies present at higher levels. They are characterized by awareness, uncertainty, and basic use.

2. Explorer (A2) – Explorer: Explorers are aware of the potential of digital technologies and are interested in exploring them to enhance pedagogical and professional practice. They have begun to use digital technologies in some areas of digital competence, but without following a comprehensive or consistent approach. They need encouragement, insight, and inspiration. This level implies having overcome the concerns or doubts present at the Beginner (A1) level. They are characterized by the exploration of digital options/resources/strategies.

3. Integrator (B1) – Integrator: Integrators experiment with digital technologies in a variety of contexts and for a range of purposes, integrating them into many of their practices. They use them creatively to enhance various aspects of their professional engagement and are eager to expand their repertoire. However, they are still working to understand which tools work best in which situations and to adapt digital technologies to pedagogical strategies and methods. They require more time for experimentation and reflection, complemented by collaborative fostering and knowledge sharing. They are characterized by the meaningful expansion/integration/implementation of professional practices and pedagogical strategies.

4. Expert (B2) – Expert: Experts use a range of digital technologies safely, creatively, and critically to enhance their professional activities. They deliberately select digital technologies for particular situations and seek to understand the benefits and drawbacks of different digital strategies. They are curious and open to new ideas, using experimentation to expand, structure, and consolidate their repertoire of strategies. Experts are the backbone of any educational organization when it comes to practice innovation.

5. Pioneer (C1) – Pioneers have a consistent and comprehensive approach to the use of digital technologies to enhance pedagogical and professional practices. They draw on a broad repertoire of digital strategies and know how to choose the most appropriate one for any situation. They continually reflect and further develop their practices, staying up-to-date through exchange with their peers. They are a source of inspiration for others, to whom they share their experience. They are characterized by

the comprehensive and critical discussion and renewal/use of professional practices and pedagogical strategies.

6. Leader (C2) – They are questioning the adequacy of contemporary digital and pedagogical practices, of which they themselves are Leaders. They are concerned about the limitations or disadvantages of these practices and are driven by the impulse to further innovate education. They experiment with highly innovative and complex digital technologies and/or develop novel pedagogical approaches. They are a unique and rare breed that leads innovation and is a role model. They are characterized by the innovation/promotion of the use/use of innovative formats in professional practices and pedagogical strategies.

The aim of the investigation is to design, implement, and evaluate an innovative educational proposal grounded in the integration of artificial intelligence, with the intention of fostering a learning environment that is adaptive, ethically responsible, and centered on the needs and agency of the student. This proposal will enhance the quality and personalization of digital teaching and learning processes and serve as a concrete pathway for the researcher to demonstrate and consolidate the highest level of digital teaching competence, as defined by the *European DigCompEdu framework* – Level C2, or Leader.

The integration of artificial intelligence to raise the level of digital competence

The future of higher education is inextricably linked to the development of new technologies and the computing power of new intelligent machines. In the educational segment, the introduction and application of artificial intelligence opens new opportunities and creates new challenges for teaching and learning in higher education institutions, with the potential for fundamental change in governance and significant changes in the internal architecture of higher education institutions.

The need to prepare specialists in the field of education, capable of productive information activity, creative information exchange, causes significant changes in the process of training future teachers at all its stages. One of the basic changes is the introduction of generative artificial intelligence tools into the process of productive activity of students with the accompanying analysis of the effectiveness of the implementation of the possibilities of its application in teaching various disciplines at different stages and, as a consequence, the adjustment and development of all existing components of the methodological training systems corresponding to these disciplines (Table 1). The methodological components of the possibilities provided by neural networks at the basic stages of teacher training are considered using the example of the curriculum of the master's degree program of the University of Guanajuato.

Table 1 – Master's degree curriculum. Own elaboration.

Area	N	Educational component	Content	Suggested changes
1	2	3	4	5
Education	1	Education in a digital society (7 ECTs) *Theoretical approach*	- Foundations of the Digital Society - A review of learning theories related to Learning 2.0 - Digital capabilities, interactions, and connections - Information, data, and media literacy - Communication, collaboration, and participation - Digital learning and self-development - ICT skills, digital literacies, and competencies - Digital identity and well-being - Criticisms of the digital society and implications for education and learning	Artificial Intelligence Integration can enrich each thematic unit with examples, discussions, and practices focused on AI as a transformative force in digital society and education: - Introduction to the impact of AI on the transformation of digital society - Analysis of how adaptive learning platforms use AI to personalize education (Khan Academy, Duolingo). - Comparison between connectivism approaches and machine learning algorithms. - The use of AI assistants (such as ChatGPT, Copilot, etc.) to expand search, writing, and collaboration capabilities. Critical evaluation: Do these tools expand or limit our cognitive capabilities? - Analysis of AI content generation. AI-generated vs. human-generated content. Discussion of biases in recommendation systems and algorithmic filtering. - Use of AI for online communities: co-writing tools to foster cross-cultural collaboration (AI-assisted Google Docs). - The use of AI as a personal mentor or tutor (e.g., educational platforms that predict student progress). How does or could each student use AI for their professional development? - Basic introduction to generative AI tools: text, images, video – creating educational content with AI (infographics, summaries, mind maps), ethical issues in the use of AI tools. - Analysis of digital identities constructed and manipulated by AI (e.g., TikTok algorithms, Instagram filters). - Digital well-being and the conscious use of AI tools (burnout detection, screen time management). - Open discussions: AI as an opportunity or threat for critical education? Reading and analysis of critical texts on AI in education. - Discussion on the ecological and social impact of the infrastructure behind AI (data centers, data mining, etc.).
	2	Theories of learning and teaching in the digital age (7 ECTs) *Theoretical approach*	- Personal perceptions of learning and teaching - Past and current theories and models of learning and teaching - Theory and research on how students learn - Theory and research on what constitute a "good" teacher - Factors influencing learning and teaching at different stages of education - Current and potential developments to support teaching and learning in educational contexts and environments - Barriers to innovations in education, training, and other potential learning environments - Approaches to establishing and evaluating innovations in learning and teaching - Models of innovation and adoption Technological innovation	Theoretical and critical reflection on the role of emerging technologies in educational processes: - Forum-based reflection: How does AI influence conceptions of the teacher and student roles? - Analysis of how classical theories (behaviorism, constructivism, connectivism) adapt to or are challenged by the use of AI systems. Comparison between traditional pedagogies and emerging AI-mediated proposals (intelligent tutoring, adaptive learning). - Review of studies showing how AI tools can support individualized learning (e.g., adaptive learning algorithms). Case studies: platforms such as Squirrel AI (China) or Century Tech (UK). - Tensions between educational humanism and automation. - Analysis of how AI can impact everything from basic to university education (automatic tutoring, detection of learning difficulties). - Reflection on differences in accessibility and equity. - Practical exploration of AI-based teaching assistants (e.g., pedagogical co-pilots, rubric or questionnaire generation). Introduction to tools such as Eduaide, Notion AI, Diffit, and Consensus. - Critical analysis of the ethical, legal, economic, and pedagogical barriers to AI adoption. Is resistance to AI pedagogical or political? - Development of practical AI intervention projects (proposals for classroom innovation with AI). - Evaluation criteria for the pedagogical quality, ethics, and effectiveness of AI-based interventions. - Application of models such as SAMR, TPACK, and the Rogers model to evaluate the integration of AI into educational processes. - Case studies: success and failure in AI adoption in educational institutions.

Table 1 Continued

1	2	3	4	5
Education	3	Social context of education and lifelong learning (7 ECTs) *Theoretical approach*	- Theories of the sociology of education - The development of educational systems and processes within broader economic, political, social, and cultural contexts - Aspects of inequality, in relation to attainment, access, and progression, examining the role of social class, gender, and race - Evaluate specific policy initiatives, such as those related to lifelong learning, widening participation, curriculum development, and special educational needs, and their impact on practice - Alternative models of education	Analyze how AI is reshaping the social, economic, and political structures that influence lifelong learning. Given the theoretical focus of the course, AI should be approached critically, contextually, and with an emphasis on equity and social justice: - Analysis of how AI fits into critical sociological theories (Bourdieu, Foucault, Freire) regarding social reproduction, control, and power. - AI as an extension of *symbolic violence* or as an opportunity to democratize knowledge. - Does AI reproduce or challenge the dominant educational habitus? - Study of the role of AI in contemporary educational reforms globally (e.g., national AI-powered assessment systems, administrative automation). - Critical reflection on digital colonization and algorithmic imperialism. - Analysis of reports on AI and algorithmic justice (e.g., UNESCO or AI Now Institute). - Critical evaluation of public policies that integrate AI for lifelong learning. - Exploration of unconventional models using AI: self-directed learning with AI, decentralized platforms (blockchain + AI), autonomous learning communities. - Case study: algorithmic discrimination in admissions, tutoring, or performance monitoring processes. - Debate on the potential of AI to sustain or subvert traditional education systems. - Discussion: How can or cannot AI expand the participation of historically marginalized groups? - Inspirations from critical, feminist, or decolonial pedagogies: What would a situated and ethical AI look like?
Educational technology	4	Workshop on digital tools for e-learning (7 ECTs) *Practical approach*	- Digital learning - Digital identity and promotion - Social media and blogging in teaching practice - Technological innovation in education - Gamification - The flipped classroom	This course can become a space where students not only learn how to use tools, but also explore, experiment, and critically reflect on the impact and potential of AI in their own teaching practices: - Use of AI-powered adaptive learning systems (e.g., Squirrel AI, Khanmigo, Century Tech). - Introduction to teaching assistants such as Copilot for Education, Eduaide, and Diffit. Introduction to the AI ecosystem in education (smart tutors, learning analytics). - Activities for designing AI-powered lessons tailored to the student's profile. - Creating educational content - summaries, teaching capsules, multimedia materials, and interactive activities with AI: podcasts, mind maps, videos in Notebook LM. - Generating a social media learning sequence with AI-generated content and reflecting on its limits. Emphasis on truthfulness, copyright, and digital ethics. - Creating custom games or quizzes with AI (e.g., Conker.ai, Quizizz with GPT support). - AI as a generator of interactive narratives or gamified learning scenarios. - Designing a gamified experience with the help of AI to increase motivation or adaptability. - Designing a flipped learning unit with AI as a teacher and student assistant. - Case study: Use of AI in inclusive education or addressing diversity.
	5	Future of Digital Education (7 ECTs) *Theoretical approach*	- Emerging trends in digital education - Online education as an innovative practice - Design and implement educational innovations - Evaluate the effectiveness of innovations - Barriers to change for individuals and institutions	- Generative artificial intelligence (such as ChatGPT, Claude, DALL·E) in teaching and learning. - AI-based EdTech: adaptive learning, predictive analytics, educational chatbots. - Simulation of virtual assistants in LMSs (e.g., ChatGPT as an automated tutor or corrector). - Co-creation of educational activities using tools such as ChatGPT, Perplexity, etc. - Use of AI to analyze learning data (learning analytics). - Automated assessment vs. human assessment: complement or replacement? - Digital competencies and technological resistance. - Ethical concerns: surveillance, teacher substitution, intellectual property.

Table 1 Continued

1	2	3	4	5
E-learning	6	Workshop for the creation of educational content for digital education (7 ECTs) *Practical approach*	- Rationale and context of the learning experience - Analysis of the learning experience and teaching strategies - Alignment of the learning experience Learning - Instructional Design for Creating Learning Content - Creating Learning Content for the Learning Experience - Evaluating the Learning Experience	- Generation of simulated educational scenarios with AI. - Support in drafting the conceptual framework using tools such as ChatGPT or Notion AI. - Digital learning models (blended, flipped, microlearning, etc.). - User profiles and personalized learning paths. - Simulation of adaptive learning scenarios.Case analysis and strategy design using AI-supported mind maps or journey maps (e.g., Miro + ChatGPT). - Learning taxonomies (Bloom, SOLO). - Assistance in drafting learning objectives. Analysis of coherence between objectives, activities, and assessments using AI tools. - Pedagogical alignment matrix generated and justified by the team. - Co-creation of storyboards using tools such as Canva Docs AI or Gamma. - Suggestion of teaching sequences by AI based on content type. Production of digital resources aligned with the experience. Content types: infographics, videos, simulations, podcasts, interactive texts. - Image generation (DALL·E, Midjourney). - Educational text writing (ChatGPT). - AI-powered narration or voice generation (Notebook LM). - Interactive activity design (H5P or Genially). - AI-powered feedback analysis (e.g., survey analysis). - Automatic generation of assessment items. - Simulation of content piloting with fictitious students and automatic feedback.
	7	Mentoring and tutoring with technology integration (7 ECTs) *Theoretical approach*	- Theoretical Perspectives Applied to Mentoring and Coaching - Learning Within a Workplace Community of Practice - Models for Teaching Skills Development with an Emphasis on Integrating Digital Tools for Mentoring and Coaching - Developing Reflective Practice - Intervention Styles - Current Frameworks for Mentoring and Coaching Practices - Peer Mentoring - Research on Mentoring and Coaching in National and International Contexts	To integrate AI from a theoretical perspective, it is essential to conceive of AI not only as a technological tool, but as a mediating agent in the processes of accompaniment, feedback, personalization, and reflection: - Explore contemporary theories on AI-augmented mentoring. - Incorporate theoretical frameworks such as Human-AI Collaboration in education and technologically mediated mentoring. - Analyze how AI-enabled platforms (such as MS Viva, LinkedIn Learning with AI, or adaptive LMS platforms) can support communities of professional practice. - Study the automation of informal knowledge flows through AI. Incorporate notions of *augmented mentoring* and *algorithmic mediation*. - Evaluate teaching competency development models with AI support: pedagogical co-pilots, instructional planning assistants, feedback generators. - Map emerging models such as "AI-supported mentorship" or "scaffolded coaching with AI." - Introduce AI tools that foster guided professional reflection (e.g., ChatGPT as a reflective journal with critical prompts). - Reflect on the limits and possibilities of the "virtual coach" versus the human mentor. - Study AI-mediated intervention styles: automated feedback, needs prediction, responsive interventions. - Analyze algorithmic biases and their impact on mentoring equity. - Review international frameworks that already include AI in mentoring (e.g., ISTE Standards for Coaches, OECD reports). - Explore automated and AI-mediated peer feedback platforms (Peergrade, EliReview, WISEfeedback). - Analyze how AI can facilitate peer-to-peer matches based on identified needs. - Explore the transformative potential, ethical challenges, and emerging models of AI-augmented mentoring and tutoring, fostering a critical understanding of its use in educational and professional contexts.

Table 1 Continued

1	2	3	4	5
E-learning	8	Learning Management Systems Workshop (7 ECTs) *Practical approach*	- What is Moodle? - Basic Moodle Structure - Organizing Courses - Customizing Courses - Publishing Teaching Materials - Publishing and Managing Activities - Grading a Course - Facilitator Tools	To incorporate AI with a practical approach focused on Moodle, it is suggested a strategy divided by topics that adds intelligent functionalities, improves the teacher-student experience and encourages critical thinking about the use of AI in educational platforms: - Present Moodle as an LMS capable of integrating AI-based tools (e.g., conversational assistants, predictive analytics, content personalization). - Introduce basic concepts of AI applied to e-learning. - Analyze how a modular architecture allows for the integration of external AI tools through LTI or APIs. - Explore the data flows needed for learning analytics. - Use generative AI to write descriptions, module topics, and personalized learning objectives (e.g., using integrated ChatGPT or Eduaide). - Explore systems that automatically adjust navigation or materials based on learner performance. - Include videos with AI-generated automatic captions, automatic summaries, or AI-generated multilingual content. - Automate quiz creation with AI tools (e.g., generating questions from readings). - OpenAI GPT Blocks for Moodle, WiseFeedback, Snorkel AI for automatic labeling. - Analyze AI tools that assist with automated grading (smart rubrics, AI essay grading). - Apply predictive analytics to identify at-risk students. - Monitor student progress through AI-based dashboards (early alerts, engagement analysis, etc.).
Educational investigation	9	Research methods of digital teaching and learning (7 ECTs) *Theoretical approach*	- Research in Education - Research Problems and Questions - Research Designs such as Surveys, Experiments, Ethnography, Phenomenology, and Case Studies - Systematic Reviews and Secondary Data Analysis - Research Methods such as Questionnaires, Interviews, Observations, and Document Analysis - Using Mixed Methods (Designs) - Quantitative Data Analysis Methods (such as Descriptive and Inferential Statistics) - Qualitative Data Analysis Methods (such as Content Analysis, Thematic Analysis, and Grounded Theory)	- AI as an object and means of research: include current cases where AI is studied in educational contexts. - Critical analysis of articles investigating the use of generative AI in learning. - Generative AI as an assistant for formulating research problems: Use of tools such as ChatGPT or Elicit to generate, refine, and discuss research questions. - Simulation with AI: Use of models to predict experimental design outcomes. - AI in systematic reviews: Use of tools such as Elicit, Research Rabbit, or Connected Papers to support searches, data extraction, and synthesis. - AI-assisted analysis of documents and observations using semantic AI (e.g., Quirkos or Atlas.ti with AI). - AI to integrate and visualize mixed data: AI tools for merging qualitative and quantitative results (such as Tableau with AI or PowerBI). - AI for automated statistical analysis: Use of Python notebooks and libraries such as scikit-learn to perform inferential analysis and predictive modeling. - Automating analysis with AI-guided scripts (e.g., using GPT to generate code in R or Python based on the study design). - AI in qualitative analysis: Automatic topic classification (topic modeling with AI). Support for open coding with generative AI. Recommended tools: Dovetail, NVivo with AI, ChatGPT for emerging category suggestions. - Ethical and critical cross-cutting dimension: reliability of AI-generated results, transparency and algorithmic biases, privacy in the use of AI on sensitive data.

Table 1 Continued

1	2	3	4	5
Educational investigation	10	Integrative project for graduation (7 ECTs) *Practical approach*	- Strategies for Focusing and Managing the Research Process - Quantitative and Qualitative Research Methodologies and Approaches - Key Data Collection Methods (Surveys, Interviews, Focus Groups, Observation) - Methods of Data Analysis Data interpretation - Writing and presentation skills for the integrative project for graduation	The integrated graduation project represents an opportunity for students to demonstrate their ability to articulate theory, practice, innovation, and critical thinking regarding the use of emerging technologies. Integrating artificial intelligence as a core project allows for addressing contemporary challenges and opportunities in teaching and learning in digital environments: 1. Instructional Design with AI. Approach: Development and analysis of personalized digital learning experiences using AI tools. Components: a. Theoretical framework: instructional design, adaptive learning, educational UX. b. Tools: ChatGPT, Khanmigo, Conker, Diffit, Magicschool.ai. c. Assessment: Analysis of engagement, comprehension, or feedback. 2. Teacher Training in the Ethical and Creative Use of AI. Approach: Development of critical, ethical, and technical competencies for educators in digital contexts. Components: a. Theoretical framework: critical digital literacy, ethics of AI use, ongoing training. b. Product: Course, MOOC, workshop, methodological guide. c. Assessment: Test of perception and appropriation. 3. AI and Equity in Digital Learning Environments. Approach: Analysis of how AI can contribute to (or affect) equity, inclusion, and educational justice. Components: Theoretical framework: sociology of education, digital justice, accessibility. Methodology: case study, digital ethnography, comparative analysis. Ethical approach: data protection, inclusive design. 4. AI as a learning mediator in digital communities. Approach: Use of AI to strengthen collaborative and community learning in digital environments. Components: a. Theoretical framework: situated learning, connectivism, collaborative learning. b. Tools: AI integrated into LMS or forums, virtual assistants. c. Assessment: participation, knowledge construction, interactions. 5. Automated Assessment and Formative Feedback with AI. Approach: Designing personalized feedback systems with AI to improve online learning. Components: a. Theoretical framework: formative assessment, effective feedback, personalized education. b. Tools: Turnitin Feedback Studio, Grammarly, Quillionz, Writefull, ChatGPT with rubrics. c. Analysis: impact on autonomous learning or academic writing.

Artificial intelligence, when thoughtfully incorporated into educational processes, becomes a high-impact training tool for strengthening digital competence. First, it promotes deeper learning of emerging technologies by exposing students to language processing systems, data analysis, task automation, and adaptive platforms. This allows them to move from basic use of digital tools to advanced, strategic, and contextualized management, as established by the European Digital Competence Framework [7].

Furthermore, AI stimulates the development of higher cognitive skills, such as the critical evaluation of information generated by algorithms, complex problem-

solving, and the ability to design data-driven educational solutions. These skills are essential in a constantly evolving digital environment.

AI also fosters self-regulation of learning and metacognition, as it allows for the design of personalized learning paths that adapt to each student's pace and style. This type of experience enhances the autonomous and ethical dimension of digital competence, requiring users to make informed and responsible decisions about their use of technologies. Integrating AI into teaching and instructional design elevates teachers' digital competence by requiring a more sophisticated command of virtual environments, learning data management, assessment automation, and pedagogical mediation with intelligent agents.

Finally, the use of AI requires addressing the ethical, social, and cultural aspects of the digital environment, which adds a layer of critical and civic depth to digital competence [6]. Understanding algorithmic biases, the risks of misinformation, and data policies becomes part of the knowledge necessary to fully exercise digital citizenship.

By implementing these recommendations, the *Master's in Digital Education* has the potential to become a benchmark program in Guanajuato, significantly contributing to teacher professionalization and improving educational quality in the digital age. The systematic and critical integration of artificial intelligence into *master's program* represents an epistemological evolution in the way we conceive teaching, learning, and research. Preparing professionals capable of leveraging these technologies ethically, creatively, and effectively becomes fundamental to the challenges of postgraduate education.

Conclusions

Artificial intelligence, when properly understood and implemented, is not a goal, but rather a cross-cutting tool that accelerates and deepens the development of digital competence at the graduate level. This research provides possible integration of artificial intelligence in *Master's program in Digital Education* that represents a transformative force that significantly enhances the development of digital competence. AI acts as a catalyst that expands the cognitive, pedagogical, and ethical dimensions of what it means to be digitally competent in the 21st century. Through adaptive learning systems, intelligent feedback, and data-driven personalization, AI enables more nuanced and responsive learning experiences, supporting both learner autonomy and inclusive teaching practices. Moreover, the use of AI in research processes – from literature synthesis to qualitative and quantitative data analysis – equips students with advanced analytical skills that are increasingly essential in digital academic environments. By engaging critically with AI technologies, students cultivate not only technical fluency but also reflective awareness of the cultural, and social implications of algorithmic systems in education. This fosters a deeper understanding of digital identity, privacy, and responsible technology use, which are core aspects of digital competence. As such, the thoughtful incorporation of AI across the curriculum

not only prepares graduates to operate in technologically mediated environments but also empowers them to lead innovation in digital education through informed, critical, and ethical practice. AI thus becomes both a subject of study and a medium for cultivating lifelong learning, creativity, and professional resilience in a rapidly evolving digital society.

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