AUSBD, 2024; "Yapay Zeka ve Sosyal Bilimler Öğretim" Özel Sayısı
(Artificial Intelligence and Social Sciences Teaching" Special Issue), 34-51 Araştırma Makale
Research Artical

e-ISSN: 2651-3064

AI INTEGRATED LEARNING FOR HIGHER EDUCATION SOCIALSCIENCE EDUCATORS

António SILVA-PINA[*]*,Claudia Lomba VIANA*[*]*,Francisca Gonçalves PRAZERES*[*]*,Judith Onyeka OHANMA*[*]*,Henrique Grossmann Gonçalves PEREIRA*[*]

Abstract

This article examines the application of artificial intelligence (AI) in higher education (HE), focusing on the social sciences within the EduAI project. It begins with an overview of AI's global use in education, outlining the EduAI project's objectives and key themes. A comprehensive literature reviewcovers meta-analyses, reports, and studies on AI implementation in HE, conducted by global organizations. The study emphasizes five critical areas: integrating AI learning in HE, addressing challenges and opportunities; ethical considerations and digital literacy; enhancing student engagement through AI; pioneering tech-driven approaches to acquire essential skills; and developing an AI- integrated pedagogical competencies scale, which are central to advancing the EduAI project.

Through analyzing the gathered information, the article provides a critical perspective on AI's role in HE. The conclusion summarizes the current application of AI in the social sciences and offers recommendations for future research, particularly in the EduAI project's context.

Keywords – AI, Social Sciences, Ethics, Competences Scale, EduAI

YÜKSEKÖĞRETİM SOSYAL BİLİMLER EĞİTİMCİLERİ İÇİN AI ENTEGRE ÖĞRENME

Özet

Bu makale, EduAI projesi kapsamında sosyal bilimlere odaklanarak yapay zekanın (AI) yüksek öğretimde (HE) uygulanmasını incelemektedir. EduAI projesinin hedeflerini ve ana temalarını özetleyen yapay zekanın eğitimde küresel kullanımına genel bir bakışla başlıyor. Kapsamlı bir literatür taraması, küresel kuruluşlar tarafından yürütülen yükseköğretimde yapay zeka uygulamasına ilişkin meta-analizleri, raporları ve çalışmaları kapsamaktadır. Çalışma beş kritik alanı vurguluyor: Yapay zeka öğreniminin yüksek öğretime entegre edilmesi, zorlukların ve fırsatların ele alınması; etik hususlar ve dijital okuryazarlık; yapay zeka yoluyla öğrenci katılımının arttırılması; temel becerilerin kazanılmasına yönelik teknoloji odaklı öncü yaklaşımlar; ve EduAI projesinin ilerletilmesinde merkezi

[*] PhD in Business Management and Sociology with Specialisation in Tourism Marketing from the University of Extremadura, silva.pina@aidlearn.pt , ORCID: 0000-0002-9533-4446

[*] Master's in Psychology in Business Economics from Universidade Católica Portuguesa (Portugal), claudia.viana@aidlearn.pt, ORCID

[*] Master's in Communication, Culture, and Information Technology from University Institute of Lisbon, ISCTE-IUL (Portugal), francisca.prazeres@aidlearn.pt, ORCID: 0009-0004-2324-3993

[*] Master's in Psychology in Business and Economics from Universidade Católica Portuguesa (Portugal), judith.ohanma@aidlearn.pt, ORCID: 0009-0004-8661-7948

[*] Master's in Psychology in business and Economics from Universidade Católica Portuguesa (Portugal), henrique.pereira@aidlearn.pt

Başvuru/Submitted: 07.08.2024 Kabul/Accepted: 23.10.2024

öneme sahip olan yapay zeka ile entegre bir pedagojik yeterlilikler ölçeğinin geliştirilmesi.

Makale, toplanan bilgileri analiz ederek yapay zekanın yüksek öğretimdeki rolüne dair eleştirel bir bakış açısı sunuyor. Sonuç bölümünde yapay zekanın sosyal bilimlerdeki mevcut uygulaması özetlenmekte ve özellikle EduAI projesi bağlamında gelecekteki araştırmalar için öneriler sunulmaktadır

Anahtar Kelimeler- Yapay Zeka, Sosyal Bilimler, Etik, Yetkinlikler Ölçeği,

Introduction

The evolution of Artificial Intelligence (AI) has catalyzed significant transformations across various fields, including education. As noted by Kayyali (2024), we are at the cusp of a groundbreaking convergence of technology and education, with AI serving as a pivotal force in this transformation. This convergence promises to reshape the educational landscape, ushering in a new era characterized by unprecedented opportunities and challenges for both educators and students.

Recent years have witnessed a rapid expansion of AI in higher education (HE), particularly with the proliferation of new AI tools. Crompton & Burke (2023) highlight that the last five years have seen substantial growth in the integration of AI into classrooms, curriculum development, and learning management systems. This trend signifies a systemic shift from traditional educational paradigms towards more technology-driven approaches (Kayyali, 2024).

The burgeoning interest in AI education (AIEd) has spurred extensive academic research into AI's role in educational settings. The concept of AI, rooted in the early work of McCarthy in 1956 and Turing in the mid-20th century, has evolved significantly. Popenici et al. (2017) defined AI as "computer systems capable of engaging in human-like processes such as learning, adaptation, synthesis, self-correction, and data processing for complex tasks" (p.2). This definition underscores the potential of AI to revolutionize educational methodologies by automating and enhancing various cognitive processes.

Systematic literature reviews on AI applications in HE reveal a focused yet fragmented research landscape. Studies have predominantly concentrated on specific disciplines, such as engineering(Shukla et al., 2019), language teaching (Liang et al., 2021), mathematics (Hwang & Tu, 2021), and medical education (Winkler-Scwartz et al., 2019). However, the comprehensive study by Ouyang et al.(2022) broadened the scope to encompass a wider range of applications within HE from 2011 to 2020.

In the social sciences, AI's presence is increasingly acknowledged, particularly for its potential to analyze vast datasets, predict trends, and provide personalized learning experiences. However, the effective integration of AI requires educators to be mindful of ethical considerations, ensuring that AI supplements rather than supplants the human aspects of teaching and learning. AI tools like chatbots can enhance student engagement by offering immediate feedback and facilitating interactive learning experiences (Kuka, Hörmann, & Sabitzer, 2022).

Public policy also plays a crucial role in shaping the use of AI in education. Major countries have developed strategic frameworks to guide AI implementation across various educational levels. The OECD's "Digital Education Outlook 2023" highlights emerging governance models for generative AI in education, noting that only a few countries, such as France and Korea, have specific regulations in place. In contrast, many countries have issued guidelines, while others have delegated responsibility to individual schools (OECD-Ilibrary, 2024). The European Union's recent approval of the Final Draft of the Artificial Intelligence Act and the UK's AI Safety Summit further emphasize the growing importance of AI regulation in education.

The EduAI project aims to bridge the gap in AI application within the social sciences by providing educators with the necessary digital skills and innovative teaching methodologies. This project focuses on digital readiness, teaching and learning methods, and knowledge sharing across educational sectors. The goal is to develop an AI-integrated learning framework that addresses the challenges, opportunities, and essential needs associated with incorporating AI into HE in the social

sciences.

This framework will be built upon a comprehensive literature review, identifying pioneering technology-driven approaches and the integrated pedagogical competencies required for AI implementation. The study will critically analyze existing research, pinpoint gaps, and offer recommendations to help educators harness AI's transformative potential. The key topics include:

1. **Integrating AI Learning in Higher Education: Challenges, Opportunities, and ImperativeNeeds** - This explores the practical and theoretical challenges of AI integration, including curriculum development, faculty training, and resource allocation.
2. **Ethical Considerations and Digital Literacy** - This addresses the ethical implications of AI use, focusing on issues like data privacy, algorithmic bias, and the importance of digital literacyamong educators and students.
3. **Enhancing Student Engagement with AI** - This examines how AI can be used to boost student engagement through personalized learning experiences, adaptive learning platforms, and AI-driven feedback mechanisms.
4. **Pioneer Tech-Driven Approaches: Most Relevant Knowledge and Skills** - This identifies key technological competencies required for effective AI integration, including the use of AI tools for data analysis, trend prediction, and personalized instruction.
5. **AI-Integrated Pedagogical Competencies Scale** - This proposes a framework for assessing the pedagogical competencies necessary for effectively using AI in teaching, drawing on models like TPACK and AI-TPACK.

The first phase of this work involves a thorough literature review, emphasizing recent studies due to therapidly evolving nature of AI research. Subsequent stages will develop the identified topics, culminating in actionable recommendations and conclusions. Special emphasis will be placed on identifying pioneering practices in AI application within HE, particularly within the social sciences, and the competencies required for effective implementation. The EduAI project aims to provide a comprehensive guide for educators to navigate the complexities and harness the opportunities presentedby AI in the evolving educational landscape.

Literature Review

In recent years, a comprehensive survey of trends in higher education (HE) research focusing on the use of AI in education (AIEd) was conducted, analyzing 371 articles published between 2016 and 2022. This timeframe was chosen to ensure that the research reflected the most current technological advancements. The study by Crompton & Burke (2023) utilized a Boolean research methodology, which resulted in the selection of 138 articles after filtering out duplicates and irrelevant content. These articles covered research from 31 countries across six continents, with a significant concentration in Asia (41%), particularly in Taiwan (12 studies) and China (30 studies). Europe accounted for 30% of the research, with notable contributions from Türkiye (8 studies), while North America, specifically the USA, represented 21% with 21 of the 29 studies. Africa and South America had minimal representation,comprising 2% and 1% respectively.

The survey highlighted that the most substantial growth in AI-related HE publications occurred in 2019and 2020, a period coinciding with increased academic research activity during the COVID-19pandemic. The faculties of education (28%) and computer science (20%) were the most prolific in producing research. The primary subject domains included language learning (17%), computer science (16%), and engineering (12%). The user focus of these AI applications predominantly centered on students (72%), followed by teachers (17%) and HE institution managers (11%).

Crompton & Burke (2023) identified five main domains in the use of AI in HE: assessment, prediction, AI-assisted learning, intelligent tutoring systems, and student learning management systems. Their findings were consistent with other systematic reviews, such as those by Zawacki-Richter et al. (2019)and Chu et al. (2022), which corroborated the trends observed by Crompton & Burke despite coveringdifferent periods.

The EDUCAUSE 2023 Horizon Report highlighted the transformative potential of ChatGPT and other generative AI tools in HE. These technologies offer new opportunities in content creation, communication, and learning, but also raise concerns about potential misuse and over-reliance on technology. The report presents a dichotomy in educational practices, oscillating between leveraging advanced technological capabilities and preserving the human elements of education.

Key technologies and practices identified as pivotal for the future of post-secondary education include AI-based applications for predictive and personalized learning, generative AI, HyFlex learning models, micro-credentials, and fostering a sense of belonging among students. Generative AI, in particular, is noted for its ability to create new content such as images, videos, text, and audio using machine learning algorithms. The HyFlex model allows students the flexibility to participate in courses either in-person or online, synchronously or asynchronously, according to their preferences.

The EDUCAUSE (2023) report outlines four potential future scenarios at the intersection of social, technological, economic, environmental, and political trends:

1. **Growth**: The pandemic has highlighted the importance of remote learning, but the digital transition has exacerbated the digital divide among students.
2. **Limitations**: Climate change is anticipated to cause significant population movements by 2033, necessitating flexible hybrid and HyFlex learning options that include personalized and inter- institutional learning paths to accommodate diverse student needs.
3. **Constraint**: The "Enrolment Cliff" of 2025 refers to the expected sharp decline in the university-age population due to the low birth rates during the Great Recession of 2008-2009. This demographic shift is expected to reduce the number of 18-year-olds by 15% over the subsequent four years.
4. **Transformation**: Emerging AI tools will enable educators to allocate more time to engage withstudents individually, fostering a sense of community and belonging within institutions.

Chaushi, Ismaili, & Chaushi (2024) provide a balanced view on the advantages and disadvantages of AI in HE. They highlight AI's potential to facilitate personalized learning tailored to individual studentneeds and preferences. For educators, AI can streamline routine tasks, enhance efficiency, and enable the creation of virtual simulations and intelligent tutoring systems. However, they also caution againstthe ethical challenges, data privacy concerns, over-reliance on technology, and the potential erosion of critical thinking skills. Additionally, they warn about the risk of widening the digital divide, which could exacerbate educational inequalities.

The authors conclude by advocating for a balanced approach that integrates digital and interpersonal skills, ensuring that technology enhances rather than detracts from the educational experience. This balanced approach is crucial for navigating the complexities of integrating AI into education, where the benefits must be weighed against the ethical and practical challenges. The findings emphasize the needfor ongoing dialogue and research to fully understand and optimize the role of AI in HE.

Key Topics

Integration of AI Learning into Higher Education: Challenges, Opportunities, and Imperative Needs

The rapid and ongoing evolution of artificial intelligence (AI) presents both significant challenges andopportunities for integration into higher education (HE). Advances in AI, such as the development of multimodal content generation tools like ChatGPT-4, have demonstrated potential improvements in efficiency and productivity. However, the integration of AI-generated academic content, including articles, course materials, and lesson plans, disrupts traditional academic training methods. Despite these advances, AI remains limited in its ability to perform complex metacognitive activities essential for academic writing (Abdous, 2023).

A comprehensive, holistic approach that incorporates education, planning, and research is necessary toeffectively integrate AI in HE. University administrators and educators must carefully evaluate the promises and limitations of AI technologies. Ethical governance frameworks, such as the Rome Call for AI Ethics and the Data Ethics Decision Aid (2023), are crucial in guiding the responsible use of AI. Furthermore, a cross-curricular strategy should be employed to ensure that AI applications and competencies are integrated across all disciplines, emphasizing a transdisciplinary approach. It is imperative that universities also address the social, ethical, and pedagogical challenges associated with AI, engaging experts from the social sciences and humanities to provide a well-rounded perspective.

In the "AI Landscape Study" conducted by EDUCAUSE in February 2024, a survey of 910 HE professionals revealed broad recognition of AI as an emerging technology that should be incorporated into curricula with a focus on implementation, adoption, research, and ethical considerations (EDUCAUSE, 2023). However, the study also highlighted a significant gap in resources and knowledge, indicating that many institutions are not fully equipped to address AI literacy among facultyand staff.

Microsoft Research (MSR, 2019) predicts that AI will become an integral component of all HE aspects.A survey conducted by MSR, in collaboration with Times Higher Education, involving 100 global university leaders, identified several key points:

- Only a minority of universities currently have a comprehensive AI strategy, though many planto develop one.
- Universities face challenges in recruiting and retaining qualified staff for AI teaching andresearch.
- AI is expected to increase employer demand for university graduates and will not lead touniversity closures.
- AI technologies can enhance student assessment, feedback, and the generation of scientifichypotheses.

The European Community's AI Watch Index (2021) provides an analysis of AI in HE, highlighting disparities in AI education across EU member states. The report noted a strong position for the EU in public and private investment in robotics and automation but recognized the need to catch up with the USA and China in AI development. The data also revealed inequalities in AI education access, with a higher prevalence of AI courses at the master's level compared to undergraduate or vocational training,affecting employability and applicability across member states (European Commission - JRC, 2022).

According to the OECD (2024), the nature of employment is undergoing profound changes globally, with AI poised to transform 500 million service jobs within the next five years. This transformation necessitates a reevaluation of HE curricula to include AI courses and personalized learning paths. Thistransformation necessitates a reevaluation of HE curricula to include AI courses and personalized learning paths, incorporating training in ethics, philosophy, critical thinking, entrepreneurship, and emotional intelligence. These skills are essential for preparing students to navigate complex decision- making processes in an AI-driven job market.

The Boston Consulting Group (2021) emphasized the urgency of updating education systems to align with the advancements in AI. Their analysis suggests that countries that proactively integrate AI into their education systems can attract significant investment, gaining competitive advantages over those that do not (BCG-Boston Consulting Group, 2021).

In summary, AI is set to become increasingly integral to all areas of higher education, necessitating a comprehensive adaptation by institutions. This includes addressing AI literacy among educators and students, investing in necessary infrastructure, and establishing robust legal and ethical standards to safeguard the academic environment. As the landscape of higher education evolves with AI, it is crucial for institutions to stay ahead of these changes to ensure they provide relevant and effective education in this new digital age.

Ethical Considerations and Digital Literacy

In the modern digital era, the integration of artificial intelligence (AI) and digital learning tools in highereducation is becoming increasingly prevalent. These technologies offer numerous benefits, such as the ability to adapt to students' individual needs, enhance digital skill development, and improve engagement through interactive digital tools. Moreover, digital learning provides broader accessibilityto educational resources, making learning opportunities more inclusive.

Digital literacy is a critical skill set that enables students to navigate the digital and virtual landscapes of educational materials effectively. This encompasses data literacy, where students learn to interpret and analyze data, and media literacy, which involves decoding media messages and identifying biases to make informed decisions. Additionally, developing data literacy fosters cybersecurity awareness, helping students understand potential threats like social engineering and promoting safe and ethical digital practices (Pisica et al., 2023). However, as Pisica and colleagues note, the rise of digital learning also raises concerns regarding data protection, storage security, and confidentiality in virtual environments.

The increasing use of AI in educational tools highlights the importance of ensuring equitable and fair access to these technologies. Lossec and Miller (2021) emphasize the need for digital competencies andskills to be on par with the requirements for using AI and digital tools effectively in education. This competency is crucial for educators to assess the implications of datafication processes and advocate for transparency and accountability in their implementation.

The ethical considerations surrounding AI in higher education are becoming a critical topic of discussion. Concerns include data privacy, surveillance, security, bias and discrimination, autonomy, ethical operations, and accountability for AI's actions (Akgun & Greenhow, 2022; Pisica et al., 2023; Ungerer & Slade, 2022; Remian, 2019). These issues reflect the broad spectrum of ethical challenges that arise with the use of AI and digital learning technologies in educational settings.

Data privacy is one of the most significant ethical concerns in the context of AI and virtual environments in the 21st century. The pervasive nature of digital platforms has led to a normalization of automatic consent, often resulting in complacency regarding personal data privacy. In higher education, students' privacy can be particularly vulnerable to exploitation through data collection methods, such as facial recognition technologies. This also affects students' autonomy, especially when predictive systems govern their educational experiences (Akgun & Greenhow, 2022). Ungerer and Slade (2022) further emphasize the need to consider AI's impact on fundamental human rights, including autonomy, data privacy, informed consent, and the risk of digital exclusion. These concerns underscore the necessity for ethical guidance in higher education, particularly regarding the monitoring and prediction of studentperformance.

The potential for students to misuse highly accurate AI software for academic dishonesty is another ethical issue (Pisica et al., 2023). Such practices not only compromise the integrity of assessments but also hinder students' skill development and understanding, as they may not engage fully with the learning process. The reliance on AI-generated knowledge and information can lead to the dissemination of inaccurate or outdated content, which undermines educational goals (Remian, 2019). Furthermore, the biases inherent in AI algorithms, often reflecting historical and societal prejudices, can perpetuate existing inequalities. This biased information can shape social and cultural values in ways that reinforce stereotypes and exclude marginalized groups.

To address these ethical concerns, there is a growing consensus on the need for comprehensive instructional materials for both students and educators. These materials should cover topics such as AIethics, data privacy, and the ethical implications of AI interactions (Akgun & Greenhow, 2022). Educational institutions must ensure that any factual data provided by AI is verified and authenticated to prevent the spread of misinformation. Protecting student privacy is paramount and begins with implementing robust data protection measures and safeguards against unauthorized access to personal information (Zaman, 2023).

Initiatives like the Rome Call for AI Ethics, supported by the Renaissance Foundation, advocate for ethical approaches in the development and application of AI. The initiative outlines six

core principles of AI ethics: transparency, equal inclusion, accountability, impartiality, reliability, and security and privacy. These principles are crucial in promoting ethical standards across international organizations, governments, educational institutions, and the private sector (RenAIssance Foundation, 2023). The goal is to foster a collective sense of responsibility in the advancement of digital technologies, ensuring that AI development prioritizes ethical considerations, safeguards against potential harms, and fosters inclusivity and fairness.

UNESCO (2021) has also provided comprehensive ethical guidelines for member states, emphasizing the need for accessible AI literacy education to bridge the digital divide and address inequalities. This includes promoting prerequisite skills for AI education in regions with notable educational gaps and encouraging the development of AI ethics curricula that incorporate humanistic and social perspectives. UNESCO recommends that future AI developments be based on rigorous research and data-driven approaches to mitigate risks and maximize benefits (UNESCO, 2021). These recommendations highlight the increasing importance of prioritizing AI literacy and the ethical standards necessary for integrating AI into educational systems. Adhering to these guidelines will help ensure fairness and safety in AI implementation, while also addressing the associated ethical challenges.

Enhancing Student Engagement with AI

The integration of technology into education has been a growing focus, especially with the emergence of artificial intelligence (AI) technologies that offer innovative ways to enhance the educational experience. The COVID-19 pandemic accelerated the adoption of digital resources, shifting traditional teaching methods to new, technology-driven approaches (Almusaed et al., 2023). This shift underscores the potential of AI to significantly improve student engagement and learning outcomes.

One of the primary benefits of AI in education is its ability to provide personalized learning experiences. AI technologies can tailor educational content and activities to individual students' learning styles, preferences, and performance levels. Tools such as chatbots and virtual assistants facilitate interactive learning by answering questions, providing feedback, and guiding students through course materials. These technologies make learning more engaging and accessible, particularly in remote or hybrid learning environments.

Student engagement, a critical component of effective learning, can be greatly enhanced through AI. By analyzing student data, AI can help educators identify participation patterns and create personalized lesson plans that address each student's strengths and weaknesses. This data-driven approach allows for more targeted teaching strategies, fostering greater student involvement and improving educational outcomes (Campbell, 2023).

However, to effectively leverage AI in the classroom, educators must first acquire a solid understanding of basic AI concepts such as machine learning, algorithms, and large language models. This foundational knowledge enables teachers to make informed decisions about selecting the most appropriate AI tools and activities for their students (Alam, 2023). Educators should consider a variety

of AI tools, such as ChatGPT for generating text, or AI-powered imaging tools like Midjourney and Stable Diffusion, which can enhance visual learning experiences.

Harvard Business Publishing's Education (H.B.P., 2024) highlights several key advantages of AI in education, including the provision of immediate feedback. This instant feedback mechanism keeps students motivated and engaged by offering timely assessments of their work, thereby fostering a sense of achievement.

To maximize the benefits of AI in education, it is essential to clearly define the learning objectives at the outset. Identifying areas where AI can enhance learning, such as data analysis, problem-solving, and creative thinking, ensures that AI activities are aligned with educational goals. The aim of generative AI should be to support and enhance productivity, not to replace the core efforts of student learning.

Selecting AI activities that are appropriate to the curriculum and promote active learning is crucial. For instance, students can use platforms like ChatGPT to create chatbots, exploring natural language processing and coding in the process. Similarly, tools like Midjourney can be used for creative projectsthat involve image creation and enhancement.

Discussing the ethical implications of AI with students is also vital. Students should be made aware ofpotential issues such as "AI hallucinations" and encouraged to critically evaluate AI-generated content.Educators should guide students in using generative AI as a starting point for projects, while ensuring that the final outputs are their own original work.

Encouraging exploration and experimentation with AI technologies through practical activities, research projects, and presentations fosters curiosity, creativity, and problem-solving skills. Group projects that require collaboration on AI-based solutions further develop teamwork, communication, and critical thinking abilities. Resources like Ben's Bites provide valuable daily updates on new tools and technologies, helping educators and students stay informed.

Personalized support and guidance are essential as students navigate AI tools. Educators should provideassistance in understanding algorithms and interpreting results, creating a supportive environment where students feel confident experimenting and developing their AI skills.

As for successful examples of the practical application of AI in social sciences and humanities courses, in sociology and in terms of analysing social networks to understand the impact of AI on political communication on public opinion, researchers at the University of South Carolina studied Twitter (X) data during the 2016 US presidential election to identify patterns in the dissemination of disinformation and the role of bots in amplifying specific messages (Jenks, Lowman, & Straughn, 2024).

For sociology projects, teachers can ask students to analyse data on social networks, or in the case of history, to create interactive visualisations (Stanford University, September, 2024).

In the field of anthropology at the University of California, Irvine, students use the Humata.ai tool in anthropological research to analyse ethnographic data, which helps to identify themes and patterns in quantitative data (Budur Turki Alshahrani, Salvatore Flavio Pileggi, & Faezeh Karimi, 2024).

Research and analysis in the social sciences and humanities at universities can use AI techniques such as machine learning and natural language processing to analyse quantitative data, interviews and surveys, providing an in-depth view of human behaviour and social trends (Prof. Nivedita Manohar Mathkunti, Prof. U. Ananthanagu, & Dr. Satish Menon, 2023).

Finally, appropriate assessment strategies are needed to evaluate students' understanding and competence in AI-related skills. A mix of formative and summative assessments, including project-based evaluations, presentations, and coding tasks, can effectively measure the application of AI concepts, critical thinking, and data analysis skills.

In conclusion, AI has the potential to transform education by shifting the focus from routine administrative tasks to enhancing student growth and learning. For AI tools to be effective, there mustbe a commitment to an equitable and holistic educational vision that ensures all students have the opportunity to succeed (World Economic Forum, 2023).

Pioneer Tech-Driven Approaches: Key Knowledge and Skills

The integration of artificial intelligence (AI) and other cutting-edge technologies into education has become a central focus for educators and institutions worldwide. At the forefront of this movement, thesixth EnlightED conference in 2023, hosted by IE University in partnership with the alliance of social sciences institutes CIVICA and various companies, emphasized the need for a paradigm shift in teaching approaches. This shift involves not only a focus on traditional subjects like mathematics and logic but also the cultivation of creativity, communication, and interpersonal skills (Lurdes & Lurdes, 2023). The conference highlighted the unique potential of the humanities and social sciences to pioneer AI integration, given their emphasis on human interaction and creativity.

A study by Vazhayil et al. (2019) underscored the importance of maintaining open-

mindedness and effective communication between educational institutions and teachers in integrating AI technology. The study highlighted the necessity of AI literacy for educators, which includes understanding AI as a tool, being aware of available AI technologies, and possibly acquiring basic coding skills. This literacyis crucial not only for effectively utilizing AI in teaching but also for overcoming challenges related toits implementation in classrooms.

In the context of higher education, AI literacy extends beyond individual teachers to encompass entireinstitutions. As noted in "Higher Education via the Lens of Industry 5.0: Strategy and Perspective" (Hashim et al., 2024), public institutions may benefit from state support, but private institutions face additional pressures to leverage technological advancements for competitiveness. This includes areas such as energy savings and operational efficiency (Albhreem et al., 2021).

Creativity and adaptability are critical skills for educators in this new technological era. AI facilitates diversified and personalized learning, allowing educators to move away from one-size-fits-all teaching models. This shift requires a reimagining of traditional roles; teachers transition from being the sole source of knowledge to facilitators who guide students through interactive, hands-on learning experiences. This new approach demands attention to individual student needs and circumstances, fostering a more personalized educational experience (Collins & Halverson, 2009).

Through a comprehensive review of the literature, several pioneering applications of AI in higher education have been identified as successful models. These include:

1. **Jill Watson at the Georgia Institute of Technology**: An AI-powered teaching assistant named Jill Watson was integrated into a master's course, handling around 10,000 student inquiries over a semester. Jill analyzed the context of questions and provided accurate answers, achieving a 97% success rate. This system significantly reduced the workload for human assistants and improved the learning experience for students (Stone, 2019).
2. **AI-Powered Chatbots**: Institutions like Arizona State University have implemented chatbots such as SUN Devil Bot, which assist students with academic and administrative tasks, from finding resources to checking grades. These chatbots provide personalized support and study suggestions, enhancing the overall student experience (Arizona State University-ASU, 2021).
3. **AI Tutors**: These AI-driven programs offer personalized learning support, guiding students through complex concepts and providing practical exercises. AI tutors help students create tailored study plans, analyze progress, and provide targeted content. This approach improves writing skills and prepares students for exams by identifying areas needing further study (QuadC, 2024).
4. **Predictive Analytics for Student Success**: Systems like Purdue University's Course Signals use historical data to identify at-risk students, allowing for timely interventions. This predictive approach helps educators provide additional support to students who may struggle academically(Kimberly & Pistilli, 2012).
5. **Automated Assessment and Grading**: Platforms such as EdX employ AI to automatically grade student assignments, providing immediate feedback. This capability is particularly useful for managing large classes and ensuring consistent and timely assessments (Teachflow, 2023).
6. **Virtual Labs and Simulations**: AI-based platforms like Labster offer virtual laboratories for subjects like biology and chemistry, allowing students to conduct experiments and explore concepts in a digital environment. These tools enhance practical learning, especially in STEMfields (Labster ApS, 2024).
7. **Adaptive Learning Platforms**: Systems like Knewton and Smart Sparrow use AI to customizeeducational content according to each student's learning style, adjusting difficulty levels and pacing as needed. This personalization enhances the learning experience by addressing individual student needs.
8. **Generative AI for Creative Projects**: AI tools like Suno, developed by a team of

musicians and AI experts from companies such as Meta and TikTok, allow students to create musiccompositions. These tools are particularly useful in courses focused on music production ormultimedia presentations.

Successful AI integration in education requires a balanced approach, prioritizing both innovation and ethical considerations. Universities must collaborate with various stakeholders to ensure that AI technologies are used in ways that support educational missions while also safeguarding against potential ethical issues. This balanced approach will help institutions leverage AI's full potential to enhance teaching and learning outcomes.

AI-Integrated Pedagogical Competencies Scale

In the ever-evolving landscape of education, instructors are increasingly challenged to integrate new technologies effectively. To prepare students for a rapidly changing world driven by technological advancements, teaching methodologies must undergo significant transformation. The TPACK model, developed by Punya Mishra and Matthew Koehler in 2006, provides a comprehensive framework for educators to integrate technology into their instructional activities effectively. This model emphasizes the interconnectedness of technology, pedagogy, and content knowledge in the classroom, highlightingthat successful teaching requires more than just expertise in a particular subject or technical skills (Schmidt et al., 2009).

The TPACK model comprises several key components. **Technological Knowledge (TK)** involves educators' understanding and proficiency in using various technologies, including tools, software, hardware, and digital resources, relevant to teaching and learning processes. **Pedagogical Knowledge (PK)** encompasses educators' understanding of teaching methods, instructional strategies, and classroom management techniques tailored to diverse learning needs. **Content Knowledge (CK)** refers to the deep understanding educators possess of the specific subjects they teach, including essential concepts, principles, and theories within these disciplines. **Technological Pedagogical Knowledge (TPK)** focuses on integrating technology into pedagogical practices to enhance student learning experiences. **Technological Content Knowledge (TCK)** emphasizes the integration of technology with subject matter expertise, facilitating effective teaching and learning in specific curricular areas. Finally, **Pedagogical Content Knowledge (PCK)** combines pedagogical and content knowledge, focusing on the use of effective teaching practices tailored to the unique needs of specific subject matter.

The TPACK framework offers educators a structured approach to creating, implementing, and evaluating learning experiences enriched by technology. By strategically integrating technological, pedagogical, and content knowledge, educators can deliver meaningful and impactful learning experiences (Goradia, 2018). Practical implementations of the TPACK model include developing curricular units that incorporate technology aligned with teaching objectives and subject goals. Professional development initiatives, such as training sessions, workshops, and collaborative projects, can enhance educators' TPACK skills. Moreover, employing technology-driven teaching methods like flipped classrooms or blended learning can achieve educational objectives and boost student engagement. Assessment tasks that measure students' mastery of subject matter and technological proficiency through diverse evaluation methods are also essential.

As technology advances, the incorporation of artificial intelligence (AI) in education has emerged as atransformative factor with the potential to revolutionize teaching and learning. Building on the TPACK model, the TPACK AI model provides a systematic approach to leveraging AI technologies in educational settings (Ning et al., 2024). This model focuses on the convergence of AI technologies, pedagogical strategies, and content expertise to enhance student learning outcomes. **Artificial Intelligence Knowledge (AIK)** refers to educators' comprehensive understanding of AI technologies, including machine learning, natural language processing, and computer vision, and awareness of the ethical implications associated with these technologies.

The TPACK AI model emphasizes several components, including Pedagogical Knowledge (PK), which remains crucial for employing AI-driven tools and resources to optimize learning experiences through effective teaching strategies. **Content Knowledge (CK)** involves understanding how AI technologies can be applied across various subject areas to enhance

comprehension, customize learning experiences, and apply knowledge practically. **AI-Pedagogical Knowledge (AI-PK)** and **AI-Content Knowledge (AI-CK)** combine AI expertise with pedagogical and content knowledge, respectively, to provide efficient educational techniques. **Pedagogical-AI-Content Knowledge (P-AI-CK)** integrates these elements to create educational experiences that utilize AI-driven tools to meet individual learning needsand enhance subject matter expertise.

The practical application of the TPACK AI model includes using adaptive learning platforms, intelligent tutoring systems, data-driven decision-making tools, natural language processing applications, and virtual reality technologies to enhance teaching and learning experiences. This model provides educators with a framework to harness the potential of AI in education effectively. By considering the interplay between AI knowledge, pedagogical techniques, and content expertise, educators can design engaging, personalized, and impactful learning experiences for students in the digital age. As AI technology advances, the TPACK AI model will serve as a guiding framework for navigating the evolving landscape of AI-enhanced education and maximizing its potential to empowerboth learners and educators.

The AIEd paradigm, or Artificial Intelligence in Education, offers another systematic framework for integrating AI into educational settings to enhance teaching and learning experiences. This paradigm incorporates AI technologies into every facet of education, from curriculum development and teaching methods to assessment and feedback mechanisms. The AIEd paradigm focuses on utilizing AI to tailorlearning experiences to individual learner needs, optimize teaching methods, and facilitate data-drivendecision-making (Lane, Yacef, & Mostow, 2015).

According to VanLehn (2011), a core aspect of the AIEd approach is individualized instruction, which adapts learning experiences to the unique requirements, preferences, and learning styles of each student. AI technologies enable the creation of adaptable learning environments that adjust content, pacing, and resources based on learners' progress and achievements. Data analytics play a crucial role in the AIEd approach, allowing educators to gather, analyze, and interpret vast amounts of educational data to gain insights into student performance, engagement, and learning behaviors. **Intelligent Tutoring Systems (ITS)** employ AI to provide personalized tutoring and support, assessing students' knowledge levels and offering individualized instruction and feedback. **Natural Language Processing (NLP)** technologies enhance language acquisition, literacy development, and communication skills by providing interactive dialogue systems, language comprehension aids, and automated writing assistance. **Augmented Reality (AR)** and **Virtual Reality (VR)** technologies offer immersive educational experiences through interactive simulations and 3D visualizations, tailored with AI algorithms to meet specific learning needs.

The AIEd paradigm also emphasizes the ethical and fair use of AI in education, addressing concerns related to data privacy, algorithmic bias, and ensuring equal access to AI-enhanced learning opportunities for all students. Practical applications of the AIEd model include adaptive learning platforms, learning analytics dashboards, automated grading and feedback systems, AI-powered virtualteaching assistants, and personalized learning platforms.

In essence, the AIEd model represents a significant shift in education, leveraging AI to revolutionize teaching and learning methodologies. By embracing personalized learning, data analytics, intelligent tutoring systems, and ethical considerations, educators can create inclusive, engaging, and effective learning experiences for students. As AI technology continues to evolve, the AIEd model will play a critical role in shaping the future of education, equipping students to thrive in an increasingly digital and rapidly changing world.

Analysis and Discussion

The primary aim of this study is to explore the application of artificial intelligence (AI) in higher education, with a particular focus on its integration into social sciences. This investigation is crucial for understanding the future development trajectory of the EduAI project. The literature review clearly indicates that AI is poised to significantly impact higher education, encompassing all courses and becoming a fixture in classrooms and student support systems. However, there exists a notable disparityin the application of AI: while there is a surge in academic research output on AI globally, its practical application in curricula and teaching practices remains sluggish. This

dichotomy may stem from a lack of AI literacy among educators, uncertainty about how to effectively implement AI, and ambiguity regarding the specific teaching-learning dynamics in which AI can be applied. Addressing these challenges requires a concerted effort to provide extensive and ongoing training for educators.

Reports from international organizations reveal widespread concern about the ethical implications anddata privacy issues associated with AI, prompting governments worldwide to issue guidelines for AI implementation, particularly in higher education. In Europe, the responsibility for implementing AI has largely been delegated to individual educational institutions. However, government agencies often control the accreditation of courses and content, which can pose a barrier to modifying academic programs to include AI components.

The European Community's monitoring of AI adoption highlights a lag in the EU's progress comparedto the significant advancements made by the USA and China. Despite this, the EU shows promise in areas such as robotics and autonomous automation. In education, AI applications have predominantly been integrated into master's programs, with undergraduate and vocational training yet to see widespread adoption.

In terms of practical applications, AI tools are being explored for university management, streamlining bureaucratic processes for students and faculty. Automatic assessment systems are more prevalent in online teaching environments, while tools like chatbots, digital tutors, and AI assistants such as ChatGPT (OpenAI), Bard (Google), and Copilot (Microsoft) are being tested for classroom support. However, a survey of 100 university decision-makers worldwide reveals that only a minority of institutions currently have an AI strategy, despite a general interest in developing one. This reluctance is often linked to challenges in recruiting and retaining talent for AI-related teaching and research.

The TPACK (Technological Pedagogical Content Knowledge) framework has proven valuable for assessing educators' competence in integrating technology to enhance student engagement and learning outcomes. The DigCompEdu framework, introduced in 2017, further refined TPACK by focusing on AI-specific competencies. The subsequent AI-TPACK model, developed in 2024, provides a comprehensive framework that integrates disciplinary, pedagogical, and AI technological knowledge. This model facilitates a collaborative approach between human instructors and AI tools, fostering innovative and adaptive teaching methodologies. However, the application of these methodologies is still in its nascent stages, requiring broader implementation and analysis to fully understand their impact, particularly in the social sciences.

Looking ahead, the rapid evolution of AI makes it difficult to predict future trends beyond a short-termhorizon. Two significant factors could reshape the higher education landscape: anticipated climate change-related migrations in the 2030s, which will necessitate more flexible education pathways, and a projected decline in student enrollment due to lower birth rates following the 2008/2009 economic recession. These factors will likely require curricula to be more adaptable, with options for synchronousand asynchronous learning.

The literature points to several promising future developments for AI in higher education:

- Personalized support for students through AI-powered tutoring, academic and career counseling, and streamlined administrative processes.
- Virtual assistants that assist in course design, grading, feedback, and enhancing accessibility tocourse content.
- Virtual research assistants capable of conducting literature reviews, data analysis, predictive modeling, and visualizing research outcomes.
- AI-driven data analytics for student success metrics, aiding in recruitment, retention, andtargeted interventions.
- Education and training programs focused on digital literacy to prepare students and educatorsfor the demands of the evolving labor market.

The ethical considerations surrounding AI, particularly issues of data privacy and the potential misuse of AI-generated content, are at the forefront of current discussions. Governments

and institutions are keenly aware of the need for guidelines and regulations to navigate these concerns. However, the rapidpace of AI development poses challenges in keeping regulations up-to-date. The dual potential of AI technologies—both positive and negative—depends heavily on their application and oversight.

Concerns include the over-reliance on AI-generated outputs without human oversight, the risk of AI making high-stakes decisions autonomously, and the potential for copyright infringement or misrepresentation of AI-generated content as human-authored. Despite these challenges, AI presents significant opportunities for enhancing education, particularly in data-driven insights and personalizedlearning experiences. Ensuring a balanced and ethical integration of AI will be critical for fostering a positive future where both human and AI contributions are valued and utilized effectively.

Conclusions and Recommendations

The integration of artificial intelligence (AI) into higher education remains a developing field, with institutions still seeking a unified and generalized approach to its application in teaching and learning. Current discourse among higher education managers and educators heavily emphasizes ethical concernsand transparency, often overshadowing the potential benefits of AI implementation. Despite these concerns, the widespread adoption of AI across all levels of education and professional activities appears inevitable.

The pressure on higher education to rapidly adapt curricula to meet new job market demands is intensifying. The World Economic Forum's Future of Jobs Report 2023 predicts significant changes inthe job market, with nearly a quarter of jobs expected to change in the next five years. The report forecasts a 10.2% growth in new job roles and a 12.3% decline in existing ones, resulting in a net loss of 14 million jobs worldwide (World Economic Forum, 2023). This transformation underscores the urgent need for educational programs to equip students with the skills required for the evolving globaldigital economy. While AI will play a crucial role in this transition, it also raises concerns about ethical use and data privacy, necessitating a careful balance between leveraging opportunities and mitigating risks.

The application of AI in the social sciences is notably underdeveloped compared to fields like medicine, technology, engineering, and management. The literature review indicates a lack of targeted research and practical applications of AI in social sciences education. The EduAI project aims to address this gap, serving as a pioneering effort to explore AI's potential in this field. It is recommended that a competency analysis model be developed, drawing on frameworks like DigCompEdu and the recent AI-TPACK models. Demonstrating the use of existing pioneering AI tools and practices in social sciences education will be crucial. Furthermore, engaging with institutions and educators to understandtheir specific needs and challenges will be key to facilitating the effective integration of AI in social sciences curricula.

As guidelines for future studies within the scope of TPACK, it is suggested in general terms to integrate AI tools into the curriculum of existing social sciences courses, and to carry out case studies in various universities, in different social sciences courses, to assess the impact of these tools, their ability to mobilise students, and their influence on learning.

With a focus on lecturers, training should be provided by universities, namely professional development workshops to improve their skills in terms of AI-TPACK, and it is recommended that the effectiveness of this training be measured through pre- and post-training evaluations.

In terms of social science students, studying their perceptions and attitudes towards the use of AI, using surveys and round tables to determine the factors that influence acceptance and engagement with the use of AI.

It is also suggested, in terms of the ethical aspects of using AI in education, to conduct a quantitative research study based on interviews with teachers, students and AI experts in order to identify ethical issues and propose guidelines for using AI responsibly.

Finally, in terms of universities, assessing the impact of teaching methods using AI on learning outcomes, implementing AI interventions in classrooms and using quantitative methods to

measure the impact on student performance and understanding.

In conclusion, while there is significant interest in the potential of AI to enhance teaching and learning,there is also a pervasive lack of literacy regarding AI technologies among educators. This gap is primarily due to insufficient training in the practical and pedagogical application of AI. Addressing thisdeficiency through comprehensive training programs will be essential for realizing the full potential of AI in higher education, particularly in the social sciences. The findings underscore the necessity for continued research and dialogue to navigate the complexities of integrating AI into educational practices, ensuring that it is done ethically and effectively.

References

Abdous, M. (2023). How AI Is Shaping the Future of Higher Ed. Obtained 02 April 2024, de InsideHigher Ed: https://www.insidehighered.com/views/2023/03/22/how-ai-shaping-future-higher-ed- opinion

Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challengesin K-12 settings. AI and Ethics, 2(3), 431-440.

Alam, A. (2023). Harnessing the Power of AI to Create Intelligent Tutoring Systems for Enhanced Classroom Experience and Improved Learning Outcomes. Em G. D. Rajakumar, Intelligent Communication Technologies and Virtual Mobile Networks (Vols. Lecture Notes on Data Engineering and Communications Technologies, Vol. 171, pp. 571–591). Singapore: Springer Nature.https://doi.org/10.1007/978-981-99-1767-9_42

Almusaed, A., Almssad, A., Yitmen, I., & Homod, R. Z. (2023). Enhancing student engagement:Harnessing ‘AIED’’s power in hybrid education – A review analysis. (J. S. Pub., Ed.) Education Sciences, 13, 632. https://doi.org/10.3390/educsci13070632

Arizona State University-ASU. (2021). ASU’s Experience Center chatbot supports the Sun Devil community. Obtained de Arizona State University-ASU;: https://tech.asu.edu/features/experience-center-chatbot

Baron, J., & Henry, R. (2020). AI Literacy: Why Teachers Need It and How to Build It. InternationalSociety for Technology in Education.

BCG-Boston Consulting Group. (2021). The Future of Jobs in the Era of AI. Boston Consulting Group. Obtained 03 April 2024, https://www.bcg.com/publications/2021/impact-of-new-technologies-on-jobs

Brynjolfsson, E., & McAfee, A. (2014, January 20). The Second Machine Age: Work, Progress, andProsperity in a Time of Brilliant Technologies. W. W. Norton & Company.

Buckingham Shum, S., & Deakin Crick, R. (2016, September 17). Learning Analytics for 21stCentury Competencies. Journal of Learning Analytics, 3(2), 6–21. https://doi.org/10.18608/jla.2016.32.2

Budur Turki Alshahrani, Salvatore Flavio Pileggi, & Faezeh Karimi. (2024). A Social Perspective on AI in the Higher Education System: A Semisystematic Literature Review. *Electronics, 13*(8). doi:https://doi.org/10.3390/electronics13081572

Campbell, R. (11 de March de 2023). Leveraging AI For Better Student Engagement And Learning Outcomes. Obtained em 8 de April de 2024, de https://richardccampbell.com/leveraging-ai-for-better-student-engagement- and-learning-outcomes/

Caswell, C. J., & LaBrie, D. J. (n.d.). Inquiry Based Learning from the Learner’s Point of View: ATeacher Candidate’s Success Story. Scholarship @ Claremont. https://scholarship.claremont.edu/jhm/vol7/iss2/8/

Chai, C. S., Jong, M., & Yan, Z. (2020). Surveying Chinese teachers' technological pedagogical STEM knowledge: A pilot validation of STEM-TPACK survey. International Journal of MobileLearning and Organisation, 14(2), 203-214.

Chaushi, B. A., Ismaili, F., & Chaushi, A. (2024). Pros and Cons of Artificial Intelligence in Education. International Journal of Advanced Natural Sciences and Engineering Researches, 8(2), 51-57.

Chu, H., Tu, Y., & Yang, K. (2022). Roles and research trends of artificial intelligence in higher education: A systematic review of the top 50 most-cited articles. Australasian Journal of EducationalTechnology, 38(3), 22-42. https://doi.org/10.14742/ajet.7526

Cristianini, N. (October de 2016). Intelligence reinvented. (ScienceDirect, Ed.) New Scientist,232(3097), 37-41. https://doi.org/10.1016/S0262-4079(16)31992-3

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: the state of the field.International Journal of Educational Technology in Higher Education, 1-22. https://doi.org/10.1186/s41239-023-00392-8

Crompton, H., Burke, D., & Gregory, K. H. (2020). AI-TPACK: Integrating Artificial IntelligenceInto the Technological Pedagogical Content Knowledge Framework. Handbook of Research on Integrating Technology Into Contemporary Language Learning and Teaching, 314-337.

DigCompEdu. (n.d.). EU Science Hub. https://joint-research- centre.ec.europa.eu/digcompedu_en

Eaton, E., Koenig, S., Schulz, C., Maurelli, F., Lee, J., Eckroth, J., Crowley, M., Freedman, R. G., Cardona-Rivera, R. E., Machado, T., & Williams, T. (2018, February 16). Blue sky ideas in artificialintelligence education from the EAAI 2017 new and future AI educator program. AI Matters. https://doi.org/10.1145/3175502.3175509

EDUCASE, H. e. (2023). 2023 EDUCAUSE Horizon Report, Teaching and Learning Edition. Boulder, CO: EDUCAUSE, 2023. Obtained https://www.educause.edu/horizon-report-teaching-and-learning-2023

European Commission - Joint Research Centre. (2022). JCR Technical Reports - AI Watch Index2021. Seville, Spain: European Commission. Obtained 10 April 2024, de https://ai-watch.ec.europa.eu/publications/ai-watch-index-2021_en

European Union. (21 de January de 2024). Final Draft of Artificial Intelligence (AI) Act. Obtainedhttps://artificialintelligenceact.eu/ai-act-explorer/

Goradia, T. (2018, December 1). Role of Educational Technologies Utilising the TPACK Frameworkand 21st Century Pedagogies: Academics' Perspectives. IAFOR Journal of Education, 6(3), 43–61. https://doi.org/10.22492/ije.6.3.03

H.B.P. (February 2023- February 2024 de 2024). Artificial Intelligence. Harvard Business School Publishing. Obtained https://www.hbsp.harvard.edu/inspiring- minds/categories/artificial-intelligence

Halverson, R., & Prichard, R. (2014). Teaching with the Internet K-12: New Literacies for NewTimes. Teachers College Press

Harry, A. (March de 2023). Role of AI in Education," Interdisciplinary J. Humanity Inj., vol. 2, no. 3,pp. 260–268, Mar. 2023, doi:. Interdisciplinary Studies in Humanities, 2, 260-268 https://doi.org/10.58631/injurity.v2i3.52. https://doi.org/10.1080/10494820.2021.1958348

Huang, C. Q., Wu, X. M., Wang, X. Z., He, T., Jian, F., & Yu, J. H. (2021). Exploring the Relationships between Achievement Goals, Community Identification and Online Collaborative Reflection: A Deep Learning and Bayesian. Educational Technology & Society,, 24(3), 201-223.

Hwang, G.-J., & Tu, Y.-F. (2021). Roles and Research Trends of Artificial Intelligence in Mathematics Education: A Bibliometric Mapping Analysis and Systematic Review. MDPI -mathematics, 9(6). https://doi.org/10.3390/math9060584

Jamieson-Proctor, R., Finger, G., & Albion, P. (2010). Auditing the TK and TPACK confidence of pre-service teachers: Are they ready for the profession?. Australian Educational Computing, 25(1), 8-17.

Jenay, R. (12 de February de 2024). The Future of AI in Higher Education. (EDUCASE, Ed.) Obtained 02 April 2024, de 2024 EDUCAUSE AI Landscape Study:

https://www.educause.edu/ecar/research-publications/2024/2024-educause-ai- landscape-study/the-future-of-ai-in-higher-education

Jenks, A., Lowman, C., & Straughn, I. (27 de June de 2024). *AI for Learning: Experiments from Three Anthropology Classrooms*. Obtido de Anthropology News website: https://www.anthropology-news.org/articles/ai-for-learning-experiments-from-three-anthropology-classrooms

Kayyali, M. (2024). Future Possibilities and Challenges of AI in Education. Em Ramesh C. Sharma,& Aras Bozkurt, Transforming Education With Generative AI: Prompt Engineering and Synthetic Content Creation (pp. ch.6, 118-137). IGI Global's Education. https://doi.org/10.4018/979-8-3693- 1351-0

Kimberly, A. E., & Pistilli, M. D. (2012). Course signals at Purdue: using learning analytics to increase student success. LAK '12: Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (pp. 267–270). Vancouver British Columbia Canada: ACM Digital Library.https://doi.org/10.1145/2330601.2330666

Koehler, M. J., & Mishra, P. (2007). Technological Pedagogical Content Knowledge: A Frameworkfor Teacher Knowledge. Teachers College Record, 108(6), 1017- 1054.

Kuka, L., Hörmann, C., & Sabitzer, B. (2022). Teaching and Learning with AI in Higher Education: A Scoping Review. Em M. P. Auer, Learning with Technologies and Technologies in Learning, seriesLecture Notes in Networks and Systems (Vol. 456, pp. 551-571). Springer, Cham. https://doi.org/10.1007/978-3-031-04286- 7_26

Labster ApS. (2024). Labster's immersive virtual labs are proven to engage students, reduce dropoutrates, and drive equitable learning outcomes. Somerville, MA, USA.

Lane, H. C., Yacef, K., & Mostow, J. (2015). Artificial Intelligence in Education. International Journal of Artificial Intelligence in Education, 25(4), 515–523. https://doi.org/10.1007/s40593-015-0051-3

Lestari, E., Rahmawatie, D. A., & Wulandari, C. L. (2023). Does Online Interprofessional Case-Based Learning Facilitate Collaborative Knowledge Construction?. Journal of multidisciplinary healthcare, 16, 85–99. https://doi.org/10.2147/JMDH.S391997

Liang, J.-C., Hwang, G.-J., Chen, M.-R. A., & Darmawansah , D. (2023). Roles and research foci ofartificial intelligence in language education: an integrated bibliographic analysis and systematic review approach. Interactive Learning Environments, 31(7), 4270-4296. https://doi.org/10.1080/10494820.2021.1958348

Microsoft Research (MSR). (2019). What are university leaders and chief technology officers doing tomeet future challenges? Microsoft . Times Hight Education. Obtained 03 April 2024, https://www.timeshighereducation.com/features/microsoft-survey-ai

Mishra, P., & Koehler, M. J. (2006, June). Technological Pedagogical Content Knowledge: AFramework for Teacher Knowledge. Teachers College Record: The Voice of Scholarship in Education, 108(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Nicolaou, S. A., & Petrou, I. (2023, August 20). Digital Redesign of Problem-Based Learning (PBL)from Face-to-Face to Synchronous Online in Biomedical Sciences MSc Courses and the Student Perspective. Education Sciences. https://doi.org/10.3390/educsci13080850

Ning, Y., Zhang, C., Xu, B., Zhou, Y., & Wijaya, T. T. (2024, January 23). Teachers' AI-TPACK:Exploring the Relationship between Knowledge Elements. Sustainability. https://doi.org/10.3390/su16030978

OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem.https://www.oecd.org/education/oecd-digital-education-outlook- 7fbfff45-en.htm

OECD-Ilibrary. (2024). Emerging governance of generative AI in education. https://www.oecd-ilibrary.org/sites/2a73a245-en/index.html?itemId=/content/component/2a73a245-en

Office Educational Technology (OET). (May de 2023). Artificial Intelligence and the Future ofTeaching and Learning Insights and Recommendations. chrome-

extension://mhnlakgilnojmhinhkckjpncpbhabphi/pages/pdf/web/viewer.html?file

=https%3A%2F%2Fwww2.ed.gov%2Fdocuments%2Fai-report%2Fai- report.pdf

Ouyang, F., Zheng, L., & Jiao , P. (26 de February de 2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. Springer Link, 7893–7925.https://doi.org/10.1007/s10639-022-10925-9

Pisica, A. L., Edu, T., Zaharia, R. M., & Zaharia, R. (5 de May de 2023). Implementing artificial intelligence in higher education: Pros and cons from the perspectives of academics. (https://www.mdpi.com/journal/societies, Ed.) Social Interactions and the Technology Development:Perspectives on E-Societies, 13(5), 1-3. https://doi.org/10.3390/soc13050118

Popenici , S. A., & Kerr, S. (23 de November de 2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. Research and Practice in Technology Enhanced Learning, 12(22), 1-13.

Prof. Nivedita Manohar Mathkunti, Prof. U. Ananthanagu, & Dr. Satish Menon. (2023). AI in Humanities: Review. *Tuijin Jishu/Journal of Propulsion Technology, 44*(5), 3674-3678.

Quad C. (s.d.). How Technology is Revolutionising Education in 2024. THE TRANSFORMATIVEIMPACT OF AI ON STUDENT SUCCESS:. (www.quadc.io, Ed.) Obtained https://39958902.fs1.hubspotusercontent-na1.net/hubfs/39958902/Marketing/Transformative%20Impact%20of%20AI%20on%20Student%20Success.pdf

Redecker, C., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., & Stoyanov, S. (2017).The Digital Competence Framework for Citizens: Towards a Common Framework for Digital

Competence Skills in Europe. European Commission, Joint Research Centre, Institute for ProspectiveTechnological Studies.

Remian, D. (2019). Augmenting Education: Ethical Considerations for Incorporating Artificial Intelligence in Education. Instructional Design Capstones Collection - ScholarWorks at UMass Boston. Obtained de https://scholarworks.umb.edu/instruction_capstone/52/

RenAIssance Foundation. (2023). The Call. Rome Call. https://www.romecall.org/the- call/

Sartori, L., & Theodorou, A. (2022). A sociotechnical perspective for the future of AI: narratives, inequalities, and human control. *Ethics Inf Technol, 24*(4). doi:https://doi.org/10.1007/s10676-022-09624-3

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009, December). Technological Pedagogical Content Knowledge (TPACK). Journal of Research onTechnology in Education, 42(2), 123–149. https://doi.org/10.1080/15391523.2009.10782544

Seo, K., Tang, J., Roll, I., Fels, S., & Yoon , D. (2021). The impact of artificial intelligence onlearner–instructor interaction in online learning . Int J Educ Technol High Educ, 18(54). https://doi.org/10.1186/s41239-021-00292-9

Shukla, A., Janmaijaya, M., Abraham, A., & Muhuri, P. K. (October de 2019). Engineering applications of artificial intelligence: A bibliometric analysis of 30 years (1988–2018). Engineering Applications of Artificial Intelligence, 85, 517- 532. https://doi.org/10.1016/j.engappai.2019.06.010

Stanford University. (September 2024). Artificial Intelligence Teaching Guide. *Teaching Commons Autumn Symposium 2024.* Stanford, CA 94305: Stanford University.

Stone, A. (December de 9 de 2019). AI and Smart Campuses Are Among Higher Ed Tech to Watch in2020: Early adopters tap emerging tools to achieve cost savings and improve learning outcomes.

Obtained de EdTech - Focus on Higher Education: https://edtechmagazine.com/higher/article/2019/12/ai-and-smart- campuses-are-among-higher-ed-tech-watch-2020-1

Teachflow. (23 de 11 de 2023). Revolutionising Assessment: AI's Automated Grading & Feedback – Unlocking Efficiency, Objectivity, and Personalized Learning. https://teachflow.ai/

The Future of Jobs Report 2018 - Weforum. (n.d.). https://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf

The Future of Jobs Report 2023 - Weforum. (n.d.). https://www.weforum.org/publications/the-future-of-jobs-report-2023/

Turing, A. M. (1937). On computable numbers, with an application to the Entscheidungs problem.Proceedings of the London Mathematical Society, Series 2(42), 230-265.

Turing, A. M. (1950). Computing Machinery and Intelligence. Mind, 433-460. UNESCO. (2019). I'd blush if I could: closing gender divides in digital skills through education. EQUALS Skills Coalition,147. https://doi.org/10.54675/RAPC9356

UNESCO. (23 de November de 2021). Recommendation on the Ethics of Artificial Intelligence.Obtained de UNESDOC: https://unesdoc.unesco.org/ark:/48223/pf0000381137

Ungerer, L., & Slade, S. (2022). Ethical Considerations of Artificial Intelligence in Learning Analytics in Distance Education Contexts. Em P. P. (eds.) (Ed.), Learning Analytics in Open and Distributed Learning (pp. 105-119). Earth Trust, Abingdon, UK: Springer Nature Singapore Pte Ltd.https://doi.org/10.1007/978- 981-19-0786-9_8.

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, andother tutoring systems. Educational Psychologist, 46(4), 197–221. https://doi.org/10.1080/00461520.2011.611369

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013, September 9). Challenges to learning and schooling in the digital networked world of the 21st century. Journal of Computer Assisted Learning,29(5), 403–413. https://doi.org/10.1111/jcal.12029

Winkler-Schwartz, A., Bissonnette, V., Mirchi, N., Ponnudurai, N., Yilmaz, R., Ledwos, N., . . . Del Maestro, F. R. (2019). Artificial Intelligence in Medical Education: Best Practices Using Machine Learning to Assess Surgical Expertise in Virtual Reality Simulation. (E. Inc., Ed.) Journal of SurgicalEducation. https://doi.org/10.1016/j.jsurg.2019.05.015

World Economic Forum. (2023). How AI can accelerate students' holistic development and maketeaching more fulfilling. DAVOS Agenda. DAVOS: WEF. https://www.weforum.org/podcasts/agenda-dialogues/episodes/davos-2024- education-meets-ai/

Zaman, B. U. (2023). Transforming Education Through AI, Benefits, Risks, and EthicalConsiderations. Authorea Preprints, 1-12.

Zhao, T. (2023). AI in Educational Technology. Preprints.org, 1-12.https://doi.org/10.20944/preprints202311.0106.v1