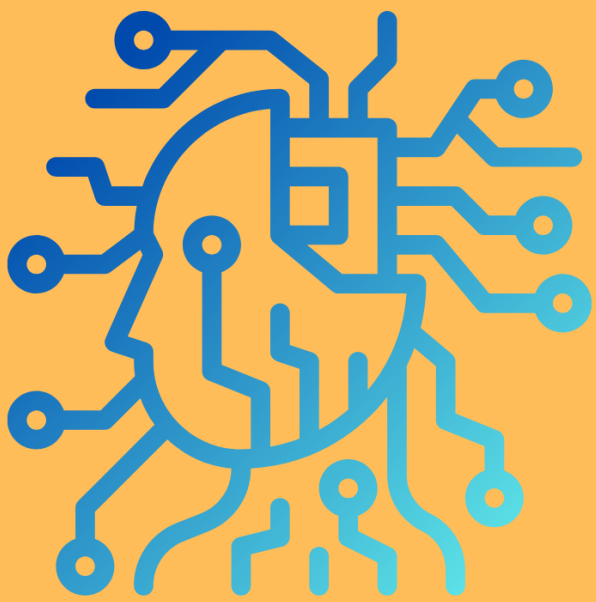
AI-Enhanced Teaching and Evaluation:

A Handbook for Higher Education



Editors
Assoc. Prof. Dr. Ceray ALDEMİR
Prof. Dr. Tuğba Uçma UYSAL
Res. Assist. Egemen KAHRAMAN

Gazi kitabevi

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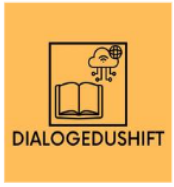

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Res. Assist. Egemen KAHRAMAN[3]

Gözi kitabevi

[1] Muğla Sıtkı Koçman University, cerayaldemir@mu.edu.tr, https://orcid.org/0000-0002-7996-4886
[2] Muğla Sıtkı Koçman University, utugba@mu.edu.tr, https://orcid.org/0000-0002-3652-7221
[3] Muğla Sıtkı Koçman University, egemenkahraman@mu.edu.tr, https://orcid.org/0000-0002-4171-7628

"En İyi Akademi, Bir Kitaplıktır."

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Editors:
Assoc. Prof. Dr. Ceray ALDEMİR
ORCID: 0000-0002-7996-4886
Prof. Dr. Tuğba Uçma UYSAL
ORCID: 0000-0002-3652-7221
Res. Assist. Egemen KAHRAMAN
ORCID: 0000-0002-4171-7628

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0.312 215 14 50
www.gazikitabevi.com.tr
info@gazikitabevi.com.tr

Sosyal Medya
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gazikitabevi
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Content

PREFACE

The rapid advancement of artificial intelligence (AI) technology is reshaping the landscape of higher education. In this transformative era, AI chat tools have emerged as powerful assets in enhancing teaching methods and assessment processes. The "Transforming Higher Education Teaching and Evaluation Approaches in the Era of AI Chat Tools" (DialogEduShift) project aims to explore and integrate these technologies effectively within higher education institutions (HEIs). This handbook, a key output of the DialogEduShift project, supported by Erasmus+ under Project No: 2023-1-PL01-KA220-HED-000167212, serves as a comprehensive guide for academic staff to navigate this integration successfully.

The primary aim of this handbook is to equip academic staff with a robust set of competencies that leverage AI chat tools to revolutionize teaching and assessment methodologies. Through comprehensive exploration and detailed guidance, it endeavors to provide educators with the insights and tools necessary to integrate AI seamlessly into their daily teaching practices. This includes an in-depth look at the types of AI chat tools available, their potential applications in educational settings, and the best practices for their implementation to ensure they are used ethically and effectively.

Further, this handbook addresses the pressing need to enhance the quality of education. It posits that through the targeted use of AI chat tools, educational experiences can be personalized to meet the diverse needs of students, making learning more engaging and accessible. This approach not only improves the immediacy and relevance of educational content but also supports educators in managing and responding to the varied learning paces and styles present in a modern classroom.

Moreover, in an era marked by rapid digital transformation, this handbook serves as a critical resource for cultivating digital preparedness within higher education institutions. It emphasizes the importance of developing a digital-first mindset among educators and administrators, preparing them to lead and thrive in a landscape increasingly dominated by digital technologies. The content herein aims to build foundational digital competencies that will enable academic institutions to remain at the cutting edge of educational advancements.

The intended audience for this handbook spans a broad spectrum of the academic community. It is particularly invaluable for educators and academic staff who are at the forefront of integrating technological advancements into their curriculum. Higher education administrators and policymakers will find strategic insights into supporting and facilitating the digital transformation within their institutions. Additionally, educational science researchers engaged in the study and implementation of AI-driven educational solutions will discover a wealth of information to support their academic inquiries and developmental initiatives.

In conclusion, by following the comprehensive strategies and ethical considerations outlined in this handbook, academic professionals can effectively harness the capabilities of AI chat tools. This will not only foster a more innovative and adaptable educational environment but also elevate the overall quality of education delivered, ensuring it meets the demands of today's digital and globalized world. We invite you to delve into this handbook and explore how AI can transform teaching and evaluation approaches within your own institutions, setting a new standard for educational excellence.

INTRODUCTION

In an era characterized by rapid technological advancements, the influence of artificial intelligence (AI) on the educational landscape is both transformative and expansive. As AI technologies become increasingly integrated into higher education, they redefine the dynamics of teaching, learning, and assessment. This integration offers substantial opportunities to enhance educational efficiency and efficacy, but it also presents significant challenges that must be addressed to harness AI's full potential responsibly.

AI's role in higher education is multifaceted, ranging from augmenting the teaching process with personalized learning algorithms to automating administrative tasks and revolutionizing assessment methods. These tools are not just facilitators of existing educational practices; they are catalysts for fundamental changes in the ways educational content is delivered and consumed. As such, there is an urgent need to explore the implications of these technologies thoroughly and develop strategies that leverage their strengths while mitigating associated risks.

The "Transforming Higher Education Teaching and Evaluation Approaches in the Era of AI Chat Tools" (DialogEduShift) project, backed by Erasmus+, addresses these needs by critically examining the integration of AI chat tools within higher education institutions (HEIs). This project seeks to provide a balanced view of the opportunities and challenges posed by AI, ensuring that educational stakeholders are equipped to make informed decisions about adopting and implementing these technologies.

This handbook is structured to provide a comprehensive exploration of the integration of artificial intelligence (AI) tools in higher education, addressing the technological, pedagogical, and ethical dimensions of this significant shift. Each chapter is designed to tackle a specific aspect of AI's application in the academic realm, from foundational technologies and tools to the detailed examination of their impacts on teaching, learning, and administrative processes. The chapters collectively aim to equip stakeholders with a deep understanding of AI's capabilities and challenges, fostering an environment where technology enhances educational outcomes while aligning with ethical standards.

Chapter 1 provides a foundational overview of generative AI, detailing the mechanisms behind AI tools like ChatGPT, Google Bard, and Microsoft Copilot. It explores their capabilities to generate responsive, contextual content that can simulate human-like interactions. The chapter also examines the implications of these tools for educational practices, highlighting their potential to significantly enhance the personalization of learning and streamline administrative operations.

Chapter 2 is investigating the ethical dimensions of AI in academia, this chapter discusses how AI can both enhance and complicate the educational landscape. It addresses the dual nature of AI—its potential to democratize education by providing personalized learning experiences and its challenges, including issues of privacy, bias, and equity. The chapter advocates for a proactive approach to the ethical deployment of AI technologies, emphasizing the development of robust ethical frameworks that guide their use.

Chapter 3 evaluates AI's role in adapting educational experiences to individual learner profiles. It reviews various AI-driven approaches, such as adaptive learning platforms and intelligent tutoring systems, assessing their effectiveness in catering to diverse educational needs and learning styles. Additionally, the chapter addresses the technical and pedagogical challenges involved in integrating these tools into traditional learning environments.

Chapter 4 is focusing on assessment, this chapter analyzes how AI tools can transform evaluation methodologies in education. It discusses the potential for AI to deliver fair, objective, and efficient assessments and highlights the necessity for transparency in AI-driven grading systems to gain trust among educators and students alike.

Chapter 5 outlines the essential skills and knowledge that academic staff need to effectively employ AI tools. It emphasizes the importance of digital literacy and pedagogical adaptability, advocating for ongoing professional development to equip educators with the competencies required to navigate a rapidly evolving AI-enhanced educational landscape.

Chapter 6 is concluding the handbook, this chapter synthesizes the discussions on ethical AI use, proposing actionable guidelines and ethical frameworks to ensure responsible deployment of AI in educational settings. It calls for a concerted effort among all educational stakeholders to develop practices that respect privacy, ensure fairness, and maintain academic integrity.

Through these chapters, the handbook aims to provide a comprehensive understanding of the role of AI in transforming higher education. It offers educators, administrators, and policymakers the insights needed to effectively integrate AI tools, ensuring that these technologies serve as enhancements rather than replacements for the human elements of teaching and learning.

Chapter 1
Generative Artificial Intelligence and Tools (ChatGPT, Gemini (Google Bard), Microsoft Copilot (Bing Chat)

Rev. Jarosław Krzewicki, PhD, European School of Law and Administration in Warsaw, Poland, krzew@libero.it

I. Introduction

The rapid evolution of artificial intelligence (AI) has ushered in a new era of technological advancements, reshaping the way we interact with machines and expanding the boundaries of what is possible. Among the most transformative innovations in this field is generative artificial intelligence (generative AI), a subset of AI that focuses on creating new content, ideas or solutions through algorithms and models trained on vast datasets (Alasadi & Baiz, 2023). This chapter delves into the world of generative AI, spotlighting three of its most prominent tools: ChatGPT, Gemini (Google Bard), and Microsoft Copilot (Bing Chat).

Generative AI uses deep learning techniques, particularly neural networks, to create text, images, music, and other human-like materials. These systems have been extensively trained on a variety of datasets, enabling them to understand and reproduce complex patterns within the data. Generative AI tools offer a wide range of capabilities, including generating coherent and contextually relevant text, as well as creating detailed visual content and more (Cao et al.2023).

ChatGPT, developed by OpenAI, stands at the forefront of conversational AI. It is designed to generate human-like responses in natural language, making it a powerful tool for customer service, content creation and interactive applications. Its underlying model, GPT (Generative Pre-trained Transformer), has undergone several iterations, each improving its ability to understand and generate text based on user inputs.

Gemini, also known as Google Bard, represents Google's foray into generative AI. This tool integrates seamlessly with Google's ecosystem, offering users a dynamic and interactive experience. Gemini combines the strengths of Google's extensive knowledge graph and advanced language models to provide insightful, context-aware responses that enhance productivity and creativity.

Microsoft Copilot, branded as Bing Chat in some contexts, exemplifies Microsoft's integration of generative AI into its suite of productivity tools. By embedding AI-driven capabilities into applications like Microsoft Office and Teams, Copilot enhances user efficiency and effectiveness, offering real-time assistance, drafting content and providing insightful recommendations.

This chapter provides a comprehensive overview of these cutting-edge tools, exploring their underlying technologies, practical applications and the transformative impact they have on various industries. We will examine how these tools are reshaping workflows, improving efficiency and opening new avenues for innovation. Through case studies and practical examples, readers will gain a deeper understanding of the potential and limitations of generative AI, as well as the ethical considerations and challenges associated with its deployment.

As we navigate through the intricacies of ChatGPT, Gemini and Microsoft Copilot, this chapter aims to equip readers with the knowledge and insights needed to leverage these tools effectively, fostering a greater appreciation for the remarkable advancements in generative artificial intelligence.

II. Review of Literature on AI Tools

Generative artificial intelligence (AI) has become a cornerstone of modern AI research and application, significantly advancing the capabilities of machine learning systems. This section provides a theoretical background on generative AI, highlighting key publications and contributions from the past five years that have shaped our understanding and development of these technologies.

The Evolution of Language Models: GPT and GPT-3

The evolution of generative AI in natural language processing (NLP) can be significantly attributed to the advancements in language models pioneered by OpenAI. Radford et al.'s 2018 paper, "Improving Language Understanding

by Generative Pre-Training" introduced the Generative Pre-trained Transformer (GPT). This model demonstrated the power of pre-training on a large corpus of text data, followed by fine-tuning on specific tasks. This two-step process significantly improved the model's performance across various NLP tasks, providing a robust foundation for more advanced models (Radford et al.'s 2018).

Building on this foundation, Brown et al. (2020) introduced GPT-3 in their paper "Language Models are Few-Shot Learners" GPT-3's architecture, with 175 billion parameters, enabled it to perform a wide range of tasks with minimal task-specific training data. The concept of few-shot learning showcased in this paper was groundbreaking. It allowed GPT-3 to generalize from just a few examples, making it highly versatile and capable of understanding and generating coherent, contextually relevant text across numerous applications. This capability marked a significant leap in the practical utility of generative AI models.

The underlying architecture of these powerful language models is the Transformer, introduced by Vaswani et al. in their 2017 paper, "Attention is All You Need". Although this publication slightly predates our five-year focus, its impact on generative AI cannot be overstated. The Transformer architecture relies on self-attention mechanisms, which enable it to process and generate text by focusing on different parts of the input data, effectively handling long-range dependencies. This innovation resolved many of the limitations associated with previous models like recurrent neural networks (RNNs) and convolutional neural networks (CNNs), making the Transformer a cornerstone of modern NLP and generative AI.

Extending Generative AI to Visual Content

Generative AI's applications are not limited to text. The development of models capable of creating visual content has been a significant area of research. In 2021, Ramesh et al. introduced DALL-E in their paper "Zero-Shot Text-to-Image Generation". DALL-E is a model designed to generate images from textual descriptions. This capability is achieved by training the model on a diverse dataset of text-image pairs, allowing it to understand and synthesize visual content from text inputs. DALL-E's ability to generate unique and contextually accurate images from descriptions has broad implications for design, art, and media, showcasing the versatility of generative AI beyond textual data.

The efficiency of training generative models is a crucial aspect of their development. Touvron et al.'s 2021 study, "Training data-efficient image transformers & distillation through attention", addressed the challenges of training efficiency and data requirements. They proposed methods to train image transformers more efficiently, which is essential for scaling these models while reducing the computational resources needed. These advancements are critical for making generative AI more accessible and practical for widespread use.

The rapid advancement of generative AI brings with it significant ethical considerations and societal impacts. Floridi and Chiriatti's 2020 paper, "GPT-3: Its Nature, Scope, Limits, and Consequences", provided a comprehensive analysis of GPT-3, discussing its technical capabilities, potential applications, and broader societal consequences. This work emphasized the need for responsible AI development and deployment, highlighting concerns such as bias, misinformation, and the broader ethical implications of deploying powerful AI systems in various domains.

Generative AI has also shown promise in the field of programming and software development. Chen et al.'s 2021 paper, "Evaluating Large Language Models Trained on Code", explored the application of generative models like Codex in code generation. Codex powers tools such as GitHub Copilot, which assist developers by generating code snippets based on natural language descriptions. This capability not only enhances productivity but also lowers the barrier to entry for programming, making software development more accessible.

These elaborations highlight the significant strides made in generative AI research, showcasing the transformative potential of these technologies. By understanding the theoretical underpinnings and key advancements in this field, we can better appreciate the development and impact of tools like ChatGPT, Gemini (Google Bard), and Microsoft Copilot. As we explore these tools in the subsequent sections, this theoretical background will provide valuable context for their capabilities and applications.

III. Overview of the Most Popular AI Tools

Overview of ChatGPT

ChatGPT, developed by OpenAI, is a conversational AI model that has revolutionized human-computer interactions. Leveraging the power of generative artificial intelligence, ChatGPT is designed to engage users in

natural language conversations, offering human-like responses and assistance across a wide range of applications. One of the core features of ChatGPT is that it exhibits a remarkable ability to comprehend and interpret human language, understanding context, nuances, and conversational cues to generate contextually relevant responses. Through its deep learning architecture, ChatGPT can adapt its responses dynamically based on the ongoing conversation, maintaining coherence and relevance over extended interactions. It can provide information, answer questions, offer recommendations, and even simulate personalities or characters. It offers scalability to meet diverse user needs and computational constraints.

ChatGPT can be fine-tuned or specialized on specific domains or tasks through additional training, enabling organizations to customize its responses and capabilities to align with their unique requirements. In content creation, ChatGPT's versatility allows writers and content creators to generate ideas, brainstorm topics, and even draft articles, stories, or marketing copy. It serves as a creative companion, offering inspiration and generating text based on user prompts. In the field of education, ChatGPT can act as a tutoring assistant, providing students with explanations, guidance, and feedback on academic concepts or homework assignments. It fosters personalized learning experiences and supports student engagement.

Overview of Gemini (Google Bard)

Gemini, also known as Google Bard, is an innovative generative artificial intelligence model developed by Google. Positioned as a successor to BERT (Bidirectional Encoder Representations from Transformers), Gemini represents a significant advancement in natural language understanding and generation, offering powerful capabilities for various applications. It is capable of bidirectional generation, meaning it can understand and generate text in multiple languages, contexts, and styles. This bidirectionality enables it to interpret user inputs accurately and generate contextually relevant responses.

Gemini integrates multimodal capabilities, allowing it to understand and generate text alongside other modalities such as images, videos, and audio. This versatility enhances its ability to interpret and respond to complex inputs across different formats. Users can exert fine-grained control over Gemini's generation process, specifying parameters such as tone, style, and level of formality. This level of control enables users to tailor Gemini's responses to specific contexts and audience preferences. Similar to other advanced AI

models, Gemini exhibits contextual adaptability, adjusting its responses dynamically based on the ongoing conversation or input context. This adaptability ensures coherence and relevance in interactions with users over extended dialogues.

Gemini is seamlessly integrated into the Google ecosystem, enabling its deployment across various Google products and services. This integration enhances user accessibility and facilitates the incorporation of Gemini's capabilities into existing Google applications. It powers virtual assistants and chatbots across various platforms, providing users with personalized assistance, information retrieval, and task automation. Its natural language understanding, and generation capabilities enhance user interactions and improve the overall user experience. Gemini supports educational content generation by generating quizzes, exercises, and learning materials tailored to specific educational objectives and student proficiency levels. Its adaptive generation capabilities enable personalized learning experiences and promote student engagement and comprehension.

Overview of Microsoft Copilot (Bing Chat)

Microsoft Copilot, also known as Bing Chat, is an innovative AI-powered tool developed by Microsoft, designed to assist software developers in writing code more efficiently and effectively. Leveraging advanced natural language processing (NLP) and machine learning algorithms, Copilot enhances developer productivity by providing intelligent code suggestions, context-aware completions, and real-time assistance during the coding process. It speeds up the coding process by reducing manual typing and minimizing syntax errors.

Copilot adapts its code suggestions and completions dynamically based on the programming language, framework, and libraries being used, as well as the specific coding patterns and conventions observed in the project. This contextual adaptability ensures that the generated code aligns with the developer's coding style and project requirements. Beyond code generation and completion, Copilot offers suggestions for code refactoring and optimization, helping developers improve code quality, readability, and performance. It identifies redundant code blocks, suggests more efficient algorithms or data structures, and offers insights into best practices and coding conventions. Copilot seamlessly integrates with popular integrated development environments (IDEs) such as Visual Studio Code, Visual Studio, and GitHub's CodeSpaces. Developers can access Copilot's features directly

within their preferred coding environment, enabling a smooth and uninterrupted coding workflow.

Copilot serves as a valuable learning tool for novice developers and students learning to code. By providing contextual code suggestions and explanations, it helps learners understand programming concepts, syntax, and best practices in real-time, facilitating skill development and knowledge acquisition. Copilot aids in code review and collaboration workflows by suggesting improvements, identifying potential bugs or vulnerabilities, and ensuring code consistency and adherence to coding standards. It fosters collaboration among development teams and promotes code quality and maintainability. Copilot encourages developers to explore new programming languages, libraries, and frameworks by generating code snippets and examples based on their queries and exploratory tasks. It facilitates experimentation and discovery, enabling developers to quickly grasp unfamiliar concepts and technologies.

IV. Best Practices

As the continuous progress of generative AI technology unfolds, its adoption across various industries continues to revolutionize long-standing practices while driving impressive advancements. Whether in the sector of healthcare, media, education, or public service, the integration of AI-powered technologies such as GPT-3 and Gemini is actively redefining the very fabric of these sectors. Through their presence, productivity is skyrocketing, and the impact of these industries is expanding exponentially. This segment provides a detailed exploration of the myriad ways in which different sectors are harnessing the transformative capabilities of generative AI, pushing the boundaries of innovation, and elevating their operational endeavors and offers invaluable insights into the future trajectory of AI-infused solutions, heralding a new era of possibilities and potentials.

OpenAI's Collaboration with Wikimedia Foundation (United States)

In the United States, OpenAI's collaboration with the Wikimedia Foundation represents a landmark initiative bridging AI research and knowledge dissemination. By integrating generative AI models like GPT-3 into Wikipedia's ecosystem, editors can leverage advanced language understanding and generation capabilities to enhance content creation and verification processes. AI-powered automated citation suggestions help

editors enrich articles with accurate references, significantly enhancing the credibility of the information presented. This feature not only saves time but also ensures that sources are consistently verified and up-to-date, maintaining Wikipedia's standard as a trusted information repository. AI tools can assist in identifying and mitigating biases, offering editors a way to present more balanced and neutral perspectives on various topics.

This collaboration underscores the potential of generative AI to augment human expertise, democratize access to information, and enrich collaborative platforms like Wikipedia with AI-powered tools for the benefit of millions of users worldwide.

ChatGPT in Healthcare Conversational Agents (United Kingdom)

Healthcare organizations in the United Kingdom are fully embracing generative AI, particularly ChatGPT, to transform patient interactions and support services. These cutting-edge conversational agents, powered by ChatGPT, are not only deployed on healthcare websites and mobile applications, but also on various other platforms, providing patients with personalized and unparalleled assistance and guidance. With their exceptional ability to understand natural language, these remarkable AI-driven virtual assistants accurately interpret patient queries and generate empathetic responses tailored to individual needs. Patients can now easily schedule appointments, access relevant healthcare information, and receive valuable real-time support, greatly enhancing their overall healthcare experience (MULUKUNTLA2022).

The integration of ChatGPT-powered conversational agents also reduces the burden on frontline healthcare staff by automating a wide range of routine administrative tasks and inquiries. This level of automation allows healthcare professionals to focus on delivering high-quality care and enhances their capacity to do so. These AI systems can provide continuous support, offering round-the-clock assistance to patients, which is particularly beneficial for those needing help outside regular office hours.

AI-driven virtual assistants can assist in patient education by providing accurate and easily understandable information about medical conditions, treatments, and preventive measures. The use of AI in healthcare also has significant implications for data management. By analyzing patient interactions, AI can identify patterns and trends, offering valuable insights for healthcare providers to improve service delivery and patient care strategies.

The seamless integration of generative AI into healthcare services is a clear example of its potential to increase patient engagement, streamline administrative workflows, and optimize resource allocation in the healthcare sector (Bharel et al., 2024).

Gemini's Impact on Journalism and Content Creation (France)

In France, media organizations are leveraging Gemini to revolutionize journalism and content creation, ushering in a new era of data-driven storytelling. Gemini's AI-driven content generation capabilities enable journalists and content creators to analyze vast datasets, extract actionable insights, and craft compelling narratives that resonate with audiences. By automating labor-intensive tasks such as article summarization and data analysis, Gemini empowers journalists to focus on uncovering newsworthy stories and providing in-depth analysis (Borchardt et al., 2024).

The implementation of Gemini significantly enhances the efficiency and productivity of media professionals. By taking over routine tasks, Gemini allows journalists to dedicate more time and resources to investigative journalism and the exploration of complex topics. Gemini's capabilities in predictive analytics allow media organizations to anticipate and respond to emerging trends and audience interests. Media outlets like Le Monde and France Télévisions harness Gemini's multilingual support and real-time translation capabilities to reach diverse audiences across linguistic boundaries, fostering greater global connectivity and information exchange. This integration of generative AI into journalism not only enhances the quality and relevance of media content but also strengthens the role of journalists as storytellers and knowledge brokers in the digital age.

AI usage for educators

AI tools such as ChatGPT, Gemini, and Microsoft Copilot can be effectively utilized by educators and instructors to immensely enhance the educational experience for their students (Graefen & Fazal, 2024). The integration of these AI tools can provide personalized support and valuable insights to both students and educators.

These tools have the capability to assess students' learning preferences, strengths, and weaknesses in order to create personalized learning materials such as quizzes, exercises, and study guides that are tailored to individual needs. This specialized and customized approach not only significantly

enhances student engagement but also fosters a deeper understanding of key concepts. In addition, with the help of AI-powered grading assistants, the time-consuming process of grading assignments can be streamlined as these assistants autonomously evaluate assignments, provide detailed feedback, and identify common misconceptions or errors. The power of AI algorithms goes even further as they can analyze students' performance data and learning behaviors to provide adaptive assessments, identify learning gaps, and offer personalized learning recommendations. Imagine the possibilities when educators can leverage these valuable insights from learning analytics to tailor instruction and provide support in each student's unique learning journey. It's like having a personalized coach for every student, ensuring that they receive the attention and guidance they need to succeed (Tapalova & Zhiyenbayeva, 2022).

Furthermore, AI chatbots equipped with natural language understanding capabilities can serve as virtual tutors, going above and beyond by assisting students with homework assignments, answering questions, and providing explanations for challenging concepts outside of classroom hours. The availability of these AI-powered tutors ensures that students have the necessary support and resources they require to excel academically. Moreover, educators can harness the power of AI tools to create educational content, design comprehensive lesson plans, and develop teaching materials that are perfectly aligned with curriculum standards and learning objectives (Nikolic et al.2024). These AI-generated resources not only support educators in optimizing lesson planning but also ensure instructional coherence and effectiveness. By eliminating the need for excessive time spent in designing curriculum materials, educators can focus their energy and expertise on delivering high-quality instruction and engaging with their students on a deeper level. Additionally, AI tools offer an array of resources for professional development and teacher support services. Educators can access personalized coaching, receive pedagogical recommendations based on their unique teaching style, and have direct access to a vast array of educational resources and best practices. This collaboration between educators and AI tools enhances their professional growth and enables them to continuously evolve as effective educators (Lameras & Arnab, 2021).

By embracing and integrating AI tools into their teaching practices, educators can unlock an abundance of new opportunities for innovation, efficiency, and effectiveness in education. (Celik, 2023) These tools hold the potential to revolutionize the way students learn and educators teach, ultimately fostering unprecedented levels of student success and lifelong

learning. AI tools extend their support to students with disabilities by offering assistive technologies such as speech recognition, text-to-speech conversion, and alternative input methods. Equipped with these assistive technologies, students with disabilities can overcome barriers and actively participate in classroom activities, ensuring that no student is left behind (Mageira et al.2022).

V. Integration in Education and Associated Challenges

Generative AI in education encompasses various applications, including intelligent tutoring systems, content generation, and student feedback mechanisms. These systems leverage AI algorithms to analyze student data, adapt instructional materials to individual learning needs, and provide real-time feedback and support. The underlying theory behind these applications draws upon principles of cognitive science, learning theory, and human-computer interaction (Kumar et al.2023).

Intelligent tutoring systems are designed based on cognitive models of learning, which emphasize the importance of providing timely and personalized feedback to learners. Generative AI enables these systems to simulate human-like interactions, offering tailored explanations, hints, and practice opportunities to enhance student understanding and mastery of concepts (Zhang et al., 2024). Adaptive learning platforms like Khan Academy and Duolingo integrate generative AI algorithms to personalize learning experiences for students. These platforms analyze user interactions, performance data, and learning goals to generate customized learning paths and recommendations. For example, Duolingo's AI-powered language learning platform adapts lesson difficulty and content based on individual proficiency levels, providing targeted practice exercises and feedback to optimize language acquisition.

Furthermore, the integration of generative AI in content generation addresses the challenge of creating adaptive and engaging learning materials. By analyzing student performance data and learning objectives, AI-powered systems can generate customized educational content, such as quizzes, exercises, and interactive simulations, that align with learners' proficiency levels and preferences. Companies like **ScribeSense** and **CogBooks** leverage generative AI to automate the process of content generation and textbook writing. These systems analyze educational standards, curriculum guidelines, and student learning outcomes to generate instructional materials, lesson

plans, and textbooks tailored to specific subjects and grade levels. While AI-generated content accelerates curriculum development, educators must critically evaluate the quality, accuracy, and pedagogical effectiveness of AI-generated materials.

However, the integration of generative AI in education also raises theoretical concerns related to algorithmic bias, privacy, and the role of human teachers (AlAli & Wardat, 2024). As AI systems influence learning experiences and decision-making processes, it is essential to ensure transparency, fairness, and accountability in their design and implementation. For instance, automated essay grading tools such as Turnitin's Gradescope and ETS's e-rater offer automated essay grading capabilities, enabling educators to efficiently assess and provide feedback on student writing assignments. These systems employ natural language processing techniques to analyze essay structure, coherence, and grammar, generating instant feedback on areas for improvement. While automated essay grading saves time for educators, it also raises concerns about the reliability and validity of AI-generated assessments compared to human grading.

Moreover, universities and educational institutions are exploring the use of virtual teaching assistants powered by generative AI to support student inquiries and administrative tasks. For instance, Georgia State University's chatbot "Pounce" uses natural language processing to answer student questions, provide course information, and assist with enrollment procedures. Virtual teaching assistants like Pounce enhance student support services, but they also require careful monitoring to ensure accurate and contextually appropriate responses.

VI. Conclusion

In this chapter, we explored the transformative impact of generative artificial intelligence (AI) and innovative AI tools such as ChatGPT, Gemini (Google Bard) and Microsoft Copilot (Bing Chat) across various domains. From enhancing human-computer interactions to revolutionizing software development, these AI tools have reshaped the way we work, learn and interact with technology.

Generative AI models have demonstrated remarkable capabilities in natural language understanding and generation, enabling human-like interactions and personalized experiences. These models have significantly transformed various industries and have a wide range of applications. Specifically, ChatGPT is extensively utilized in customer service, education,

content creation, and therapeutic interventions, where it has proven to be remarkably effective in delivering exceptional user experiences.

Gemini and Copilot, two other generative AI models, possess exceptional proficiency in generating content, translating languages, storytelling, and even software development. Their capabilities have opened up new avenues for innovation and creativity in these areas. The seamless integration of these AI tools with existing platforms and ecosystems further enhances their usability and applicability in real-life scenarios.

Recommendations for organizations implementing AI tools include a strong commitment to ethical AI practices. By doing so, organizations can mitigate potential risks and ensure positive societal impacts. Emphasizing transparency and responsible AI use should be a top priority to maintain public trust and confidence. Interdisciplinary collaboration plays a significant role in tackling complex societal challenges associated with AI. Bringing together AI researchers, domain experts, policymakers, and ethicists will help navigate the ethical dilemmas and ensure that AI technologies serve the common good. By fostering collaboration and knowledge exchange, we can develop comprehensive approaches that consider diverse perspectives and interests.

User education and awareness are equally vital in the advancement of responsible AI adoption and usage. Educating users about the capabilities and limitations of AI, as well as its ethical implications, empowers them to make informed decisions. It is through this awareness that individuals can responsibly engage with AI technologies and fully leverage their potential. Continuous innovation and research remain the driving force behind the advancements in AI. Ongoing efforts are crucial to push the boundaries of what is possible, address emerging challenges, and unlock new opportunities for AI-driven solutions across diverse domains. By investing in research and encouraging innovative thinking, we can further propel the state-of-the-art in AI and harness its transformative power for the betterment of society as a whole.

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Chapter 2
AI's Impact on Academic Studies and Science. An Ethical Perspective

Assoc. Prof. Dr. Murat AKTAN Muğla Sıtkı Koçman University, Faculty of Economics and Business Administration, Turkey, murataktan@mu.edu.tr

Prof. Dr. Tuğba UÇMA UYSAL Muğla Sıtkı Koçman University, Faculty of Economics and Business Administration, Turkey, utugba@mu.edu.tr

Assoc. Prof. Dr. Ceray ALDEMİR Muğla Sıtkı Koçman University, Faculty of Economics and Business Administration, Turkey, cerayaldemir@mu.edu.tr

I. Introduction

Alan Turing first raised the question of whether machines can think in his seminal paper "Computing Machinery and Intelligence." After this breaking-edge development, scholars and some private technology initiatives, including Turing, Apple Siri, and Amazon, have developed tests (i.e., Turing test, ELIZA, Amazon Alexa, Microsoft Cortana, etc.) in an attempt to evaluate machine's ability to act, plan, predict like humans (Dönmez et.al., 2023). According to Xu et al. (2021), if a machine is capable of mimicking human behavior and thinking like human beings, it is considered artificially intelligent. Therefore, AI can shortly refer to the imitation of human intelligence by a technological machine or a system that can learn, perceive, predict and do planning, etc.

The ever-increasing surge of interest in AI has primarily centered around remarkable advancements such as ChatGPT and other tools that are changing our habits of finding information. Meanwhile, public discourse has raised concerns about AI's unforeseen threats and advantages (Aldemir and Uysal., 2024) AI has been stigmatized by many people for causing layoffs in the job markets, generation of faulty information, AI-enabled surveillance, and biased decision-making making (Agrawal et al., 2024). Euronews (2023) reported that a Belgian male possessed by eco-anxiety found comfort in talking to Eliza (a chatbot using EleutherAI's GPT-J language model) about climate change. According to his wife, Eliza reportedly encouraged him to sacrifice his life to

help the planet. Although there are mounting examples of AI's potential drawbacks and fears, AI's main contribution to our lives lies in its capacity to transform scientific innovation, discovery, and academic studies (Kren et al., 2022). In this respect, this chapter aims at categorizing AI's influence on academic studies by investigating current scientific literature. AI's influence on academic studies is listed as follows: "personalized learning, teaching assistants, data analysis and research automation, AI and value co-creativity, and ethical considerations." Despite the ever-growing importance of ethics when it comes to integrating new technologies into our lives, there is no study in the literature focusing on ethical aspects of AI use in the academic field. At this point, this chapter proposes a conceptual framework dealing with ethical issues related to the use of AI in academic studies (Nehme et al., 2022; Demir, 2017; Wright, 2011).

II. Personalized Learning

One of AI's significant impacts on academic studies is personalized learning. Personalized learning is defined as adapting learning to the individual's strengths, capabilities, and personal conditions. This approach provides learners with a flexible environment in which they are empowered to decide what, how, where, and when they learn (Patrick et al.ru, 2013). Personalized learning collects data from each learning activity and then uses this data to tailor learning solutions according to individual needs. Personalized learning also allows students to progress and learn at their abilities and pace, providing them with a comfortable and flexible learning environment. Nevertheless, AI and personalized learning generally lack the affective, critical thinking, and interactive aspects of humans and thus cannot entirely replace physical education (Fitria, 2021; Rouhiainen, 2019).

In essence, AI has the potential to transform educational institutions, complement physical education, and optimize the learning process. Universities worldwide have faced a wide range of challenges, especially after the economic downturn caused by the pandemic. Forced shifting to online teaching to control the infections caused worldwide protests from university students, causing high dropout rates and students' disengagement (Aktan et al., 2023; Zaman et al., 2021). However, on the positive side, students have become more used to learning on online platforms, urging universities to modernize the traditional "one-size-fits-all" approach in education. According to the Harvard Business Review article, personalized learning powered by AI presents a huge benefit to tailoring education to individuals' abilities and

needs, enhancing students' engagement and lessening dropout rates. Furthermore, lecturers can also have a more accurate and detailed understanding of each student's learning process, increasing the course's effectiveness. In particular, an AI-based personalized learning system can provide lecturers with significant information about students' learning styles, progress, and abilities and provide suggestions about how to adapt their teaching methods to each student. In short, personalized learning systems are pivotal for future educational institutions to help their students reach their full potential and thrive (Rouhiainen, 2019).

III. AI Teaching Assistants

In a systematic review article focusing on applications of artificial intelligence in higher education from 2016 to 2022, Crompton and Burke (2022) highlighted the extent to which artificial intelligence can support students' learning process. As a particular example, AI teaching assistants can interact with students with the aim of diagnosing students' needs. For instance, an AI teaching assistant can elaborate on whether a student needs help in "goal initiation (want it), goal formation (plan for it), action control (do it) and emotion control (finish it)" (Kim and Bennekin, 2016). Similarly, Georgia Tech has developed an artificially intelligent agent named "Jill Watson," unleashing the potential of lifelong learning. In the spring of 2016, Jill Watson was introduced as a pioneering virtual teaching assistant. Initially designed to alleviate the workload of human TAs by handling routine queries, Jill quickly became famous as her news spread. Some students claimed that they didn't even notice that she was not real, and Jill triggered widespread attention with media coverage in national news outlets. Nevertheless, the creators of Jill emphasized that AI assistants will complement human educators, not entirely replace them. Artificial intelligence teaching agents will revolutionize learning, making quality education a reality for more people worldwide (Tate, 2018).

Benefits and Impacts of AI Teaching Assistants

AI teaching assistants have many benefits, increasing the effectiveness of physical education. For instance, they warrant an instant response to students' queries without making students wait for a convenient time. Long story short, AI assistants are irrespective of time zones or schedules. In a similar vein, they can deal with numerous queries simultaneously, making them efficient when dealing with overcrowded classrooms with diverse backgrounds.

Nevertheless, AI assistants are consistent in their responses, always providing similar responses to frequently asked questions. Thus, in terms of consistency, they provide more robust and consistent assistance to all students. Last but not least, AI assistance can take into consideration students' academic abilities and preferences and offer the best solutions to students at an individual level. In their intensive literature survey, Qui et al. (2023) showed the benefits of using AI assistance in English courses for students in China. In summary, AI is found to improve learner's second language writing skills while providing real-time feedback and allowing teachers to design tailored courses. In another recent work, Schön et al. (2023) demonstrated the impacts of AI assistants on education by offering a novel structure involving multifaceted layers of AI-supported education. In their conceptualization, the authors assessed the AI assistants' impact on humans, organizations adopting them, and the overall learning process.

Impact of AI Assistants on Students and Teachers

AI has a substantial impact on students as it allows students to notice and reduce their knowledge gaps and receive personalized monitoring and assessment of their progress (Zawacki-Richter et al., 2019). Student assessment constitutes an integral part of the learning process, which provides essential feedback to students about their overall progress and understanding. In alliance with rapid digital transformation in educational organizations, traditional methods to measure student performance need to be updated. Prior literature has revealed that AI-driven self-assessment tools are more effective than classroom-based examinations. The reason lies in the fact that digital environments offer timely and personalized feedback, which eventually fosters students' engagement with the learning process (Saini et al., 2024). AI-powered self-assessment tools may also assist students in tracking their educational progress and help them build self-directed learning abilities.

When it comes to teachers, AI assistants can accomplish various compulsory tasks such as grading assignments, administration, feedback, plagiarism detection, and course and syllabus design. Hence, the teachers have more time to focus on value-creating tasks such as supporting low-performers and providing empathic teaching and academic assistance (Rudolph et al., 2023). However, these benefits come with explicit costs. While adapting AI tools, students and teachers have to improve their AI skills to properly apply this cutting-edge technology (Carolus et al., 2022). The prior literature has addressed a variety of skills that are essential in working with AI assistants, such as ChatGPT. These AI skills are generally highlighted as digital literacy,

AI literacy, language skills, and machine-learning knowledge (Wang et.al. 2022).

Furthermore, people's perception of AI assistants, such as the perceived benefits and problems, may also determine their motivation to benefit from AI assistants (Sarwari et al., 2023). In a recent study on a student sample in the UAE, Bilquise et al. (2024) explored factors (i.e., socio-emotional, functional, and relational factors) affecting students' behavioral intentions in adopting AI-powered academic assistants. The study findings unveiled that the perceived ease of use and social influence significantly increase chatbots' acceptance intentions. However, other factors, such as perceived usefulness and trust, were found to have no significant impact on behavioral intentions to accept advising chatbots. Another research chose students enrolled in four universities in the UAE, famous for having AI voice-based assistants. During the survey, only the students who had used AI assistants were recruited, and the empirical findings revealed that enjoyment, trust, and perceived ease of use positively influenced the perceived usefulness of AI voice assistants (Al Shamsi, 2022). Despite these similar findings, research on AI's impact on students and teachers is still a nascent field of research. Therefore, there is a need for more research integrating behavioral theories that are well-accepted in different disciplines to understand AI assistants and human interaction better.

Impact of AI Assistants on Organizations

The rapid adaptation of AI assistants in higher education organizations will eventually result in the integration of AI assistants into every aspect of student affairs, from preparing study materials to issuing certificates. These digital helpers are reachable 24 hours a day, 7 days a week, to assist organizations in a multifaceted way, including the matriculation process, administrative tasks, etc. However, there are some hidden dangers that may reduce the quality of education. For instance, imagine a scenario where lecturers utilize AI assistants to create exams while students, in turn, also rely on AI assistants to craft their answers. In this case, it would end up in a situation where AI generates the complete exam, which will be completed again by an AI assistant. This absurd scenario poses the threat of adopting AI assistants without enacting regulations and measures (Susnjak, 2022).

From the academic viewpoint, traditional modes of student assessment, such as online exams, homework, and term papers, will become obsolete with the increased penetration of AI assistants such as ChatGPT. This development

forces higher education organizations to reconsider their assessment tools while finding innovative and tech-based solutions to ensure fair evaluation and combat fraud. In this regard, universities must enact new regulations and clear guidelines that are imperative to safeguarding academic integrity (Schön et al., 2023).

IV. Data Analysis and Research Automation with AI in Academic Studies and Science

Data analysis using artificial Intelligence that relies on elements from machine learning and statistics is revolutionizing academic research. The fact that AI-powered systems enable data analysis automation and unlock new insights means a remarkable leap forward in the research world (Anning et al., 2022). With AI penetrating academia, a need was born to have principles to constrain AI usage. As proposed by Wilkinson (2016), the FAIR principles ensure that AI-generated scientific data remains findable (F), accessible (A), interoperable (I), and reusable (R) across different platforms and applications. Thanks to FAIR platforms like TensorFow and Pytorch (Ravi et al., 2022), scientists are becoming more capable of benefiting from AI libraries for in-depth scientific inquiry (Sbailò et al., 2022). Especially when researchers have clear research goals and hygienic structured data. The future of AI in scientific and academic fields is promising (Grimaldi & Ehrler, 2023). Apart from the advantages of FAIR AI-scientific platforms, the prior literature has manifested several ways in which AI may contribute to scientific research.

First, unlike their traditional human counterparts, AI algorithms can quickly process vast amounts of data, helping researchers maneuver through complex datasets efficiently (Moraru et al., 2020). This characteristic is particularly beneficial when data is too complex because AI can identify patterns and relationships that may not be apparent in traditional methods. In a similar vein, Pethani (2021) manifested that AI can analyze medical images such as X-rays, helping with disease diagnosis and physical treatment. Furthermore, academic tools like Scite.ai can support researchers by summarizing prior literature, crafting scientific manuscripts, generating summaries, highlighting critical information in prior studies, suggesting related studies, and even helping in the peer-review process (Angelis et al., 2023; Buriak, 2023). This automation streamlines the research process and helps researchers harness the latest findings in their field.

4.1. AI and Co-Creativity in Academic Studies and Science

Thanks to its increasing prevalence, AI has become an integral part of the creative process, leading to the emergence of human-AI collaboration to produce creative outputs. Human-AI co-creativity is a twofold practice in which AI not only supports human creativity but also actively engages in the creative process (Rezwana & Maher, 2023; Rezwana & Maher, 2022). The prevalence of AI platforms will unstoppably trigger new forms of co-creation and innovation (Gordon et al., 2022; Oppenlaender, 2022). Larsson et al. (2022) proposed that AI can be delegated more suggestive roles rather than controlling and monitoring the creativity process, making AI a reliable partner instead of a human colleague. Empowering AI with more agency and responsibility is proposed as a novel approach that can enhance co-creativity efficiency. However, using AI in co-creative activities is not without challenges. In a recent study, Vinchon et al. (2023) manifested four laws aimed at enhancing human-AI co-creativity morally. First, by its design, AI must not duplicate the work of a human and credit content created by humans. Furthermore, in creative endeavors, AI must adhere to ethical and moral standards and not create harmful content, where the ultimate goal is the betterment of the environment and planet. Last but not least, AI must disclose when the content is created artificially. Long story short, the evolving landscape of AI and co-creativity discloses the potential to fundamentally transform the way creativity and innovation are redefined in various domains.

4.2. Ethical Considerations of AI use in Academic Studies and Science

Autonomous AI systems can collaborate with humans, and thanks to machine learning, they can learn from their environment, human behavior, and experiences from human-AI interaction. Consequently, AI's capabilities to mimic human intelligence and creativity sometimes go beyond a real human's ability when dealing with scientific knowledge. Therefore, ethical standards are to be set to clarify what will be perceived as moral/ethical or vice versa as an outcome of the human-AI interaction. One of the seminal works in this field was carried out by Steinert (2014), who developed the term roboethics, referring to the essential ethical norms that autonomous smart robots must adhere to.

Majeed (2017) suggested that ethics is related to "the intrinsic evaluation of what is good or bad," while law enforcement dictates acceptable good behaviors and punishes the wrong ones. From the AI viewpoint, the main ethical concern involving AI is the conflicting interests of normal individuals and scientists/scholars using advanced tools like AI. In short, although it is people's right to be safe, AI technology grows ambitiously, sometimes violating them in their comfort zones (Alsegier, 2016). As a response, prior literature addressed the need for comprehensive ethical frameworks to establish coherent ethical standards keeping up with technological advancements such as smart robots, AIT, and blockchain technologies (Nehme et al., 2022; Demir, 2017; Wright, 2011).

V. Framework for Ethical AI Usage in Academic Studies

Although prior literature has offered ethical frameworks for smart robots, autonomous intelligent systems, and AI in general (Nehme et al., 2022; Wong, 2021; Leikas et al., 2019), there is limited to no study in the literature focusing on ethical aspects of AI use in academic field. Therefore, establishing AI ethics principles in the academic field is imperative to guide the development and deployment of science-related artificial intelligence technologies. Prior literature manifested some key principles for responsible AI usage, including transparency, accountability, fairness, privacy, and respect for human autonomy (Madaio et al., 2020; Mittelstadt, 2019). In addition, ethical AI solutions in science and academic studies shouldn't overlook the human factor because humans not only use but are also being influenced by AI technologies (Shaban-Nejad et al., 2022). At this point, Huriye (2023) suggested adopting a human-centered approach to prioritize the needs and values of humans (i.e., students, professors, teachers, school managers, etc.) by taking account of every stakeholder's opinion while formulating the AI ethical guidelines.

Despite the mentioned studies, there are also some studies offering ethical frameworks to ensure that AI systems function in coherence with ethical principles. Floridi et al. (2018) analyzed the existing sets of AI ethical principles produced by reputable stakeholders and initiatives such as the Asilomar AI Principles, The Montreal Declaration for Responsible AI, the European Commission's European Group on Ethics in Science and New Technologies, etc., and identified fourtyseven principles. Afterwards, Floridi et al. (2018) synthesized five principles that adapt well to the ethical

challenges posed by artificial intelligence. As one objective of this chapter, these principles are explained from the lens of academic studies below.

Autonomy

In academia, the integration of AI introduces a paradigm where scholars willingly delegate certain aspects of decision-making to machines. Embracing the autonomy principle requires a delicate equilibrium between the decision-making authority retained by humans (i.e., scholars and students) and that which is delegated to artificial agents. Also, the "autonomy" concept emphasizes not only the promotion of human autonomy but also a prudential limitation of AI's autonomy. From an ethical viewpoint, human choice's intrinsic value must be safeguarded, especially in pivotal research decisions. Scholars must determine which decisions AI is permitted to make and delegate decision-making only when it is necessary and efficient. In short, the autonomy principle asserts that human intellect and judgment must not be overlooked, and the excessive reliance on AI in scientific decisions must be avoided. For instance, although AI algorithms can autonomously analyze academic literature to help scholar find gaps in a particular field of study, scholars must not be reliant only on AI but conduct their own literature survey by accessing the original sources. Therefore, AI agents should be considered virtual assistants capable of analyzing vast amounts of literature, helping scholars and students to formulate sound research ideas. Similarly, AI tools can process and analyze complex datasets and extract some meaningful insights. However, interpreting a research finding requires a researcher's expertise of particular research methods. Especially when it comes to understanding the broader context and implications of the research findings, domain-specific knowledge, critical thinking ability, and academic experience are essential (Spector & Ma, 2019).

Beneficence

The principle of beneficence manifests that AI technologies must contribute positively to humanity and the environment. Therefore, researchers utilizing AI technology must ensure that their work is ethical and AI is used for good purposes. According to the beneficence principle, when scholars deploy AI agents, their inherent objective must be fostering prosperity for mankind and animals and preserving nature and the environment (Pieper & Thomson, 2016).

In academia, scholars are utilizing AI applications in various fields such as public health, environmental science, ecology, etc. AI agents can analyze health data and predict and prevent the spread of diseases (Baclic et al., 2020). Likewise, AI techniques in agriculture can optimize yields by reducing use of natural resources and minimizing adverse environmental impacts (Efremova et al., 2023). To sum up, thanks to interdisciplinary science collaboration, AI can play a transformative role in preserving nature and promoting the well-being of both humans and animals. Therefore, it is the scholar's duty to prioritize human and planet interests over self-interests.

Non-Maleficence

Although the non-maleficence principle advocates the promotion of well-being, which is similar to the already discussed beneficence principle, the main concern of non-maleficence is preventing the potential adverse effects of excessive or improper utilization of AI technologies (Moraru et al., 2020). Therefore, this principle encompasses preventing deliberate and unintentional arms, whether arising from AI itself or the actions of scholars and students. For example, suppose a social researcher (i.e., graduate student) conducting research on human subjects by processing a large volume of personal data via an AI agent. In line with the maleficence principle, the researcher needs to verify that the AI algorithm does not negatively discriminate against certain groups based on religion, ethnicity, education, and race over others. Also, in online education, AI systems must be designed to ensure transparent communication, and consent must be sought from all stakeholders (i.e., students and teachers). In personalized learning, AI agents need to learn the personal details and knowledge levels of the students to provide a better experience. Necessary measures must be taken during the design stage of AI to prevent privacy violations such as sharing personal information with other users (i.e., school administration and other students) without personal consent. Furthermore, if AI has some mispredictions about students' abilities, there is a potential danger that it can undermine students' autonomy and offer inappropriate content, thus putting students' learning progress in danger.

Justice

In the realm of academia, the justice principle concerns the equitable allocation of resources and opportunities. Because scientific research often seeks to address challenges humans face and foster well-being, justice in AI ethics must entail considering and prioritizing collective benefits. For

instance, in scientific research, the broader societal impact must be targeted, including disadvantaged and underprivileged communities. Thus, AI-automated research neglecting the needs of vulnerable communities would not produce equitable results, bringing the need for human coordination before and during the research process.

From the institutional viewpoint, not all scientific institutions and researchers have similar opportunities and infrastructure to equivocally benefit from AI resources. Even students are impacted by this inequality as their organizations (i.e., schools, universities, etc.) may not allocate extra budget to purchase AI tools on an institutional basis. This gap between organizations worsens the problem of unequal educational rights and opportunities, justifying social inequalities and distorting national competitiveness (Meyer, 2016). By upholding the AI justice principle, academia can contribute to the sustainable advancement of society as a whole.

Explicability

Floridi et al. (2018) coined the concept of explicability as the combination of "intelligibility and ethical accountability" as a complementary principle to the four principles mentioned above. In their conceptualization, "intelligibility" refers to humans' capability to understand how AI works, and "accountability" provides an answer to the question: "Who takes responsibility for the AI actions?". According to the explicability principle, human stakeholders must possess particular AI knowledge and skills to understand the underlying mechanism of AI outcomes and actions (i.e., intelligibility). Consequently, the explicability principle asserts that human users must accept their accountability in the event of a negative, unwanted outcome.

From the academic viewpoint, academic and research institutions may develop awareness and educational courses and programs to enhance AI literacy. Thanks to these initiatives, students and scholars gain solid knowledge to sense AI operating logic and the associated responsibilities they hold in case of wrongdoings. Thus, users are to be taught that it is their moral responsibility to use AI technologies in a transparent and accountable way. Also, scholars and students must provide explanations to human readers about how and to what extent AI was utilized in the research design, analysis, and interpretation of the findings. However, this responsibility shouldn't be left to individuals, but educational organizations must provide legal frameworks and

guidelines showcasing how explicability can be deployed in individual research efforts (Coppi et al., 2021).

V. Conclusion

The exponential growth of artificial intelligence (AI) has been reshaping academic studies and scientific research. Despite the cutting-edge advancements thanks to AI, there are also unprecedented ethical challenges for higher education organizations, research institutions, students and scholars, etc. (Uysal and Aldemir, 2023) The introduction of AI has revolutionized personalized learning, catering to individual's capabilities, needs, and preferences. Furthermore, the adoption of AI teaching assistants has enhanced the efficiency of physical education since it can provide instant responses to student queries and support in various academic tasks. Although the prior literature postulated that AI-powered systems are effective, there is a general belief that they lack human empathy and sensibility toward learners and students. Also, utilizing AI assistants necessitates continuous skill development among students and teachers to harness the full potential of these technologies while mitigating potential drawbacks (i.e., ethical violations). Thus, AI must be considered complementary to traditional physical education methods, cultivating critical thinking and interactive skills in learners.

Besides education, AI has proven to be an invaluable tool for researchers and scholars. AI-powered systems can streamline data analysis and automate research. In this way, AI agents can process vast data sets, finding patterns that would otherwise be hard for human intelligence to discover. Therefore, AI facilitates the extraction of information, accelerating scientific discovery. Nevertheless, AI usage in science should abide by the FAIR principle of data management, ensuring that the data created by AI remains findable, accessible, interoperable, and reusable. Last but not least, the emergence of human-AI co-creativity in science has redefined the creative process, offering novel opportunities for collaboration and innovation between and within researchers and AI systems.

As AI technologies continue to permeate academic institutions, it is imperative to critically examine their impact and formulate ethical frameworks to guide their responsible use. Floridi et al. (2018) classified five principles of ethical AI: autonomy, beneficence, non-maleficence, justice, and explicability. The present book chapter also developed an ethical framework that resonates with the needs of academic studies and scientific work and proposed some suggestions.

As a rule of thumb, researchers utilizing AI technology must ensure that their work is ethical and that AI is used for good purposes (Spector & Ma, 2019). Also, researchers using AI in their studies should provide clear explanations of how AI was used and its impact on research findings, ensuring transparency and accountability (Coppi et al., 2021). To mitigate the potential risks of AI, scholars and students are advised to conduct their own literature survey to ensure thoroughness and critical analysis, although AI is capable of doing comprehensive literature surveys within a minuscule time (Moraru et al., 2020). Similarly, AI systems used in educational settings should be designed to protect student privacy and avoid bias in content delivery, safeguarding students' autonomy and well-being. Lastly, academic research initiatives using AI should prioritize addressing societal challenges, including those affecting disadvantaged communities.

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Chapter 3
AI Tools for Personalized Learning

Svitlana Tarasenko, PhD in Economics, Sumy State University, Ukraine, tarasenkosvitlana1@gmail.com

Yuriy Petrushenko, Professor, Doctor of Economic Sciences, Sumy State University, Ukraine, y.petrushenko@biem.sumdu.edu.ua)

I. Introduction

The higher education system is transforming under the influence of technology and globalization. One of the important areas of transformation in the academic services provided by higher education institutions is personalized learning. Personalized learning is seen as a response to the challenges of traditional approaches to learning, which are often limited by institutional frameworks or external circumstances, such as the learning process schedule, the size and diversity of the student body, and the availability of learning resources. In the traditional learning model, the pace of learning is determined by the majority, which often results in neglecting the opportunities and abilities of the minority and creating barriers to learning. The capabilities of artificial intelligence (AI) currently being tested can be used to personalize student learning, helping to build an inclusive and accessible learning environment according to the needs and capabilities of each student.

This chapter focuses on the use of AI to make the educational process more individualized for each student. The first part of the chapter provides an overview of personalized learning in a research environment and forms of AI tools for personalized learning. Next best practices of AI tools for personalized learning are presented. Finally, the chapter examines the benefits, challenges, and integration strategies of personalized learning with AI tools. The main issues addressed in the chapter are summarized in the conclusion.

II. AI as a tool for personalizing student learning

The trend of personalized learning is driven by a desire to increase its effectiveness and attractiveness (Rossiter et al., 2024), acknowledging technology as the driving force behind the transformation of education (Rossiter et al., 2024; Rahiman & Kodikal, 2024). The primary goal of personalized learning is to furnish each student with a unique learning experience that ensures educational quality and enhances outcomes. This is achieved by tailoring the teaching-learning process to meet the diverse learning needs, abilities, opportunities, individual pacing, and learning styles of each student. Key factors influencing the effectiveness of this approach include:

- Identifying students' individual needs and capabilities;
- Adapting content and methods;
- Diversifying instructional method;
- Monitoring and support.

Personalized learning also implies a degree of autonomy and academic freedom for students (Shemshack & Spector, 2020), allowing them to progress at their own pace, choose their learning experiences, and study at times that suit them best.A study by Walkington & Bernacki (2020) examines three main dimensions of implementing personalized learning. The first dimension concerns the consideration of students' experience in the educational process. For example, education can be personalized according to the student's characteristics at a simplified, superficial level (including a specific element tailored to the student's hobbies/interests in the educational task to capture their attention), or at the level of significant characteristics (learning goals).

The second dimension of personalized learning implementation relates to the size of the students' group. Based on this parameter, personalization can be applied individually for each student, for small groups, or large groups, using more general characteristics. For instance, adapting educational tasks for students based on their proficiency level in a foreign language can be considered personalization based on general parameters. Personalization for smaller student groups, for example, involves executing tasks based on four specified parameters. Personalization for small-sized groups entails shaping individual learning experiences for students, including the use of AI tools.

The third dimension of personalized learning implementation involves the extent of autonomy and choice offered to students. Options can range from individual learning paths (what is learned) to methods of achieving learning

outcomes (how learning is accomplished). Thus, taking into account students' individual interests and needs contributes to their engagement and motivation in learning, as well as deeper mastery of the educational material. The integration of AI tools into higher education expands the possibilities of personalized learning. With their ability to quickly process large volumes of information and identify trends, AI tools adapt the teaching-learning process to the needs, abilities, opportunities, and learning goals of each student (Dumont & Ready, 2023). Furthermore, AI-enabled personalized learning contributes to improving academic performance and democratizing access to education (Gligorea et al., 2023).

Among the main forms of educational products that utilize AI are:

- adaptive learning platforms

- AI-based tutoring systems, and various forms of data analytics, such as predictive analytics (Jian, 2023).

Adaptive learning platforms

Adaptive educational platforms analyze data on students' progress and performance to create a personalized learning experience (Tretow-Fish & Khalid, 2023). These platforms use AI and machine learning algorithms to tailor content, pace, and delivery methods based on an analysis of each student's strengths, weaknesses, pace, and learning styles, thus optimizing the learning process and enhancing learning outcomes (Gligorea et al., 2023). Integrating AI tools into learning platforms also creates opportunities for generating and utilizing dynamic learning content (generate personalized learning materials).

Moreover, both students and academic staff can have the ability to access information regarding learning progress in real-time. This enables instructors to identify issues in the learning of individual students and provide timely timely assistance and support (Alé-Ruiz et al., 2023). AI tools can collect personal data about students from various sources: online platforms, assessment results, and media resources. This data may include demographic indicators, information about cognitive development characteristics, as well as details about interaction patterns and preferences. The collection of this data, whether in real-time or asynchronously, enables AI-based learning systems to continually refine student profiles.

AI tutors or intelligent tutoring systems

AI tutors or intelligent tutoring systems are powerful AI tools for personalized learning that simulate interaction with academic staff. They provide individualized assistance, offering explanations, resources, and feedback tailored to each student's pace and learning style. AI tutors deliver instant feedback, answer questions, and offer hints or explanations to guide students through their tasks, helping them achieve desired learning outcomes. These tools adapt educational strategies based on student progress and are accessible 24/7.

Intelligent tutoring systems present an innovative approach to overcoming traditional educational barriers such as accessibility, cost, and location, by providing on-demand learning experiences. For example, an AI tutor might assist a student struggling with a calculus concept by offering step-by-step problem-solving sessions, adjusting the difficulty level based on the student's responses. Another example is language learning chatbots that use natural language processing (NLP) to engage students in the target language, providing a conversational approach to language learning. These bots can simulate real-life conversations, making corrections and introducing new vocabulary and grammar as needed, thereby enhancing language acquisition. A positive example of using AI tutors is educational product of Walden University, which developed Julian, an AI tutoring system utilizing Google Cloud AI technology (Sadler, 2023).

Thus, AI tutors can complement interactions with human teachers by offering a learning experience tailored to each student’s educational needs, abilities, capabilities, and goals. So adaptive learning platforms use AI to tailor educational content to the individual needs of each student. They adapt the difficulty, style, and pace of the material based on the student’s performance and learning preferences. By analyzing a student's interactions and progress, adaptive learning platforms provide personalized pathways through the curriculum, ensuring that students receive the right level of support. And AI tutors or intelligent tutoring systems act like virtual tutors, providing personalized instruction and feedback to students. They simulate one-on-one tutoring experiences using AI. AI-based tutoring systems can identify areas where students are struggling and offer help, explanations, and practice problems. They often use natural language processing to understand and respond to students' questions.

In the next section we will explore the best practices universities employ in using AI tools for personalized learning.

III. Best practices of AI tools for Personalized learning

Carnegie Mellon University's Simon Initiative

Carnegie Mellon University's Simon Initiative is a cross-disciplinary research initiative that focuses on improving learning outcomes through the use of technology and data analytics. It leverages AI and machine learning algorithms to develop personalized learning experiences for students. AI Integration: The Simon Initiative utilizes AI-powered educational platforms and tools to analyze student data, such as learning behaviors, performance metrics, and engagement patterns. This data-driven approach enables instructors to tailor instruction, interventions, and support services to meet the diverse needs of students. By understanding each student's strengths, weaknesses, and learning preferences, instructors can tailor instruction and interventions to optimize learning outcomes The Simon Initiative places a strong emphasis on enhancing learning outcomes for students across various disciplines. By leveraging technology and data analytics, the initiative seeks to identify effective teaching methods, improve student engagement, and ultimately drive academic success. The Simon Initiative fosters innovation in teaching and learning practices, driving continuous improvement in educational outcomes (The Simon Initiative).

University of Michigan's Digital Innovation Greenhouse (DIG)

The University of Michigan's DIG is an interdisciplinary research and development center that explores emerging technologies, including AI, for educational innovation. It collaborates with faculty, students, and industry partners to create AI-driven solutions for personalized learning AI Integration: DIG develops AI-powered learning platforms and tools that adapt to individual student needs and preferences. These platforms analyze student data, such as learning styles, performance trends, and knowledge gaps, to deliver personalized content, assessments, and feedback (Digital Innovation; Bogardus, 2017). Through its AI initiatives, the University of Michigan enhances student engagement, learning outcomes, and retention rates. DIG's innovative approach to personalized learning fosters student success and empowers educators to make data-informed instructional decisions.

Stanford University's Lytics Lab

Stanford University's Lytics Lab is a research group that focuses on advancing personalized learning through the integration of AI, learning analytics, and cognitive science. It collaborates with faculty, students, and educational technology experts to develop AI-driven solutions for higher education. AI Integration: The Lytics Lab develops AI algorithms and models that analyze student data from various sources, such as learning management systems, online activities, and assessment results. These algorithms generate personalized recommendations for course materials, study strategies, and academic support services (The Stanford).

Stanford University's Lytics Lab enhances student engagement, motivation, and achievement through its AI-driven personalized learning initiatives. By leveraging AI for adaptive learning experiences, the lab contributes to the advancement of teaching and learning practices in higher education. So universities have opportunity to improve educational process using AI tools. However, the integration of these tools into education comes with associated challenges that must be addressed.

IV. Integration in Education and Associated Challenges

The model of influence AI tools for personalized learning is demonstrated at Fig. 1.

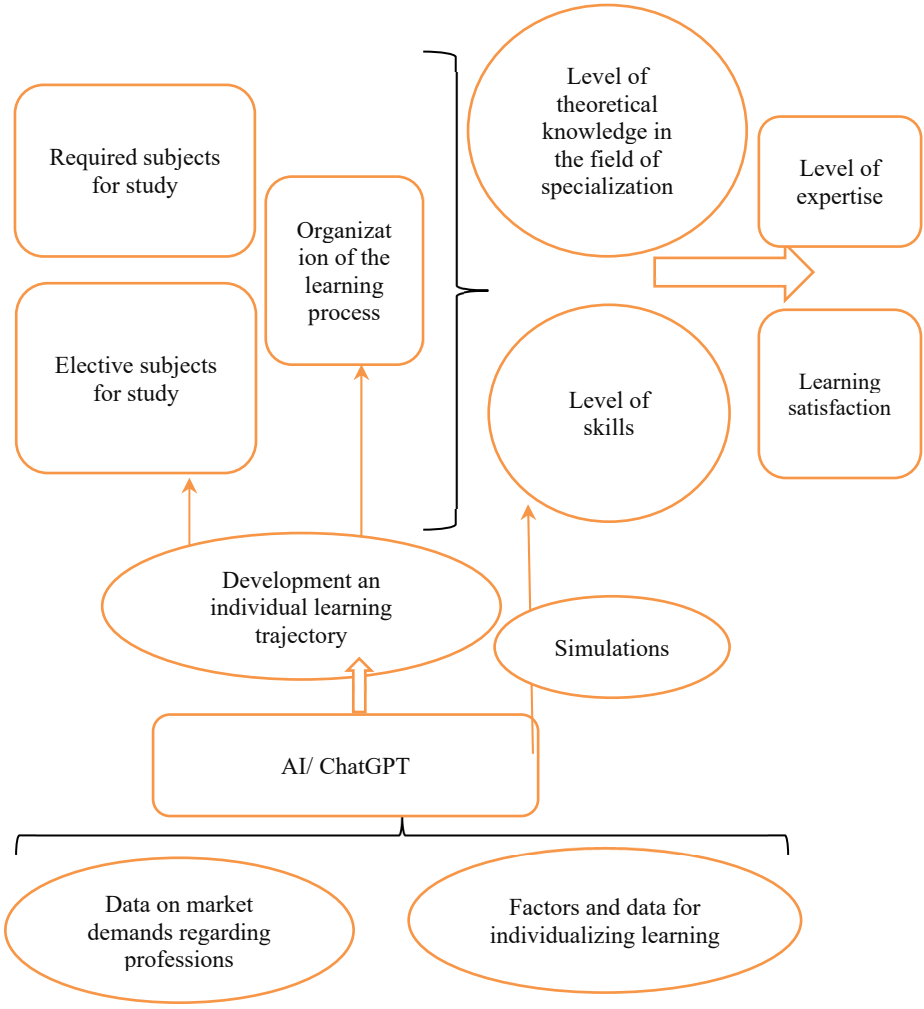

Fig. 1. Model of influence AI tools for personalized learning

It includes the following connections and mechanisms:

1. Development an individual learning trajectory based on market demand data for professions and factors/data for learning personalization using AI/ChatGPT.

2. Adapting the organization of the initial process and forming a list of elective disciplines for study according to the individual learning trajectory.
3. Creating simulations using AI/ChatGPT to develop skills in accordance with the individual learning trajectory.
4. Level of skills are determined by simulations, the organization of the learning process, normative and elective subjects for study.
5. Level of theoretical knowledge in the specialty is determined by the organization of the learning process, normative and elective subjects for study.
6. Level of skills and the level of theoretical knowledge in the specialty determine the student's level of expertise and satisfaction with learning.

The integration of various AI tools in a higher education institution for the personalization of learning take place following stages:

1. *Planning and definition of goals*	• Clearly formulate the objectives for integrating AI tools into the teaching and learning, specifying the desired outcomes of the personalized learning system; • Evaluate and select adaptive learning platforms and AI tools that best meet these objectives.
2. *Development of technical infrastructure*	• Install and configure adaptive learning platforms and AI tools within the existing learning support system; • Develop security protocols to protect students' personal data.
3. *Data collection and analysis*	• Automatically collect data on student performance, learning styles, and individual needs; • Use AI and machine learning algorithms to analyze this data and identify patterns and trends in student learning.
4. *Personalization of the teaching and learning*	• Automatically adapt learning content and teaching methods to the individual needs of students; • Utilize AI tutors to provide personalized support for students.
5. *Monitoring and evaluation*	• Regularly monitor student progress to determine the effectiveness of AI implementation; • Analyze collected data to assess the impact of using AI tools for personalization on academic performance and student satisfaction

This proposed sequence offers a general guideline for the implementation of AI technologies for personalizing learning in higher education. Therefore, through the integration of AI tools into the higher education system, opportunities arise to enhance the effectiveness of learning and implement personalized learning technology. The AI capabilities currently being tested can help adapt the educational process to students' individual educational needs, thus contributing to improved academic performance and the quality of educational services. Adaptive educational platforms, AI-based tutoring systems – these educational products play a crucial role in shaping flexible and relevant teaching methods. Moreover, the use of AI in education may not only be a tool for improving specific aspects of the educational process but also become the foundation for delivering services in higher education.

The integration of AI tools into education not only opens new opportunities for the implementation of personalized learning technology but also poses challenging tasks for higher education institutions in transforming the learning environment. According to a UNESCO report (2023), AI can significantly transform teaching and learning methods, offering solutions to the challenges of the digital era. Digital technologies enhance the quality and accessibility of education by adapting the teaching-learning process to the individual needs of students. However, this requires the development of appropriate policies to ensure the ethical use of AI, data privacy, and non-discrimination. Such an approach to integrating AI into education can harness the potential of AI while ensuring fairness and equality in access to quality education.

Research in recent years on the problem of using AI in education indicates many ***benefits*** that contribute to the implementation of personalized learning technology. These advantages include:

Dynamic learning content and learning resources: The integration of AI tools makes it possible to offer a large number of personalized learning resources and materials that meet the learning needs of each student (Chen et al., 2024; Jian, 2023). Learning platforms with integrated AI algorithms can recommend additional resources to students, such as books, articles, and video lectures, that help deepen their understanding of complex topics or overcome specific knowledge gaps. This allows students to progress at their own optimal pace and time, mastering the nuances of the courses, which enhances program learning outcomes and boosts study motivation.

Personalized assessment and feedback: The use of AI tools significantly changes the assessment of student progress and learning outcomes. Primarily,

this concerns the ability to automate the evaluation of a wide variety of tasks, from simple tests to complex analytical works. AI generates accurate and diverse feedback, not only detecting errors or inaccuracies in student works but also offering advice on how to improve them (Xu et al., 2021; Hooda et al., 2022). This capability fosters continuous self-improvement in the learning process. Additionally, the use of AI tools substantially reduces the time academic staff spend on grading assignments, allowing them to focus more on enhancing teaching methods and individual student interactions (Liu et al., 2020).

Predictive analytics for early intervention: By analyzing personalized data, AI algorithms can help identify at-risk students early, predicting potential academic difficulties before they become apparent. With such information, teachers can provide targeted and timely support to students (Herodotou et al., 2019). Such a proactive approach helps to maintain students' motivation, involving them in the learning and supporting their academic success.

Involvement in learning through gamification: The use of adaptive learning platforms with gamified elements such as missions, awards and leaderboards significantly motivate students by providing them with an interactive and engaging learning experience (Daghestani et al., 2020; Alsubhi et al., 2021). The use of AI algorithms to create personalized gamified tasks highlights the potential of this technology in increasing student engagement and learning productivity.

Promotion of inclusive education: AI algorithms, thanks to the possibility of creating personalized learning experiences, offer a path to a more inclusive education, meeting the diverse needs, abilities, capabilities and learning styles of students (Jian, 2023). This is especially true for people with special learning needs who need additional support in the learning process. For example, for students with dyslexia, AI algorithms can present text content in formats that are more readable or use audiovisual materials to enhance comprehension. In addition, AI contributes to the creation of an inclusive learning environment by adapting not only academic content but also teaching methods to accommodate a diversity of learning styles. This means that every student receives the necessary support and resources to achieve programmatic learning outcomes regardless of special learning needs and capabilities.

***Improving the quality of education through data analysis*:** AI tools greatly enhance the ability to analyze student data, which serves not only to

personalize learning but also to improve teaching-learning strategies at the institutional level. With the help of AI algorithms, higher education institutions can analyze large volumes of data to uncover trends and patterns that might go unnoticed with traditional monitoring methods (Luan et al., 2020). This contributes to the development of more effective curriculums and the optimization of courses, thereby improving the quality of students' learning experiences. Specifically, AI algorithms can identify effective teaching and learning methods, the most popular resources among students, and curriculum and course aspects that require updating or refinement. Automated analysis identifies gaps in students' knowledge, enabling timely corrections that ensure high-quality education.

Thus, the integration of AI tools in higher education creates a more effective learning environment that adapts to the needs of each student and the constantly changing requirements of the modern world.

Despite these significant advantages, the integration of AI tools in higher education also presents several ***challenges***, ranging from ethical considerations and data privacy to the need for robust institutional infrastructure and appropriate staff training. Let’s explore these challenges in more detail.

Confidentiality and security of personal data: The integration of AI tools into the teaching-learning process, especially in the context of personalized learning, raises significant concerns related to the privacy and protection of personal data (Gligorea et al., 2023). Ensuring the security of personal data requires a comprehensive approach that includes the use of modern encryption technologies, secure data transmission protocols, and the development of reliable data loss and theft protection systems. To effectively manage data privacy and security, it is essential for all parties involved in the teaching-learning process – including students, academic staff, and administration – to be informed about the rules and practices for ensuring privacy. Another important aspect is the development and implementation of institutional policies and procedures for the responsible use of personal data, including their collection, storage, analysis, and use. Monitoring and regularly revising these policies are crucial to adapting them to changing conditions and addressing new challenges in the field of data protection.

Ethical dilemmas: The integration of AI in education introduces several ethical dilemmas. One primary concern is the potential bias in AI algorithms, which may perpetuate existing social and cultural stereotypes. This underscores the necessity for transparency in how AI algorithms function,

allowing students and teachers to understand how decisions are made within the teaching-learning process – including recommendations and assessments – to foster trust in AI-enhanced learning experiences.

The ethical creation and use of AI-generated content must ensure accuracy, objectivity, and freedom from bias or misinformation. This consideration extends to issues of copyright and content ownership.Maintaining fairness, transparency, and integrity in the use of AI also requires clear, itructured communication, informed consent from all participants in the teaching-learning process, and opportunities to challenge AI-based decisions (Bajaj, 2023). Continuous monitoring, evaluation, and adjustment of AI algorithms are crucial to prevent negative impacts on students' learning experiences (Gligorea et al., 2023).

Impact on social interaction in the teaching-learning process: The use of AI tools in education can diminish direct human interaction, which is vital for developing students' social skills (Hohenstein et al., 2021). Although AI is effective in supporting personalized learning, it cannot fully replicate the complexity of human emotions and social connections (Maples et al., 2024). It is important, therefore, to adopt a balanced approach that leverages the benefits of AI while preserving the importance of direct interaction in the learning process. Courses should include group projects, discussions, and other interactive learning activities to foster interpersonal skills and community building. In this context, academic staff can utilize AI as a supportive tool, ensuring that learning remains student-centered and communication remains a core element of the teaching-learning process.

Excessive reliance on AI: The integration of AI also introduces risks associated with over-dependence on technology (Shanmugasundaram & Tamilarasu, 2023). Such dependency can impede the development of critical thinking and creativity in students, which are crucial for innovation and solving complex challenges (Ivanov, 2023). Therefore, institutions of higher education should develop and implement strategies that effectively integrate both innovative and traditional teaching methods. These strategies should include updated assessment criteria that reflect a broader range of competencies, including critical thinking, creativity, and teamwork. Additionally, it is essential to develop and incorporate AI literacy courses within educational programs to provide students with the knowledge necessary for the effective and ethical use of these tools (Liang, 2023).

Long-term impact on students' intellectual and emotional development: Concerns exist about the potential long-term effects of AI on students'

intellectual and emotional development, including risks like digital dementia – a decline in cognitive function attributed to the overuse of digital technology – and impaired working memory performance (Maples et al., 2024; Shanmugasundaram & Tamilarasu, 2023). As the evidence regarding these impacts remains mixed, employing AI tools judiciously in education is crucial. Specifically, we advocate for an integrative approach that complements rather than replaces human cognitive functions (Bai et al., 2023).

Technical requirements and infrastructure: The technical requirements and infrastructural foundation are critical for successfully integrating AI tools into the educational processes at higher education institutions. This integration forms an essential part of the digital transformation of the learning environment and the development of the digital ecosystem. For example, the implementation and maintenance of educational platforms based on AI algorithms require both software and hardware infrastructure, as well as technical specialists. Moreover, integrating various AI algorithms and machine learning techniques with existing electronic learning support systems poses a complex challenge. Continuously updating and training AI models is crucial to ensure their effective performance and relevance over time.

Resistance to innovation and academic staff training: Resistance from academic staff, concerned about the potential replacement of their roles, is one challenge in integrating AI tools. This resistance can slow down transformational processes in higher education and hinder the integration of AI tools (Shemshack & Spector, 2020). To overcome this resistance, it is vital to implement professional development programs for academic and technical staff. These programs should not only provide the necessary knowledge and skills but also help staff understand the benefits of integrating AI tools and algorithms (Alé-Ruiz et al., 2023). Such programs could include training, seminars, workshops and other educational activities that address fundamental AI concepts, ethical considerations, and approaches of implementing AI tools in the educational process.

The challenges discussed in integrating AI tools into the educational environment of higher education institutions demonstrate the complexity of this process. During the implementation of AI in the educational process, it is important to ensure that AI does not undermine the fundamental goals of education but rather helps improve the quality and accessibility of higher education Based on the advantages and challenges of integrating AI tools in higher education, assessing the potential benefits and risks of this process is possible (Table 1).

Table 1. SWOT Analysis of Integration AI Tools in Higher Education for Personalized Learning

Strengths	*Weaknesses*
1. AI adapts the teaching-learning process to the individual needs of students, allowing for a more personalized learning experience 2. Fast and effective feedback and evaluation enhance learning outcomes 3. Student engagement and motivation through interactive and tailored content Optimization of resources (e.g., time, materials, budget), improving efficiency in educational delivery.	1. High cost of implementation, necessitating significant initial investments 2. Risk of developing a dependence on technology, potentially reducing critical thinking skills 3. Resistance to innovation among staff, often arising from concerns about job security and workflow changes Need for additional training for staff and students to effectively utilize new AI tools
Opportunities	*Threats*
1. Growth of digital competence among students, preparing them for modern technological workplaces 2. Expanding access to education for students with learning needs, offering customized support 3. Development of new teaching approaches and methods that correspond to the demands of the AI era Improving the quality of learning services by addressing the learning needs of each student	1. Data privacy and security issues, necessitating robust protection measures 2. Ethical dilemmas, such as bias in AI algorithms that could affect fairness in learning opportunities 3. Potential isolation due to excessive use of digital technologies, impacting social skills development 4. Possible decline in students' intellectual and emotional development if AI tools are not integrated thoughtfully

The presented SWOT analysis is identified strategies for integrating AI to personalize student learning in higher education institutions. These ***strategies*** include using strengths to capitalize on opportunities (SO strategies), leveraging strengths to minimize threats (ST strategies), addressing weaknesses by seizing opportunities (WO strategies), and mitigating negative aspects in the face of existing threats (WT strategies) (Table 2).

Table 2. Strategies of Integration AI Tools in Higher Education for Personalized Learning

SO Strategies	*ST Strategies*
S1O1. High-level personalized learning strategy S1O2. Educational product diversification strategy according to specific educational needs S1O3. Educational chat-bot development strategy S1O4. 50:50 Strategy (50% interaction with AI-tutor in the learning process, 50% traditional learning) S2O1. Systematic implementation strategy of AI in the educational process S2O2. Individual AI courses strategy S2O3. Student Performance Improvement Strategy based on AI S2O4. Student satisfaction enhancement strategy based on AI S3O1. High-level personalized learning strategy S3O2. Individual AI courses strategy S3O3. AI-tutor development strategy S3O4. Individual AI courses strategy S4O1. Medium-level personalized learning strategy S4O2. Educational product diversification strategy according to specific educational needs S4O3. Educational chat-bot development Strategy S4O4. Student performance improvement strategy based on AI	S1T1. Educational chat-bot development strategy S1T2. Low-level personalized learning Strategy S1T3. 50:50 Strategy (50% interaction with AI-tutor in the learning process, 50% traditional learning) S1T4. Individual AI Courses strategy S2T1. Medium-level personalized learning strategy S2T2. Individual AI courses strategy S2T3. Low-level personalized learning strategy S2T4. Individual AI Courses strategy S3T1. Medium-level personalized learning strategy S3T2. 50:50 Strategy (50% interaction with AI-tutor in the learning process, 50% traditional learning) S3T3. Low-level personalized learning strategy S3T4. Low-level personalized learning strategy S4T1. Partnership strategy with technology companies S4T2. Educational chat-bot development strategy S4T3. Low-level personalized learning strategy S4T4. Educational chat-bot development Strategy
WO Strategies	*WT Strategies*
W1O1. Strategy of partnership with technology companies W1O2. Low-level personalized learning strategy W1O3. Educational chat-bot development strategy W1O4. Strategy of individual courses with AI W2O1. 50:50 strategy (50% interaction with AI-tutor in the learning process, 50% traditional learning) W2O2. Strategy of individual courses with AI	W1T1. Low-level personalized learning strategy W1T2. Strategy of partnership with technology companies W1T3. Strategy of individual courses with AI W1T4. Strategy of individual courses with AI W2T1. Low-level personalized learning strategy W2T2. Strategy of individual courses with AI

W2O3. Strategy of diversification of educational products according to special educational needs W2O4. Medium-level personalized learning strategy W3O1. Strategy of systematic implementation of AI in the educational process W3O2. Strategy of diversification of educational products according to special educational needs W3O3. Strategy of individual courses with AI W3O4. Medium-level personalized learning strategy W4O1. Strategy of partnership with technology companies W4O2. Strategy of diversification of educational products according to special educational needs W4O3. Strategy of AI-tutor development W4O4. Strategy of systematic implementation of AI in the educational process	W2T3. Low-level personalized learning strategy W2T4. Low-level personalized learning strategy W3T1. Strategy of individual courses with AI W3T2. Strategy of individual courses with AI W3T3. Strategy of individual courses with AI W3T4. Strategy of individual courses with AI W4T1. Strategy of partnership with technology companies W4T2. Medium-level personalized learning strategy W4T3. Strategy of individual courses with AI W4T4. Strategy of individual courses with AI

Thus there are four types of strategies:

1. By the level of personalization:
    - high-level personalization strategy. This strategy involves creating highly customized learning experiences tailored to each student's unique needs and learning pace. AI tools continuously adapt content and assessments based on real-time performance data. This approach maximizes individual student engagement and success but requires significant resources and sophisticated AI algorithms;
    - medium-level personalization strategy. It offers a balanced approach, providing tailored learning paths while maintaining some standardization across the curriculum. AI tools adjust content based on general performance trends and common learning patterns. It provides personalized support without the complexity and cost of high-level customization;
    - low-level personalization strategy. This strategy offers basic personalization, such as adapting the difficulty level of tasks or providing supplementary resources based on overall student

performance. AI tools use minimal data to make slight adjustments to the learning experience. It's a cost-effective way to introduce personalization without extensive infrastructure changes.

2. By interaction methods:
   - chat-bot development strategy. It provides developing AI chatbots to assist students with frequently asked questions, administrative tasks, and basic learning support. Chatbots provide instant responses and can be available 24/7, enhancing student accessibility and convenience. This strategy helps free up human resources for more complex interactions;
   - AI-tutor development strategy. It proposes creating AI-powered virtual tutors that offer personalized instruction, feedback, and support to students. AI-tutors simulate one-on-one tutoring experiences and can adapt their teaching style to individual learning preferences. This strategy aims to provide personalized learning assistance;
   - 50:50 strategy (50% interaction with AI-tutor during learning, 50% traditional learning). This strategy combines AI-tutor interactions with traditional face-to-face or online learning methods. Students spend 50% of their time engaging with AI-tutors and 50% with human instructors or self-study materials. This blended approach leverages the strengths of both AI and human teaching for a comprehensive learning experience.
3. By implementation scale:
   - systemic implementation strategy of AI. This strategy provides integration AI across the entire educational institution, affecting all departments, courses, and administrative processes. This comprehensive approach ensures that AI tools and data are used to enhance learning outcomes and operational efficiency. It requires significant investment and change management but can transform the institution;
   - individual courses with AI strategy. It means that AI tools implement in specific courses or programs to pilot and refine their effectiveness. This approach allows for targeted improvements and the collection of detailed feedback before broader application. It’s a cost-effective way to test AI integration and demonstrate its value;

- partnership strategy with technology companies. It deals with collaboration universities with technology companies to access cutting-edge AI tools and expertise. Partnerships can provide institutions with the resources and support needed to implement advanced AI solutions without developing them in-house. This strategy leverages external innovation and reduces the burden on institutional resources.

4. Depending on the goals:
   - strategy for improving student performance based on AI. This strategy uses AI to analyze student performance data and identify areas for improvement. AI tools provide targeted interventions and personalized learning plans to help students achieve better academic outcomes. This strategy focuses on maximizing academic success and closing achievement gaps;
   - strategy for increasing student satisfaction with AI-based learning. It enhances student's experience by using AI to provide timely support, personalized learning paths, and engaging content. This strategy aims to increase student satisfaction by making learning more enjoyable and responsive to individual needs. It focuses on the qualitative aspects of education, such as student engagement and well-being;
   - strategy for diversifying educational products according to specific educational needs. This strategy provides developing of AI-driven educational products to diverse learning preferences and requirements. This strategy involves creating specialized tools and resources for different subjects, skill levels, and learning styles.

Each of the recommended strategies has the potential to achieve an optimal balance between implementing innovative technologies and accommodating the unique functions of higher education institutions. The effectiveness of integrating AI into the learning environment requires gradual implementation of these strategies, adapted to the specific conditions and needs of the institution. This approach helps increase the adoption of innovations among all stakeholders.

V. Conclusions

Personalized learning promotes the individual development of each student and enhances the overall quality of education. Key elements of the effectiveness of personalized learning include identifying individual needs and abilities of students, adapting content and teaching methods, providing diverse instructional approaches, and monitoring and supporting studentsıo The role of technology in personalized learning lies in providing students with autonomy and academic freedom, allowing them to learn at their own pace and convenience.

Measures of implementing personalized learning include considering students' experiences, group size, and the level of autonomy in choosing learning trajectories and methods of achieving results. The model for integrating AI tools into higher education involves building individual learning plans, adapting educational programs, and creating skill development simulations. AI tools help optimize the learning process and provide support for the individual development of each student.

To integrate AI for personalized student learning, higher education institutions could use strategies such as:

- By the level of personalization: high-level personalization strategy, medium-level personalization strategy, low-level personalization strategy.
- By interaction methods: chat-bot development strategy, AI-tutor development strategy, 50:50 strategy (50% interaction with AI-tutor during learning, 50% traditional learning).
- By implementation scale: systemic implementation strategy of AI, individual courses with AI strategy, partnership strategy with technology companies.
- Depending on the goals: strategy for improving student performance based on AI, strategy for increasing student satisfaction with AI-based learning, strategy for diversifying educational products according to specific educational needs.

AI tools offer varied integration possibilities, from institutional to individual levels. Academic staff, for instance, can utilize AI tools such as ChatGPT, Gemini (Google Bard), and Microsoft Copilot (Bing Chat) to personalize the learning experience for students, aligning with the policy of their higher educational institutions. The successful integration of AI tools in education not only requires teachers to possess technical skills but also to

engage in continuous self-development. By realizing the potential of AI to personalize learning and finding a balance between technology use and personal interaction, educators can maximize the benefits of AI. This approach ensures a harmonious blend of innovation with traditional teaching and learning methods, effectively overcoming potential challenges.

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Chapter 4
AI tools for Evaluation

Klaudia Sadurska, The Eastern Institute of Business Education Foundation, Poland, klaudia.sadurska@gmail.com

Wojciech Duranowski, PhD in economics, University of Opole, Poland, biuro@zofiazamenhof.pl

Zbigniew Dąbrowski, MA, The Eastern Institute of Business Education Foundation, Poland, biuro@zofiazamenhof.pl

I. Introduction

In the rapidly evolving landscape of education, artificial intelligence (AI) is emerging as a transformative force with the potential to revolutionize the evaluation process. The problems with integrating AI tools into evaluations, however, are due to the lack of knowledge and insufficient focus on best practices involving AI tools (Celik, 2023). To effectively incorporate these tools in evaluations, it is important for evaluators to sufficiently understand how AI works as a tool. While a potential result of the integration of AI tools into evaluations could be better-informed policymaking, transparency and accountability through evaluators remain an increasingly important task as we embrace this innovative use of technology.

While using a set of closely linked tools, activities and criteria to evaluate a student's decontextualized literacy knowledge (understanding and use of abstract language, reading, and writing skills that are not tied to immediate, practical contexts) and skills on a point or continuum scale, not adequate enough to be integrated with his/her socio-culturally appropriated knowledge fails to provide sufficient information about the problems and the lack of understanding (Jokhan et al., 2022). To overcome such fragmentation, the student has to be evaluated as a 'whole'. With a more comprehensive and detailed evaluation, the decontextualized literacy knowledge and skills should be integrated with the student's socio-culturally appropriated knowledge and competencies. However, it is not easy to evaluate the students who are capable of deploying multidimensional and multimodal actions.

Regardless of the educational context, assessment plays an important role in learning spaces, focusing the teacher's attention on the strengths and difficulties of each student. As the focus points of each level of education vary and depending on the internal and external policies of each country, the goals of the evaluation instruments are quite variable. In the standards-based approach, goals are often rooted in 'decontextualized' literacy knowledge and skills that teachers are expected to present in their teaching to a certain extent aside from their socio-cultural appropriated knowledge. The improvement in students' learning and reasoning requires that students' decontextualized literacy knowledge and skills should be integrated with these socio-culturally appropriated knowledge (Ivanović et al.2022).

This chapter delves into the intersection of AI tools used for evaluation, providing a comprehensive overview of the latest theoretical research, best practices and practical challenges associated with integrating AI tools into educational settings. We begin with an extensive review of the theoretical foundations. These studies offer valuable insights into the mechanisms by which AI can assess progress, the benefits and potential drawbacks, and the ethical considerations that must be addressed.

Following the theoretical exploration, we present three international case studies that exemplify successful implementation of AI tools in education. These examples from Finland, China, and the United States highlight diverse approaches and contexts, showcasing the versatility and global relevance of AI-driven evaluation tools. We then turn our attention to the practical aspects of integrating AI in education, examining the technical, pedagogical and organizational challenges that educators and institutions face. From curriculum design to teacher training, infrastructure requirements to stakeholder engagement, this section provides a roadmap for overcoming the obstacles to effective AI integration. Through this comprehensive examination, we aim to equip educators, policymakers and researchers with the knowledge and tools necessary to harness the power of AI for evaluation, ultimately contributing to more effective, engaging and equitable educational experiences for all students.

II. Desk Research – Theoretical Background

In this section, we explore the theoretical underpinnings of AI tools for evaluation, drawing on ten key publications from renowned databases such as Web of Science (WoS), Scopus, IEEE Xplore, and ERIC, all published within the last five years. This review aims to provide a robust understanding of the

current state of research, the benefits, challenges and emerging trends in the field.

Definition and Scope of AI-Driven Evaluation

AI-driven evaluation refers to the implementation of advanced artificial intelligence technologies to assess and deeply analyze student performance, offering timely and insightful feedback. This revolutionary approach to educational strategies aims to customize instruction in order to cater to the distinct and specific requirements, abilities, and passions of each individual student. Unlike conventional assessment methods, this cutting-edge approach places emphasis on dynamic, data-driven techniques which have the capability to provide remarkably precise and personalized feedback (Ahmad et al.2023). By harnessing the power of AI tools, evaluation is revolutionized through:

- Adaptive testing: The power of AI allows for tailor-made assessments by dynamically adjusting the complexity of questions based on each student's proficiency, thus ensuring a highly accurate evaluation of their knowledge and skills. This adaptive testing approach is a game-changer in providing customized assessments that truly reflect a student's abilities.
- Real-time feedback: By employing AI systems, students receive prompt and immediate feedback, which is instrumental in helping them comprehend their areas of strength and identify the areas that require improvement. This real-time feedback mechanism empowers students to actively participate in their learning journey, enabling them to progress and develop at an optimal pace.
- Predictive analytics: Through the thorough analysis of patterns within student data, AI possesses the remarkable capability to predict future academic performance and pinpoint students who may be at risk. By identifying potential areas of concern at an early stage, AI helps educators take proactive measures to offer the necessary support and guidance to students, ensuring their success and well-being (Fahd et al.2022).

Embarking on the AI-driven evaluation route promises to unravel a realm of endless possibilities, transforming the educational landscape as we know it. Embracing AI technology empowers educators, students, and institutions alike to unlock the full potential of education by fostering accurate assessment, timely feedback, and predictive insights. With AI as our guide, education takes

a stride towards innovation and excellence, paving the path for a brighter and more successful future (Saaida2023).

III. AI Algorithms and Models in Evaluation

Artificial intelligence algorithms are central to the evaluation of student performance, utilizing machine learning (ML) and deep learning (DL) to analyze and process student data (Alsariera et al.2022). These advanced algorithms are instrumental in predicting the most effective and efficient learning paths for individual students, optimizing their educational journey to ensure maximum growth and comprehension (Gligorea et al.2023). The primary types of AI algorithms used in evaluation systems are as follows:

1) Supervised learning. These algorithms undergo thorough training using extensive and diverse labeled datasets, enabling them to accurately predict outcomes and offer highly personalized recommendations for students. Through a meticulous examination of the data, they can identify which concepts a student has already mastered, tailoring their educational experience based on individual strengths and weaknesses. Additionally, these algorithms pinpoint areas that require further attention, ensuring a comprehensive learning process.

2) Unsupervised learning. In contrast to supervised learning, these intelligent algorithms uncover complex patterns and relationships in data without predefined labels. By carefully analyzing vast amounts of information, they reveal new and valuable insights about student learning behaviors and preferences. This comprehensive understanding allows educators to refine teaching methodologies and create an even more inclusive and adaptive learning environment.

3) Deep learning. Powered by neural networks, specifically deep learning models, these algorithms excel in handling and processing massive volumes of data. With their exceptional capabilities, they effortlessly recognize and decipher complex patterns, contributing to the creation of truly adaptive learning experiences (Ferlitsch, 2021). By constantly adapting and evolving with the learner's progress, deep learning algorithms ensure an immersive educational journey tailored to the unique needs and aspirations of each student.

3.1. Benefits and Impact on Learning Outcomes

Research highlights the significant benefits of AI-driven personalized evaluation systems. These benefits are instrumental in transforming traditional evaluation methods into more dynamic, personalized and effective process.

- AI-driven evaluation systems offer interactive and adaptive assessments that adjust in real-time based on the individual's performance. This adaptability ensures that each assessment is tailored to the individual's current level of understanding and skill, which can lead to several advantages, such as: increased engagements, personalized experience and immediate feedback (Saaida2023).
- By offering tailored feedback and resources, AI systems can significantly enhance learning outcomes. Another advantage is giving better understanding of the subject matter, as students receive guidance that is directly relevant to their needs.
- Adaptive evaluation technologies are adept at diagnosing learning gaps and providing targeted interventions, which can be crucial for improving overall outcomes. This can include early detection of issues and customized interventions (iu Zaman, 2024).

These benefits underscore the transformative potential of AI in evaluation, offering a more personalized, efficient and effective approach to assessing and enhancing individual performance. By using AI tools, evaluation systems can provide a more impactful assessment experience.

3.2. Future Trends and Research Directions in AI Evaluation

The field of AI in evaluation is continuously evolving, with several promising trends on the horizon. Let's explore these exciting advancements in more detail:

1) Natural Language Processing (NLP): Natural Language Processing technologies are increasingly being utilized to enhance interactive assessments and provide more intuitive feedback (Onesi-Ozigagun et al.2024). With advancements in NLP, educators can expect a significant improvement in the accuracy and contextuality of feedback provided to students. The capability of AI-driven systems to understand and interpret human language will revolutionize the way assessments are conducted, ensuring a more personalized and enriching learning experience (Yousuf & Wahid 2021).

2) Predictive Analytics: AI-driven predictive analytics offer educators real-time insights and support. By analyzing vast amounts of data, predictive analytics can anticipate student needs and proactively address learning challenges before they become significant obstacles. This proactive approach to education will provide educators with the tools they need to tailor their teaching methods, ensuring that each student's unique requirements are met. Through the utilization of predictive analytics, educators will have the ability to guide students on a successful learning path and help them achieve their full potential (Chen et al. 2020).

These remarkable advancements are set to redefine and expand the capabilities of AI tools for evaluation, making them more effective and responsive to individual student needs. By synthesizing recent research and highlighting emerging trends, this theoretical background provides a solid foundation for understanding the current and future landscape of AI in evaluation.

This comprehensive review of the theoretical background not only sets the stage for understanding the practical applications of AI tools for evaluation but also explores the challenges that come with integrating these tools into education. In the subsequent sections of this chapter, we will delve into the intricacies of implementing AI in evaluation, addressing potential concerns and providing strategies for successful integration. Together, these advancements in AI evaluation promise to reshape the education landscape, empowering educators and students alike. The future holds immense potential for leveraging AI tools to create a more personalized, effective, and inclusive learning environment. As we embark on this exciting journey, let's embrace the transformative power of AI and unlock the full potential of education.

IV. Best Practices and Evaluation

Numerous nations all around the world have actively incorporated artificial intelligence tools into their education sectors to not only facilitate evaluation but also provide assistance with a variety of other essential functions. Consequently, in order to gain a comprehensive understanding of this remarkable phenomenon, let us meticulously examine some outstanding instances from three distinct countries that have embraced this technological revolution in their educational systems. In this section, we explore three international examples of successful implementation of AI tools for evaluation. These case studies from Finland, China, and the United States

illustrate diverse approaches and highlight best practices that can serve as models for other educational systems aiming to integrate AI-driven personalized evaluation solutions.

4.1. China

China has been at the forefront of utilizing AI in education, particularly for evaluation purposes. They have fully embraced and implemented various AI-powered tools. One of the groundbreaking tools they have adopted is the Intelligent Tutoring Systems. These systems are highly advanced and utilize cutting-edge AI algorithms (Guo et al.2021). By leveraging these algorithms, the Intelligent Tutoring Systems provide personalized feedback to students, aiding in identifying areas for improvement and tailoring the learning process to individual needs. This revolutionary approach allows for a more comprehensive and effective learning experience, promoting academic growth like never before.

Another remarkable AI-powered tool that China has integrated into its education system is the Automated Essay Scoring technology. This technology harnesses the power of AI to evaluate students' essays. With this tool, students receive immediate feedback and precise grades, freeing up teachers from the arduous task of manual grading. The Automated Essay Scoring system not only reduces the workload on teachers but also encourages students to continuously improve their writing skills by promptly providing valuable feedback. This synergy between AI and education is propelling student achievement to new heights (Qian et al.2020). AI tools are being increasingly integrated into the education sectors of various countries for purposes such as evaluation and improvement of learning outcomes.

China has also implemented cutting-edge Facial Recognition technology in some schools. This forward-thinking approach utilizes AI-powered facial recognition technology to monitor student engagement and behavior in the classroom. The data collected through this progressive method serves the purpose of evaluating classroom management strategies and analyzing individual student participation (Kostka et al.2021). By harnessing the power of AI, educators can gain valuable insights into optimizing the overall educational environment. This innovative use of technology complements traditional teaching methodologies, enhancing the educational experience for both students and teachers alike.

4.2. United States

The United States has also been extensively utilizing AI tools in various ways within the education sector. Some notable applications include the integration of Adaptive Learning Platforms. These platforms are designed to personalize the learning experience for each student based on their individual needs and progress (Kem, 2022). They rely on highly sophisticated AI algorithms to continuously assess students' strengths and weaknesses, dynamically adjusting the difficulty of the material accordingly. This personalized approach ensures that students receive tailored and engaging learning experiences that cater to their individual needs and abilities (Taylor et al., 2021). Prominent examples of such platforms include DreamBox and Khan Academy, which have revolutionized the educational landscape by enabling students of all levels to thrive in their academic pursuits.

Moreover, the United States has also embraced AI-powered virtual tutors. These innovative virtual tutors utilize advanced natural language processing techniques to engage students in interactive conversations, answering their questions and providing guidance in real-time. Through the use of AI, these virtual tutors can analyze vast amounts of data to better understand students' learning patterns and preferences, allowing them to tailor their instruction even further (Alam, 2023). The result is a more personalized and effective learning experience that empowers students to excel in their educational journey.

In addition, AI has been leveraged in the United States to enhance the accessibility and inclusivity of education. With AI-powered transcription services, students with hearing impairments can now participate fully in classroom discussions and lectures (Mehigan, 2020). AI algorithms are capable of accurately transcribing spoken words into text in real-time, enabling students to follow along and understand the content with ease. This breakthrough technology has opened up new opportunities for students with hearing impairments to actively engage in learning environments and pursue their academic aspirations without barriers

The United States has embraced the power of AI in the education sector, leveraging its capabilities to revolutionize learning experiences and enhance educational outcomes. From personalized adaptive learning platforms to AI-powered virtual tutors, transcription services, grading systems, and instructional support tools, AI has opened up new possibilities and opportunities for students of all levels. As AI continues to evolve and advance, the educational landscape will undoubtedly witness further transformation,

empowering students and educators alike to thrive in their pursuit of knowledge and academic excellence (Kem2022).

4.3. Finland

Finland, renowned for its highly innovative and progressive education system, has also wholeheartedly embraced the integration of artificial intelligence in a wide array of educational aspects, showcasing its commitment to advancing education through cutting-edge technology (Mertala et al. 2022). The Finnish Ministry of Education and Culture has prioritized the integration of AI technologies to enhance personalized learning and improve educational outcomes.Some notable and groundbreaking ways in which Finland has seamlessly incorporated AI into its educational landscape are as follows:

Learning analytics: With the ingenious application of AI-driven learning analytics, teachers in Finland are empowered to closely monitor and meticulously track the progress of their students, gleaning valuable insights from real-time data (Gabriel et al. 2022). This revolutionary approach not only allows educators to gain an in-depth understanding of each student's unique learning journey, but it also enables them to tailor instruction and interventions to meet individual needs. By leveraging the power of AI-driven learning analytics, Finland aims to revolutionize personalized learning experiences, cultivating an environment where students can truly thrive, unleash their full potential, and achieve unparalleled academic success (Heilala et al.2024).

Language learning applications: Finland embraces the power of AI-driven language learning applications, leveraging remarkable platforms like the highly acclaimed WordDive, to facilitate a more immersive, efficient, and effective language acquisition experience. These cutting-edge applications expertly evaluate students' progress in real-time, providing insightful feedback, and expertly tailoring content to match individual learning paces and preferences. By harnessing the power of AI in language learning, Finland endeavors to create a harmonious and personalized language learning journey, empowering students to confidently embrace new languages, broaden their cultural horizons, and foster a deep appreciation for linguistic diversity. The strategic integration of AI into various facets of education exemplifies Finland's unwavering commitment to nurturing a forward-thinking and technologically adept generation of learners.

Formative assessment tools (such as online quizzes and interactive activities): In Finland, AI tools are widely utilized for formative assessments,

serving as invaluable aids in providing instant feedback and constructive guidance to both students and educators alike. These remarkable tools play a pivotal role in swiftly identifying learning gaps and adapting teaching methodologies, accordingly, ensuring that students receive the necessary support, personalized attention, and targeted interventions needed to excel academically. By seamlessly integrating AI-powered formative assessment tools, Finland is committed to ensuring that no student is left behind, leaving no stone unturned in the pursuit of educational excellence (Nieminen & Atjonen, 2023).

One notable example is the use of AI tools in Finnish primary schools to support individualized learning paths. AI-powered platforms like "SmartLearning" provide real-time feedback and adaptive exercises, helping students to stay engaged and progress at their own pace. Key success factors include comprehensive teacher training through extensive professional development programs to ensure proficiency in using AI tools, a collaborative approach involving close cooperation between educators, policymakers, and technology providers, and robust infrastructure investment to support the seamless integration of AI tools.

4.5. Criteria of Evaluation

Assessing the work of students who utilize AI tools requires specific standards and approaches to safeguard the genuineness and originality of their learning, while recognizing the role of AI as a tool. Firstly, technical proficiency in effectively and efficiently using AI tools, as well as integrating AI outputs into their work, is an important criterion. To ensure a fair assessment**, clear guidelines and expectations must be provided**. Students should receive specific instructions on how AI tools can be used (or not used) and the expectations for original contributions and AI content attribution. It is also important to document the process, requiring students to detail their AI usage and decision-making process and submit multiple drafts to observe the evolution of their work. Including reflective components in the evaluation process helps gauge students' understanding and critical reflection on their AI usage.

The importance of **originality and authenticity** cannot be overstated. This entails examining the presence of unique ideas and individual perspectives that go beyond AI-generated suggestions. It is critical to ensure that students produce content that reflects their own creativity and independent thinking. Evaluating the depth of analysis and interpretation of AI-generated

information is crucial for understanding the student's capacity for critical and independent thinking.

Another crucial criterion for evaluation is the **understanding and application of concepts**. Determining whether the student comprehends the subject matter and can apply AI-generated content accurately and appropriately to various contexts is essential. The proper use of AI tools is also a key consideration, which entails ensuring that students use AI tools ethically and appropriately, with transparent attribution of AI-generated content. The integration of AI with personal insights is a significant factor in assessment, involving an evaluation of how well students balance AI assistance with their own contributions, integrating AI outputs with their personal insights and knowledge.

Personalized assessments, such as oral exams or presentations, can further reveal the student's grasp of the material and the role of AI in their work. Utilizing plagiarism detection and AI checkers ensures content originality and proper attribution of AI-generated content. Developing detailed rubrics with specific criteria for evaluating AI-assisted work and sharing these rubrics with students in advance helps set clear expectations. Peer review processes focusing on originality and AI usage and encouraging collaborative projects that require both individual and group contributions, can enhance the evaluation process. Ultimately, creating tasks specifically for an AI environment that demand thorough examination, contemplation, and utilization can alleviate the excessive dependence on AI for basic solutions.

To assess students' work utilizing AI tools effectively, it is essential to establish a comprehensive evaluation scale that balances the recognition of AI as a useful tool with the assurance of genuine and original learning outcomes. The proposed evaluation scale encompasses multiple criteria derived from key principles mentioned in the text.

Criteria	Excellent (4)	Good (3)	Fair (2)	Poor (1)
Originality and authenticity: presence of unique ideas and perspectives	Rich in unique ideas, clear individual perspectives	Some unique ideas, balance of AI and personal input	Limited originality, heavy AI reliance	Predominantly AI-generated, minimal original input
Depth of analysis and interpretation: critical thinking and analysis	Deep analysis and interpretation of AI content	Good analysis, some critical reflection	Basic analysis, limited engagement	Minimal analysis, lack of engagement
Understanding and application of concepts subject matter comprehension	Thorough understanding, accurate application	Good understanding, minor inaccuracies	Basic understanding, noticeable inaccuracies	Limited comprehension, frequent inaccuracies
Ethical and appropriate use of AI: transparency and attribution	Ethical use, clear and accurate attribution	Mostly ethical, minor attribution issues	Some ethical concerns, attribution issues	Significant ethical issues, lack of attribution
Integration of AI with personal insights: balance of AI assistance and personal contributions	Effective balance, substantial personal insights	Good balance, more personal contributions	Imbalance, noticeable AI reliance	Overreliance on AI, minimal personal contributions
Process documentation: detailing AI usage and decision-making	Thorough documentation	Good documentation, minor gaps	Basic documentation, significant gaps	Minimal documentation
Use of Plagiarism Detection and AI Checkers		Pass/Fail - Work passes plagiarism and AI originality checks		

4.6. Synthesis of Best Practices

The synthesis of best practices from international examples for implementing AI tools for evaluation includes investing in comprehensive teacher training programs to ensure effective use of AI tools, fostering collaboration among educators, policymakers, technology providers, and researchers, developing supportive policies and robust technological infrastructure to facilitate seamless AI integration, utilizing data analytics to inform instructional strategies and provide timely interventions, and encouraging innovation while ensuring AI tools are accessible to all students,

including those with diverse learning needs. By adopting these best practices, educational systems worldwide can leverage AI to enhance evaluation tools and improve educational outcomes for all students.

V. Integration in Education and Associated Challenges

The integration of AI tools in education offers transformative potential for evaluation, but also presents several challenges. This section explores the practical aspects of implementing AI in educational settings and addresses the key challenges educators and institutions face.

5.1. Integrating AI Tools for Evaluation in Education

The integration of artificial intelligence into educational evaluation systems is transforming the assessment landscape, offering unprecedented efficiency, fairness, and personalized learning. Effective incorporation of AI tools in educational evaluations involves strategies such as automated grading systems, feedback mechanisms, monitoring, data-driven insights, content evaluation, and educator development.

AI-driven automated grading systems streamline the evaluation process for both objective and subjective assessments. For objective tests, such as multiple-choice or true/false questions, AI ensures rapid and accurate grading. Natural language processing (NLP) technology can assess written responses by analyzing grammar, coherence, and content relevance, significantly reducing educators' workload. AI enables the creation of adaptive tests that adjust difficulty based on students' responses, providing tailored evaluations that accurately reflect individual abilities. Learning analytics enhance personalization by identifying students' strengths and weaknesses, offering customized learning resources and strategies to address specific needs. Additionally, AI can automatically generate questions from course material, ensuring comprehensive coverage of the subject matter and improving assessment quality.

Immediate feedback is crucial for effective learning. AI tools can provide real-time feedback on assignments and quizzes, helping students understand their mistakes and improve their knowledge. Furthermore, AI facilitates peer reviews by guiding students on how to constructively evaluate their peers' work, fostering a collaborative learning environment. Thanks to its ability to track and analyze student performance over time, educators gain insights into

trends and can forecast students' future performance. During examinations, AI-powered tools ensure the integrity of the evaluation process by monitoring exams and preventing cheating. These tools analyze students' behavior during exams, such as eye movements and body language, to detect suspicious activities and maintain a fair testing environment.

AI also provides feedback to teachers on their instructional methods and classroom interactions, aiding professional growth. AI-driven training programs help educators understand and effectively utilize AI tools, enhancing their teaching strategies.

5.2. Teacher Training and Professional Development - Importance of training educators to use AI tools effectively

The successful implementation of AI in education depends on educators being adequately trained to effectively utilize these powerful tools. It is crucial for educators to receive comprehensive training programs that provide thorough instruction on AI tools. These training programs should emphasize the capabilities, advantages, and constraints of these tools. In addition to initial training, continuous professional development is essential to keep educators informed about the most recent AI advancements and teaching strategies. This ongoing learning opportunity ensures that educators are well-equipped to integrate AI into their teaching practices.

Another key aspect of effective teacher preparation for AI integration is the establishment of collaborative learning communities. These communities serve as platforms for educators to exchange experiences, discuss challenges, and share best practices related to AI integration. By fostering a sense of belonging and encouraging collaboration, these communities provide valuable support and resources for educators as they navigate the implementation of AI in education. An example of this would be a district-wide professional development initiative that trains teachers to use AI-based assessment tools to provide personalized feedback and support.

5.3. Infrastructure and technical requirements

Implementing AI tools in education requires robust infrastructure and technical support. Key considerations include ensuring that schools have the necessary hardware and software requirements, such as sufficient computing power, internet connectivity, and appropriate software to support AI

applications. Without these foundational elements, the integration of AI tools would be inefficient and ineffective. Another critical aspect is the implementation of secure and efficient data management systems. These systems are essential to handle the large volumes of data generated by AI tools, ensuring that data is not only processed effectively but also stored and protected in compliance with privacy standards. Effective data management is crucial for maintaining the integrity and security of student information, which is a significant concern in educational environments.

Additionally, providing ongoing technical support and maintenance is vital for the smooth operation of AI systems. This includes having a dedicated team to troubleshoot issues and perform regular maintenance to keep the AI tools running optimally. Continuous technical support helps minimize downtime and ensures that any problems that arise can be addressed promptly, reducing disruption to the learning process. An example of these considerations in practice is the investment in high-speed internet and cloud-based platforms by schools. These investments support the seamless operation of AI-driven learning environments, ensuring that both students and educators can fully leverage the capabilities of AI tools without technical hindrances.

5.4. Resistance to change and stakeholder engagement

Resistance to change is a common challenge when introducing new technologies in education. One effective strategy to address this is stakeholder involvement, which means engaging educators, students, and parents in the planning and implementation process. By including these stakeholders from the beginning, schools can build buy-in and address any concerns they might have about the new technology. Clear communication is also crucial in this process. Educators and administrators need to clearly communicate the benefits and objectives of AI tools to all stakeholders, ensuring that everyone understands how these tools will improve evaluation and learning experience.

Another approach is to implement pilot programs. These programs allow schools to demonstrate the effectiveness of AI tools on a smaller scale and gather valuable feedback for improvement before a full rollout. Pilot programs help to show tangible results and can ease the transition by providing proof of the benefits that AI tools can bring to education.

For example, conducting workshops and information sessions for parents. During these sessions, schools can explain how AI tools will assess children's work and progress, addressing any concerns and highlighting the positive impacts. These proactive steps help in building trust and acceptance among

all stakeholders, facilitating a smoother integration of AI technologies into the educational environment.

5.5. Assessment and evaluation

Evaluating the impact of AI tools on personalized learning is absolutely crucial for continuous enhancement and advancement in the field. It is vital to employ effective assessment approaches that involve utilizing data analytics to comprehensively monitor student progress and accurately measure learning outcomes. Moreover, gathering valuable and constructive feedback from both students and teachers is imperative to assess the effectiveness and overall usability of AI tools in the educational setting.

To evaluate the effectiveness of AI tools, the main approach involves a multi-faceted assessment strategy. This includes a combination of quantitative data analysis and qualitative feedback. The primary scheme for evaluation consists of setting clear objectives, collecting relevant data, analyzing the results, and making informed decisions based on the findings. The main challenges in this process include data privacy concerns, ensuring the reliability and validity of assessment tools, and addressing the diverse needs of students.

To truly understand the potential of AI tools, it is essential to conduct comparative studies that meticulously compare the performance of students utilizing AI tools with those who rely on traditional evaluation methods. This comprehensive analysis can provide valuable insights into the advantages and potential drawbacks of integrating AI tools into the educational process. However, the successful incorporation of AI tools into education requires addressing various practical challenges. These challenges include ensuring proper curriculum alignment with the AI tools, offering adequate training to teachers to ensure their proficiency in utilizing these tools, establishing a robust infrastructure to support the technology, actively engaging with stakeholders to ensure their support and involvement, and most importantly, implementing effective assessment strategies.

Educational institutions must prioritize these areas to overcome these obstacles and fully harness the immense potential of AI tools in optimizing educational outcomes. By proactively addressing these challenges and focusing on enhancing these fundamental areas, educational institutions can pave the way for a future where AI becomes an integral part of the educational process, revolutionizing education and empowering learners worldwide.

VI. Conclusions

The integration of AI tools for evaluation in education represents a transformative shift in how student performance is assessed and enhanced. Drawing from a comprehensive review of recent publications across reputable databases, this text has delved into the theoretical foundations, benefits, challenges, and emerging trends associated with AI-driven evaluation systems.

AI-driven evaluation offers a dynamic approach that goes beyond traditional methods by providing personalized and precise feedback. Through adaptive testing, real-time feedback, and predictive analytics, AI tools enable a more customized learning experience that caters to the unique needs and abilities of each student. The implementation of various AI algorithms, including supervised, unsupervised, and deep learning, further optimizes the educational journey, ensuring maximum growth and comprehension.

The benefits of AI in education are evident, with research highlighting improved learning outcomes, increased engagement, and more effective identification of learning gaps. However, the integration of AI also brings significant ethical and data privacy concerns that must be addressed to ensure fairness, transparency, and the protection of sensitive information.International case studies from China, the United States, and Finland illustrate successful implementation practices and offer valuable insights into the diverse ways AI can enhance educational systems. These examples underscore the importance of comprehensive teacher training, robust infrastructure, and collaborative approaches among educators, policymakers, and technology providers.

Despite the promising potential of AI-driven evaluation, challenges such as resistance to change, technical requirements, and the need for continuous assessment and improvement must be carefully managed. By focusing on effective curriculum alignment, professional development, and stakeholder engagement, educational institutions can overcome these obstacles and fully leverage AI's capabilities to improve educational outcomes. The future of AI in education holds immense potential for creating more personalized, efficient, and inclusive learning environments. Embracing the transformative power of AI, educators and institutions can unlock new opportunities for academic excellence and student success, paving the way for a brighter and more innovative educational landscape.

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Chapter 5
Necessary Skills of Academic Staff in Working with AI Tools

Anda Āboliņa, Mg.sc.ing., PhD Candidate in Education Science, Rezekne Academy of Technologies, Latvia, anda.abolina@rta.lv

Velta Ļubkina, Prof., Dr.paed. Riga Technical University, Rezekne Academy of Technologies, Latvia, velta.lubkina@rta.lv

Līga Danilāne, Dr.paed., Rezekne Academy of Technologies, Latvia, liga.danilane@rta.lv

I. Introduction

In recent years, the integration of Artificial Intelligence (AI) tools into academic contexts has transformed the landscape of teaching, research, and intellectual activity. As AI evolves, it becomes increasingly important for academic staff to have the requisite skills to fully realise its promise. In this study, we intend to explore into this critical element by reviewing scientific articles published in the recent five years from databases such as IEEE Xplore, Web of Science, Scopus, and ERIC. Through this extensive investigation, we hope to detect emerging patterns and innovative techniques for the competencies required for academic professionals to interact with AI tools. These articles are a significant resource, providing insights into current research and achievements in AI integration within the university setting.

II. Theoretical background

Technological advances have opened new opportunities for learning and knowledge dissemination. According to Xu et al. (2021), AI has proven useful in facilitating search procedures, learning applications, and decision-making processes. Interactive learning environments have consistently gained widespread recognition for their ability to improve productivity, understanding, and relevance (Rospigliosi, 2023). In 2022, AI introduced a powerful, stimulating, personalized and efficient tool known as ChatGPT (Chat Generative Pre-Trained Transformer), which has captured the world's

attention for its ability to simply and systematically generate results based on external stimuli (Dwivedi et al., 2023).

The contributions and consequences of ChatGPT on research, pedagogies, teaching, and learning have piqued the interest of academics, researchers, and higher education institutions (Fuchs, 2023). The robust potential of ChatGPT for doing data analysis, answering students' questions, and assisting with literature reviews may be the reason for its growing use in both teaching and research. Additionally, ChatGPT's accessibility and user-friendliness are increased because it doesn't require any technical knowledge or knowledge of coding languages(Singh & Singh, 2023). However, researchers remain concerned about ChatGPT's use in academia due to potential ethical issues or breaches (Mhlanga, 2023), even with the applicability of the technology expanding rapidly across a range of contexts, including learning-based assessments (Qureshi, 2023), research (Sedaghat, 2023), and teaching (Trust & Minghim, 2023).

ChatGPT has already demonstrated revolutionary benefits for teachers, students, and other stakeholders (Dwivedi et al., 2023). There have been various identified ways in which working and teaching pedagogies have changed significantly. To begin, ChatGPT has aided in "automating several tasks of the educators" such as developing evaluations, study materials, case study formulation, presenting tools, and so on (Kasneci et al., 2023). This will allow instructors to focus on more important topics such as classroom analysis, creative pedagogies, and so on (Kumar et al., 2024).

Because they are resistant to altering their pedagogical approaches, university instructors often take a while to adjust to new technology (McGrath et al., 2023). Academics at universities view AI as both a threat and an opportunity. The worry that AI will eventually replace teachers is a recurring topic in discussions about AI in education (McGrath et al., 2023). Many educators are reluctant to use AI in the classroom or are unaware of its potential as a teaching tool (Chiu & Chai, 2020). The requirement for greater time to devote to understanding how to apply AI efficiently is one common explanation (McGrath et al., 2023).

The educators frequently do not see any personal benefit in adopting AI-based learning and teaching pedagogies because they typically rely more on external motivations or incentives (recognition, promotion, and monetary rewards) than on internal motivation (interesting teaching and learning, improved learning outcomes, and improved teaching quality) (Lee et al., 2024). Moreover, a lot of educators believe that AI technologies are still in

their infancy and do not yet possess the accuracy necessary for content distribution or retrieval in learning and teaching situations (McGrath et al., 2023).To improve student performance and prevent the unethical use of generative AI, educators should modify their methods of instruction and assessment (Pearce & Chiavaroli, 2023). Universities must establish robust policies and ongoing research agendas that tackle AI challenges, including ethical aspects, in order for this to happen (Bearman et al., 2023).

Through recommendation systems, individualised learning, and intelligent tutoring, AI-driven technologies can improve students' educational experiences (Hwang et al., 2022). According to each student's needs, aptitude, preferred learning style, and experience, AI-driven systems can create personalised learning profiles for them as well as learning journeys and resources (Fu et al., 2020). But for a lot of teachers, this is their first time utilising AI in an online learning setting, and they might not have the necessary knowledge and abilities to work with these AI programmes (Guerrero-Roldán et al., 2021). This explains the necessity for educators to acquire relevant digital abilities in order to facilitate effective instruction and learning in virtual learning environments.

To help lecturers in their teaching, AIED technologies provide them with new features and functionalities (such as chat functionality, personalised support, automated communication, and learning analytics). When used effectively, they can help teachers become more effective teachers (Whitelock-Wainwright et al., 2021), inspire students to learn, increase their self-efficacy, encourage self-regulation (Seo et al., 2021), and facilitate student interaction in AI-driven learning environments. Instructors must seize the chance to advance their digital competency in AI in a timely manner in order to provide students with improved (online) learning opportunities (Ng, Leung, et al., 2023). It's possible that educators are unfamiliar with these cutting-edge tools that can help them with both technical and more general aspects of teaching (such as communication, teamwork, and transdisciplinary abilities). Teachers can encounter a variety of obstacles when creating an AI-driven learning environment, including technological barriers that prevent students from using AI applications and creating algorithms, a lack of tools or evaluation techniques, inadequate funding, and immature AI curricula (Ng, Lee, et al., 2023).

The digital transformation has put teachers under pressure to fulfil new standards that were not part of the traditional expectations for good teaching practices during their professional development as teachers. Meeting

complicated demands and emerging trends (such online learning and AI education) in the classroom makes them feel challenged. AI was discovered to help with teaching and administrative tasks; nevertheless, teachers now must deal with a number of technical issues and require more time and resources to become accustomed to these AI technologies (Luan et al., 2020). Lecturers might not prepare with the technological know-how and abilities needed for this kind of digital shift. According to studies (Seo et al., 2021), technological issues could significantly lower the quality of teachers' delivery of content, instructional design, and assessments. Research has indicated that to guarantee the presence of highly qualified educators in classrooms with AI enhancements, educators must acquire technological skills related to AI in order to support students' acquisition and expression of knowledge (Ng, Leung, et al., 2023). Additionally, educators must engage with learners using AI technologies, such as chatbots and automated feedback (Guerrero-Roldán et al., 2021; Whitelock-Wainwright et al., 2021). Consequently, in order to improve students' AI-driven online learning, instructor competencies have become essential. Through continual professional training, such as technical assistance, guidelines, and teacher education programmes (Chiu & Chai, 2020; Luan et al., 2020), teachers need to update their skills and expertise and connect the tools to topic knowledge and pedagogy (Kim et al., 2021). These can assist educators in being more equipped to lessen the socialisation gaps, technological problems, and obstacles that keep AI systems from accomplishing their intended purposes.

To effectively integrate AIED technologies in the classroom, educators must cultivate an ethical mindset and a positive leadership attitude in addition to their technical expertise. Some educators are concerned that AI may eventually take their place and are uncomfortable depending on AI interpretation to decipher students' nonverbal clues in social situations (Seo et al., 2021). As a matter of fact, scholars have noted that AIED technologies might be a "black box," meaning that educators might not be aware of the inner workings of the system that generates these assessments and suggestions for students. Due to such misinterpretation or deception, a number of possible dangers and conflicts have been highlighted between students and teachers, including privacy concerns, shifts in power relations, and excessive control (Seo et al., 2021). According to Seo et al., (2021), teachers who only rely on AI-driven technology to forecast and evaluate students' learning outcomes run the risk of their students performing poorly as a result of the incorrect recommendations that AI may provide. AI-powered platforms may misinterpret users and provide learners with false recommendations (Seo et

al., 2021). These platforms might not be available to all learners and may have been trained and built by certain learner groups. Teachers should be aware of the ethical issues and constraints associated with AI-driven technologies in this way. AI systems shouldn't, for instance, provide uniform assistance to every student, nor should social interaction and academic results solely depend on AI interpretation. Finally, because elements like eye tracking and facial expression analysis feel like surveillance to students, the design of such platforms may not be sufficiently human-centered (or even student-centered), which could induce discomfort (Seo et al., 2021). Thus, rather than worrying that one day AI will take the place of teachers' socialisation and mentoring roles in a physical learning environment, educators should become knowledgeable about AI and educate themselves about the ethical issues, constraints, and human-centered design that surround AI technologies to support students' learning (Ng, Leung, et al., 2023).

III. Skills of Academic Staff

In a world where people must communicate and access pertinent information via digital technologies like social media, mobile devices, and internet platforms, "digital competencies" refers to a set of abilities that everyone needs to live, learn, and work (Falloon, 2020). AI innovations like chatbots, robotics, and smart devices have permeated every aspect of our lives in recent years. Teachers may now create relevant curricula and pedagogy to help students develop the information, skills, and attitude that will help them learn, live, and work more easily thanks to the availability of more age-appropriate technologies. Proficiency in artificial intelligence has emerged as a crucial technological ability for the twenty-first century. People that possess AI skills can use AI as a tool at work, at home, and in the classroom as well as critically assess AI technologies and communicate and interact with them (Ng, Leung, et al., 2023).

Important digital competences have been suggested by recent research and reports to help determine what knowledge and skills people should acquire. Long & Magerko (2020) suggested that individuals acquire the following 16 competencies: data competency, learning from data, critically interpreting data, higher-level reasoning of AI, sensors, and ethical concerns behind. They also suggested that people distinguish between general and narrow AI, recognise strengths and weaknesses of AI, imagine future applications of AI and their societal impacts, and make decision-making. Teachers can build lessons and assessments around the two recommended sets

of competences, which serve as the foundation for what students should learn about AI. Going one step further, Ng et al. (2021) used Bloom's Taxonomy as inspiration to classify the required AI competences into four cognition domains (know and comprehend, use and apply, assess and develop, and ethical issues) in order to support students' progression from poor to high thinking skills in AI knowledge. With the use of this model, educators may better comprehend the AI competencies that students require and create learning models that can be used to apply effective pedagogies and instructional design to improve student learning outcomes.

Few studies currently address how teacher education programmes could improve teachers' AI digital competency to apply AI for teaching, learning, and evaluation, as indicated by Ng et al. (2021) proposed an additional set of AI competences for teachers, which include managing information, developing learning content, utilising basic applications, and establishing technological connections with their students. Markauskaite et al., (2022) proposed that in order to satisfy educational requirements, educators should incorporate new digital technologies into their lessons, support learning through digital technologies, participate in professional development to develop competences, and gain expertise with AI-enabled tools. In addition, educators should be trained in the use of appropriate AI-driven tools like intelligent agents and adaptive learning systems to support their day-to-day management of the classroom and practices for working with parents and colleagues. They should also learn how to enhance personalised learning to better understand the needs and progress of individual students, as well as perform a variety of tasks like providing automatic feedback, self-diagnosing, and encouraging online collaboration among students (Cavalcanti et al., 2021). In order to empower students, they must not only use AIED technologies but also keep up with the latest developments in pedagogy and content knowledge on AI. They must also learn how to create appropriate pedagogies (such as problem-based learning and collaborative learning), digital resources, learning materials, and assessments. This aligns with the review of Ng et al. (2021) that updates the Technological, Pedagogical and Content Knowledge (TPACK) framework to support teachers' understanding of how AI might be used to construct their lessons and instruction. A nuanced perspective on teachers' digital competences through different forms of knowledge is provided by the TPACK framework, which has been incorporated in research on teachers' technology integration (Koehler et al., 2013; Scherer et al., 2023). Teachers' personal understanding of the subject is referred to as their content knowledge. Teachers' understanding of their

methods, procedures, and techniques for teaching and learning is referred to as pedagogical knowledge. Technological knowledge refers to an educator's familiarity with and proficiency with a range of digital resources, technological tools, and technologies (Falloon, 2020).

Realising the potential advantages of AI in education is mostly the responsibility of educators. Lecturers must develop a more complex set of abilities than in the past due to the fast changing demands they confront (European Commission & Directorate-General for Education, 2022). This is especially true when utilising digital technology to assist pupils in becoming digitally competent. A solid foundation for educators to use while developing their lesson plans and implementing tools is provided by DigCompEdu. The framework is designed to facilitate the development of educator-specific digital abilities. It outlines the essential competencies of instructors and includes competence levels as a general guide (Caena & Redecker, 2019). The European Commission & Directorate-General for Education (2022) has organised a wide range of components into six primary areas, which are as follows: (1) professional engagement; (2) digital resources; (3) teaching and learning; (4) assessment; (5) empowering learners; and (6) promoting learners' digital proficiency.

Professional engagement - Academicians should think about a variety of AI-driven tools and systems to assist students in creating and refining organisational communication strategies, given the digital affordances of AI technology. AI has the potential to improve organisational communication between educators and facilitate the sharing and exchange of pedagogies, experiences, and information (Ng, Leung, et al., 2023). Digital resources - There is presently an abundance of AI-driven learning tools available for teachers to utilise in their classrooms (Archambault et al., 2022). First, according to Archambault et al. (2022), artificial intelligence (AI) can help teachers manage their teaching materials, make teaching easier, and find, produce, and distribute resources that best suit their needs, teaching style, and learning objectives. For instance, according to students' requirements, preferences, and progress, AI recommendation engines can assist teachers in recommending learning activities and materials (Klašnja-Milićević et al., 2015). For teaching and learning, educators should locate, pick, alter, and expand upon these already-available AI resources and technology. When creating digital resources and organising their use, they must consider how to incorporate these materials in accordance with various specific learning goals, the learning environment, pedagogy, and learner group.

Teaching and learning - The DigCompEdu proposes four main components for exploring how digital technologies might support teaching and learning: (1) instruction; (2) guidance; (3) collaborative learning; and (4) self-regulated learning. Combining these components is thought to help educators get ready for teaching and learning with artificial intelligence. Teachers must reorganise lessons, activities, and learning materials to better serve learning objectives considering the many AI technologies supporting instruction. Second, AI assists professors in rapidly answering queries and doubts from students in order to provide timely and focused instruction and assistance. For instance, using natural language processing to provide students with timely advice and feedback, intelligent agents and chatbots could enable personalised learning (Zawacki-Richter et al., 2019).

Assessment - Academicians should think about how AI can improve current assessment techniques when using AI technologies with assessment processes. Teachers can develop creative techniques to evaluation with the help of AI (Chassignol et al., 2018; Chiu, 2021). AI-driven writing assistants, for instance, are able to automatically assess and grade student work by identifying elements like syntax, sentence structure, and word usage. Chatbots can act as virtual assistants for teachers, asking them questions with basic explanations and giving them instructions in response to a variety of inquiries (Smutny & Schreiberova, 2020). Through the analysis and interpretation of data produced by AI systems, teachers can gain insight into the learning behaviours of their students. This supports educators in improving their decision-making and learning intervention strategies. In general, educators should become proficient in using a variety of AI tools to oversee the tracking of students' development, expedite the delivery of feedback, and enable them to evaluate and modify their own pedagogical approaches.

Empowering learners - AI technologies can enhance learner-centered pedagogical practices, classroom differentiation, and personalised learning. Personalised learning is made possible by the application of AI in differentiated learning, which was previously impractical when teaching large classrooms (Renz & Hilbig, 2020). It helps educators to comprehend the learning styles, histories, developmental stages, and scholastic pursuits of their students. By enabling students to pursue their own learning routes and progress at varying rates and levels, it meets the diverse learning demands of the students. Second, it may support and guarantee accessibility for all students, including those with special educational needs, and assist close the achievement gap caused by issues of inequality. AI can guarantee that educational materials and activities are accessible.

Facilitating learners' AI competency - Teachers empower students to use AI tools for communication, information gathering, content creation, and problem solving in a creative and responsible way. According to the DigCompEdu framework, educators should possess the following five competencies: (1) media and information literacy; (2) digital problem solving; (3) digital content production; (4) responsible use of artificial intelligence; and (5) digital communication and cooperation. To meet students' information needs—such as locating resources in AI-driven environments and organising, analysing, and interpreting material using AI—teachers must have a solid foundation in information and media literacy. Second, teachers must provide students with the tools they need to collaborate and communicate with each other using AI. The ethical use of AI and data in teaching, learning, and assessment is something that educators should be mindful of, according to recently published ethical standards (European Commission & Directorate-General for Education, 2022). Lastly, AI can help educators address challenges in the classroom and free up students to be innovative problem solvers (European Commission & Directorate-General for Education, 2022). For students to use artificial intelligence (AI) to solve real-world problems alongside their peers, teachers must improve their pedagogical and technological skills.

In their study, Cetindamar et al. (2024) identified four categories of workplace competencies linked to artificial intelligence (AI). These categories include technological competencies (like data collection, analytics, ethics, and security), work-related competencies (like decision-making, critical thinking, and teamwork), human–machine interaction (like situation assessments, affordance analysis, and adaptive expertise), and learning-related competencies (like lifelong learning and self-learning ability). Additional research has also emphasised the significance of life and professional skills in the context of the fourth industrial revolution, including problem-solving, emotional intelligence, judgement, service orientation, negotiating, and cognitive flexibility, communication and teamwork skills (Seo et al., 2021).

To help educators improve their digital skills, Ng, Leung, et al., (2023) provide the following recommendations:

- To enable teachers to build the AI knowledge, abilities, and mindsets they need to use the teaching tools effectively, professional development, teacher training programmes, guidelines, and technical assistance are essential.

- To support successful digital capability and development, schools should modernise their digital equipment and infrastructure.
- Many internet technologies, including big data, blockchain, cloud computing, and metaverse, are applied in education to enhance AI-driven learning experiences. To be digitally competent, teachers should always be updating their expertise and learning how to use modern technologies in the classroom. Instructors shouldn't limit their instruction to technological know-how. Rather, they must acquire other critical skill sets, including risk-taking and ethical mindsets, as well as interdisciplinary, learning, and innovative skills.
- To help educators create effective curriculum and instruction, professional development, learning environments, and learning standards and assessments, more frameworks for digital competences should be put forth. Two models that give instructions to teachers on how to build the digital competencies required for AI-driven learning environments are P21's framework and EduCompEdu.

Chan (2023) have identified ten main areas and 25 sub-themes that are directly related to AI policy planning for teaching and learning in higher education institutions while conducting research from the qualitative data (table 1).

Table 1 Main themes and subthemes (Chan, 2023)

Main themes	Subthemes
1. Understanding, identifying and preventing academic misconduct and ethical dilemmas	● Develop guidelines and strategies for detecting and preventing the misuse of generative AI ● Identify ethical dilemmas ● Familiarize students with ethical issues
2. Addressing governance of AI: Data privacy, transparency, accountability and security	● Be transparent about decisions concerning AI use ● Ensure data privacy and security ● Address ethical issues such as bias and stereotypes
3. Monitoring and evaluating AI implementation	● Conduct longitudinal experiments to examine the effects of AI use ● Collect feedback from teachers and students to make informed decisions
4. Ensuring equity in access to AI technologies	● Provide resources and support to all students and staff ● Ensure all students have access and training to AI tools

Main themes	Subthemes
5. Attributing AI technologies	● Promote academic integrity in AI use ● Develop guidelines on how to attribute generative AI's contribution to student work
6. Providing training and support for teachers, staff and students in AI literacy	● Enhance staff confidence and competence through adequate training ● Teach students how to use and critique the use of AI technologies ● Provide education on ethics; knowledge of the affordances, use, and limitations; and capability to evaluate AI outputs
7. Rethinking assessments and examinations	● Design assessments that integrate AI technologies to enhance learning outcomes ● Develop assessment strategies that focus on students' critical thinking and analysis
8. Encouraging a balanced approach to AI adoption	● Recognize the potential benefits and limitations of generative AI technologies ● Avoid over-reliance on AI technologies ● Use AI technologies as complementary tools
9. Preparing students for the AI-driven workplace	● Teach students how to use AI responsibly ● Develop curricula that equip students with AI skills and knowledge ● Familiarize students with AI tools they will encounter for university studies and future workplace
10. Developing student holistic competencies/generic skills	● Enhance students' critical thinking to help them use AI technologies effectively ● Provide opportunities for developing competencies that are impeded by AI use such as teamwork and leadership

IV. Integration in education and associated challenges

Kumar et al. (2024) have compiled scientific literature on pedagogy, technology, assessment and ethics, the advantages, difficulties and applications of AI in these areas. The integration of Artificial Intelligence (AI) in education spans across pedagogy, technology, assessment, and ethics, presenting a spectrum of benefits and challenges alongside diverse applications.

Pedagogy:

- **Benefits -** Supports digital writing and Automated Writing Evaluations, enhances knowledge and understanding, complements learning and research processes, potential for effective tutoring.

- **Challenges -** Difficulty in handling indeterminate and uncertain data, concerns about impact on writing pedagogy, difficulty differentiating between student work and AI-generated content.
- **Use Cases -** Personalizing learning, enhancing student engagement, supporting second language writing, creating supportive learning environments, decreasing teaching workload.

Technology:

- **Benefits -** Enhanced productivity across industries, self-improving capability, produces accurate, human-like responses, facilitates complex learning, decreases teaching workload.
- **Challenges -** Consequences of biases, misuse, and misinformation, disruptions to practices, ensuring ethical use of student data, potential overestimation of understanding.
- **Use Cases -** Content generation for writing classes and course materials, detecting AI-generated essays, identifying AI-generated text for plagiarism checks.

Assessment:

- **Benefits -** High performance in various tests, opportunities for innovative assessment design, supports development of critical thinking, increases student engagement.
- **Challenges -** Difficulty distinguishing between human-written and AI-generated text, concerns about authenticity of assessment, impact on developing lateral competencies.
- **Use Cases -** Assisting in student work and assessments, testing AI's performance in standardized tests, designing AI-assisted assessments.

Ethics:

- **Benefits -** Offers personalized feedback, adaptive learning pathways, potential to shape digital literacy.
- **Challenges -** Threats to privacy and security, issues related to academic integrity and safety, risk to professionalism, limitations in assessing learning outcomes.
- **Use Cases -** Promoting academic integrity, preventing misuse of AI models, educating users in AI-prevalent environment (Kumar et al., 2024).

In today's educational setting, using artificial intelligence (AI) poses both obstacles and potential. As we go deeper into AI implementation, it becomes critical to investigate the enablers that make it effective and appropriate for use in teaching, learning, and evaluation. This section covers several enablers that make it possible to use AI in educational contexts, focusing on interactions with academics, professionals, students, and industry stakeholders. Institutions may manage the challenges of AI integration and leverage its potential to improve educational practices by encouraging student participation, favourable attitudes towards AI, and redesigning evaluation and learning outcomes. Implementing solutions for tackling academic integrity and generative AI necessitates a tactical rather than technological approach. To implement AI in academic integrity, cross-disciplinary teams can build just-in-time instructions for students and staff.

- Collaborate with students to use AI effectively.
- Encourage positive attitudes about AI and its usage in teaching, learning, and assessment. Create policy to establish safe parameters for self-regulated AI use, and reconsider our institutional approaches to digital literacy among our students and staff.
- Reimagine assessment and learning outcomes with AI as a conversation starter. Examine the results of AI-powered assessment questions with academics and students to improve digital literacy skills and, for students, higher order analytical and critical thinking abilities.
- Helping students understand how to use AI successfully and appropriately.
- Encouraging staff and students to consider assessment with AI in mind, including the fundamental issue, "What is being assessed?" (Venaruzzo et al., 2023).

Several difficulties arise when integrating artificial intelligence (AI) into educational environments, preventing its easy adoption and use. These limitations derive not only from institutional issues, but also from broader ethical and cultural concerns about AI application. Understanding and tackling these hurdles is critical for maximising AI's potential in education.

- Many institutions are still recuperating from COVID and other big changes, including migration to new Learning Management Systems and organisational restructures, making change fatigue a serious concern.

- Inconsistent discussion of privacy, intellectual property, and ethics in the sector may lead to institutions taking individual approaches that hinder AI's potential for future learning, teaching, and evaluation.
- Private firms drive the majority of AI development. Subscription-based paid access models have the potential to increase the digital gap for children while also creating learning imbalance.
- AI's rapid technological advancements outpace institutional policies and norms.
- AI literacy: instant support and guidance for students and staff, followed by longer-term programmes to improve individuals' ability to understand, use, and critically assess AI processes and outputs. Without proper AI literacy priorities, humans may misinterpret AI and lack the abilities to apply it effectively in school, work, and society.
- Equity and access - while much of AI is accessible, much remains unknown. Intellectual property ownership, copyright, attribution, and privacy are important problems to comprehend, and AI technology companies have not been upfront about how they collect and use inputted data. Clear and consistent guidance from top leadership is essential on how to safely implement these technologies. As AI technology manufacturers provide paid and subscription models of access, there is a concern that AI will exacerbate the digital divide among students and introduce new kinds of unfairness (Venaruzzo et al., 2023).

V. Conclusions

The incorporation of artificial intelligence (AI), notably through tools has transformed many aspects of education, including teaching and learning, assessment, and research. While AI has many advantages, such as increased productivity, personalised learning experiences, and novel assessment design, it also poses substantial concerns, particularly in terms of ethics, biases, and the possibility of misuse.

Despite AI's transformational potential, educators frequently express resistance or hesitation to adopt AI-driven technology due to concerns about job displacement, ethical consequences, and the requirement for technical expertise. Furthermore, there are gaps in instructors' digital literacy, with many missing the abilities required to effectively use AI tools in the classroom.

To solve these issues and reap the benefits of AI in education, it is critical to prioritise the development of educators' digital skills. This includes offering thorough training programmes, technical support, and recommendations for incorporating AI into teaching practices. Furthermore, educational institutions must have clear regulations and ethical norms for the responsible use of AI, data protection, and academic integrity. Educators must collaborate to create inclusive learning experiences, rethink assessment methodologies, and prepare students for the AI-driven job while also fostering critical thinking skills and overall competences.

The successful integration of AI in education necessitates a collaborative effort from all stakeholders, including educators, policymakers, and technology developers. By addressing obstacles, improving digital competencies, and encouraging ethical use, AI has the potential to transform teaching and learning, empowering instructors and enriching students' educational experiences. As technology advances, schools must adapt by instilling skills like data literacy, critical thinking, and adaptability. Furthermore, developing a collaborative mentality and adopting lifelong learning are critical for negotiating the complexity of AI integration. By improving these skills, academic staff can leverage the power of AI tools to improve teaching, learning, and research, ultimately empowering both educators and students in the digital age.

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Chapter 6
Ethical Use of AI in The Study Process

Dr. Piotr Sieniawski, Institute of Political Science and Administration, Cardinal Stefan Wyszynski University in Warsaw, Poland, p.sieniawski@uksw.edu.pl

I. Introduction

Pursuant to the definition prepared by the European Commission, the notion Artificial Intelligence (AI) is understood as "systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)" (The European Commission 2018). AI can also be seen as an umbrella term that covers a set of complementary techniques that have developed from statistics, computer science and cognitive psychology (Hall and Pesenti 2017).

AI continues to play a significant role in higher education institutions both by academic staff and students. According to a survey conducted in 2023 in Poland, as many as 97 per cent of students use electronic devices in their studies. Furthermore, around 20 per cent of students were planning to use AI while writing their Bachelor's or Master's theses (Sewastianowicz 2023). According to a survey conducted by the journal Nature, researchers perceived the following benefits of the AI: faster data processing, faster calculations, saving time and money of researchers, greater access to data, processing of new types of data, faster writing of computer programs, providing answers to highly-complicated questions, improvement of research methods, new discoveries, new hypotheses (Rotkiewicz 2024). The main risks that have been identified in the survey were interpretation of data without its understanding, repetition of mistakes included in the data, easier frauds, financial barrier in accessing AI, energy consumption (Rotkiewicz 2024).

In February 2024, a survey was conducted among academic teachers at Warsaw universities. Based on the feedback from participants, AI's effectiveness in handling large volumes of data and generating visuals improves data processing procedures. Additionally, AI may contribute to the development of new educational materials and concepts. The amount of data management and its effectiveness emphasizes its value in conducting desk research analyses. Certain participants pointed out that while it might be too early to assess AI's advantages in higher education, current findings underscore its capacity to expedite workflows and enhance the accessibility of educational resources. Nevertheless, the participants emphasized serious concerns regarding plagiarism risks and the potential decrease in students' originality. Additionally, there were concerns regarding students' inclination towards idleness, as AI offers swift solutions, which may impede their ability for critical analysis. Text-generating tools that are capable of producing dubious quality content pose a substantial concern, particularly related to academic tasks and dissertations, and also raise concerns about copyright infringement. Furthermore, excessive dependence on AI might reduce critical thinking and analytical capabilities. There was also concern that AI usage could restrict students' intellectual exploration in humanities and social sciences, and potentially hinder unconventional perspectives. Therefore, there is a need for implementation of control mechanisms that could identify whether an assignment has been written by artificial intelligence or not (Sieniawski 2024).

The aim of this paper is to analyze the significance of ethical use of the AI, introduce and discuss some of the best practices as well as shed light on integration in education and associated processes. It attempts to identify the most significant issues related to ethical use of AI tools in higher education based on desk research. Next, it outlines best practices related to the ethical use of AI tools, designed by universities in the United States. The third chapter discusses the need for integration of AI tools into higher education as well as associated challenges.

II. Ethical Use of the AI

As AI tools find broader use in higher education, it is crucial to identify the main areas and challenges and ensure that the use of AI corresponds with ethical standards. Based on the report Towards a Regulation of AI Systems, Larry A. DiMatteo distinguishes seven areas related to the ethics of AI (Di Matteo 2022, 12).

Table 1: Outline of areas related to the ethics of AI

Area	Main issues
Justice	It is mainly expressed in terms of fairness and prevention (or mitigation) of algorithmic biases that can lead to discrimination; fair access to the benefits of AI (designing AI systems especially when compiling the training datasets)
Nonmaleficence and privacy	Misuse via cyberwarfare and malicious hacking (privacy by design frameworks)
Responsibility and accountability	It includes AI developers, designers, and the entire industry sector
Beneficence	AI should benefit "everyone," "humanity," and "society at large"
Freedom and autonomy	Freedom from technological experimentation, manipulation, or surveillance (pursuing transparent and explainable AI, raising AI literacy, ensuring informed consent)
Trustworthiness	Control should not be delegated to AI (processes to monitor and evaluate the integrity of AI systems)
Dignity	Prerogative of humans but not of robots; protection and promotion of human rights; not just data subjects but human subjects

2.1. Questions of responsibility

Responsibility is a multifaceted subject that encompasses various dimensions such as causal, moral, and legal aspects. It is closely intertwined with concepts of agency and the narrative of how events unfolded, what ought to occur in the future, and who bears which duties. In a broad sense, responsibility is understood as "moral, legal, or mental accountability" (Merriam-Webster Dictionary 2024) or "a duty to deal with or take care of somebody or something, so that one may be blamed if something goes wrong" (Oxford Learner's Dictionary 2024) In the field of AI, questions regarding responsibility abound for a multitude of reasons. The intricate nature of the technology, the involvement of numerous individuals and organizations in its development and deployment, and its incorporation into complex systems often leave us grappling with challenging queries regarding the assignment of accountability and its dispersal throughout a system. The issue of transparency further complicates matters of responsibility, while debates regarding the allocation of agency between machines and humans add another layer of complexity. Moreover, the rapid evolution of technology and its societal integration spark discussions and disagreements regarding the essence and distribution of responsibility (Boddington 2023, 53).

In case of violation of university internal regulations or legal regulations in general by students or academic staff, responsibility may be applied. When AI has been used in an unethical way, the user may be held accountable before a competent organ of university administration. It is usually the user of the AI that is held responsible, since the accountability of the AI remains to be a controversial matter. In various situation, accountability may involve not only the final users of AI tools, but also organizations (including universities), academic teachers (either as final users or as supervisors of students' theses), AI tools providers, their developers etc.

2.2. Questions of privacy

Another instance of AI increasing existing ethical dilemmas involves privacy and data safeguarding issues. The necessity for access to extensive datasets and the capacity to obtain insights from them, as well as amalgamate various datasets, implies that AI can introduce new challenges to data protection. For instance, it may entail collecting new types of data or enabling automated surveillance, thereby posing unprecedented threats to data security (Stahl 2023).

Privacy concerns related to AI stem from various factors that include software, hardware, and societal attitudes towards technology. The advancement in processing capabilities, which facilitates the analysis of extensive personal data, and the ability to make predictions, are significant sources of concern. This is particularly disturbing given AI's reliance on massive datasets. Additionally, technological advancements, such as wearables, computer vision, and ubiquitous devices like smartphones, have augmented the capacity to monitor surroundings and gather personal information, albeit at the expense of privacy, which may resort to increased surveillance by external parties. Furthermore, significant shifts in our technological usage patterns are influencing the intricate landscape of privacy attitudes, which often exhibit considerable complexity (Boddington 2023, 53).

The introduction of seemingly innocuous data into AI models can inadvertently unveil sensitive or personally identifiable information about students, academic teachers or university administration staff when combined with other datasets. This poses risks of privacy breaches, which may expose students or university staff to potential identity theft or discriminatory practices. The incorporation of irrelevant or poor-quality data into AI models can have a detrimental effect on their precision and efficiency. This may result in biased or underperforming models that could potentially lead to subpar

learning outcomes and the exacerbation of existing disparities within the education system.

The accumulation and utilization of excessive data beyond what is strictly necessary contradicts the principle of data minimization, which stresses the importance of limiting data collection to essential requirements. This heightens the likelihood of data breaches and privacy infringements as surplus information is stored and processed. Another issue is the integration of seemingly insignificant data into AI models without appropriate consent or adherence to privacy regulations such the General Data Protection Regulation (GDPR), which can result in non-compliance with normative acts. This could entail significant legal and financial consequences for educational institutions. Breaches of privacy can also undermine trust in educational institutions, adversely affect students' learning experiences and harm the reputation of higher educational institutions (The Ark HQ 2023).

III. Best Practices

Stanford University (US)

Stanford University is a private research university based in California, US. It belongs to the world leading research and teaching institutions. When using AI tools, students are strongly encouraged to clearly state when AI tools were used in completing their assignments. "Absent a clear statement from a course instructor, use of or consultation with generative AI shall be treated analogously to assistance from another person. In particular, using generative AI tools to substantially complete an assignment or exam (e.g. by entering exam or assignment questions) is not permitted. Students should acknowledge the use of generative AI (other than incidental use) and default to disclosing such assistance when in doubt" (Stanford 2023).

The specific policies on the use of AI tools are to be set by course instructors. They may freely choose whether they would allow the use of AI in courses or not. Such decision has to be clearly stated in a course syllabus and communicated to students at the beginning of the course. "Individual course instructors are free to set their own policies regulating the use of generative AI tools in their courses, including allowing or disallowing some or all uses of such tools. Course instructors should set such policies in their course syllabi and clearly communicate such policies to students. Students who are unsure of policies regarding generative AI tools are encouraged to ask their instructors for clarification" (Stanford 2023).

The best practices outlined by the Stanford University can be summarized in the table below (Stanford 2024):

Table 2: Outline of the best practices related to generative AI at Stanford University

Area	Best Practices
Data Privacy & Usage	Avoid inputting data into generative AI about others that you wouldn't want them to input about you.
Data Privacy & Usage	Avoid inputting any sensitive data, such as Moderate or High Risk Data, whether using a personal or Stanford account with a third-party AI platform or tool that is not covered by a Stanford Business Associates Agreement. Review Stanford approved services by data risk classification.
Data Privacy & Usage	If inputting Low Risk Data, think about whether you want it to be public.
Data Privacy & Usage	It is recommended to opt out of sharing data for AI iterative learning wherever possible.
Data Privacy & Usage	If generative AI is to be used to interact with users, obtain their informed consent. Users must be informed about how their data is being used and have the option to opt-out or delete their data.
Emerging Technology	To keep meetings secure and private, avoid potentially risky third-party bots and integrations. (Third-party tools may have the ability to scrape one's calendar for information, unknowingly transcribe or record meetings, save meetings in unknown places, and join meetings even when one is not present.)
Recommended Best Practices	For content creation: If use of generative AI is permitted at all, one should always transparently cite its use.
Recommended Best Practices	Always refer to the specific policies and statements of discipline-relevant journals, publishers, and professional groups.
Promoting Discourse	Discuss opportunities for AI to contribute positively to your goals.
Promoting Discourse	Have conversations around ethical issues and limitations related to AI use and development.

Yale University (US)

Yale University is a private university based in New Haven, Connecticut (US). It is a member of the Ivy League and belongs to leading high-educational and research institutions in the US. The University issued its Guidelines for the Use of Generative AI Tools, in which it defined best practices according to the areas of AI use. The best practices are listed in the table below (Yale 2023).

Table 3: Outline of the best practices related to generative AI at Yale University

Area	Best practices
Protecting confidential information and oneself	Students and staff are encouraged not to enter confidential or legally restricted data or any data that Yale's data classification policy identifies as moderate or high-risk into an AI tool. If students and staff are not sure whether you should share certain data, they are asked to review Yale's data classification policy.
Assuming that all information may be shared with public	Students and staff are encouraged to treat all information shared with an AI tool as if it will become public. They are asked not to share information that is personal or sensitive, and be mindful that the information they input into an AI tool may be retained.
Following academic integrity gueidelines and institutional standards of conduct	All students and faculty are expected to know and adhere to their school's academic integrity policies. Faculty members are expected to provide clear instructions on the permitted use of generative AI tools for academic work and requirements for attribution. Likewise, students are expected to follow their instructors' guidelines about permitted use of AI for coursework.
Being alert for bias and inaccuracies	AI-generated responses can be biased, inaccurate, inappropriate, or may contain unauthorized copyrighted information. Students and staff are responsible for the content of their work product. They are expected to always review and verify outputs generated by AI tools, especially before publication.
Protecting oneself and one's own credentials	Students and staff should never share their University NetID and password with AI tools, and always be aware of phishing schemes. For information, tips, and toolkits on cybersafe practices, they are encouraged to visit Yale's Cybersecurity website, which also includes information about security policies and standards.
Seeking support from the University	The university is working to support procurement practices that coordinate shared interests and minimize institutional risk. If staff are considering acquiring an AI product, they are expected conduct an initial review of the tool to ensure that it conforms to institutional security requirements.

Carnegie Mellon University (US)

Carnegie Mellon University is a private university located in Pittsburgh, Pennsylvania, US. In 2023, the university had over 16,300 students enrolled in undergraduate, Master's and doctoral programs. Carnegie Mellon University's AI research standards encompass the principles of "fairness, transparency, and accountability". These guidelines also mandate researchers to address biases in both data and algorithms. Every AI ethics protocol within

the university underscores the importance of equity, openness, and responsibility in AI advancement, along with the imperative to recognize and address biases in data and algorithms. The ethical, societal, and policy ramifications of AI are examined within the respective centers of each university (Slimi and Villarejo Carballido 2023). The Software and Engineering Institute in 2019 developed 11 Foundational Practices for ethical use of AI that are stated in the table below (Horneman, Mellinger and Ozkaya 2019).

Table 4: Outline of the foundational practices for ethical use of AI at Carnegie Mellon University

Area	Best practices
Defining a problem that should be solved with the help of AI	Staff are encouraged to ensure that they have a problem that both can and should be solved by AI, so that they know both the outcomes they want to achieve and the data they will need to achieve them. They should start with a well-defined problem, understanding what they want to accomplish and the outcomes they need, while ensuring they have data available to infer those outcomes.
Inclusion of highly integrated experts and data scientists	Staff are advised to include highly integrated subject matter experts, data scientists, and data architects in their software engineering teams. AI engineering teams consist of experts in the problem domain (subject matter experts), data engineering, model selection and refinement, hardware infrastructure, and software architecting, in addition to the other typical software engineering expertise.
Protection, monitoring and data validation	Staff are advised to take their data seriously to prevent it from consuming their project. Data ingestion, cleansing, protection, monitoring, and validation are consdered necessary for engineering a successful AI system - and they require tremendous amounts of resources, time, and attention.
Choosing a suitable algorithm depending on the problem and the input information	Staff are advised to choose algorithms based on what they need your model to do, not on their popularity. Algorithms differ in several important dimensions: what kinds of problems they can solve, how detailed the information in the output is, how interpretable the output and models are, and how robust the algorithm is to adversaries (via manipulating training data, interfering with a feedback loop, and the like).
Securing AI systems	Staff are encouraged to secure AI systems by applying highly integrated monitoring and mitigation strategies. The attack surface of an AI system is expanded due to challenges with understanding how its complex models function and depend on data. These additional attack surface dimensions compound the vulnerability of the traditional hardware and software attack surface.

Recovery, traceability and justification	Staff are advised to define checkpoints to account for the potential needs of recovery, traceability, and decision justification. AI systems are acutely sensitive to the dependencies among input data, training data, and models. Changes to the version or characteristics of any one can quickly – and sometimes subtly – affect others.
Incorporating user experience	Staff should incorporate user experience and interaction to constantly validate and evolve models and architecture. As much as possible, they should use an automated approach to capture human feedback on system output and improve (i.e., retrain) models. Staff are advised to monitor user experience to detect issues early, such as degraded performance in the form of system latency or reduced accuracy.
Interpretation of AI output	Staff should design for the interpretation of the inherent ambiguity in the output. AI output requires much more interpretation than that of most other systems. The uncertainty introduced by an AI system might not be acceptable under certain scenarios for the mission and users.
Implementing solutions	Staff are advised to implement loosely coupled solutions that can be extended or replaced to adapt to ruthless and inevitable data and model changes and algorithm innovations. The boundaries between the components of an AI system deteriorate more quickly than those in traditional systems due to the entanglement of data. Moreover, the impact of change is heightened due to unanticipated direct and indirect data dependencies.
Investing resources into AI, committing time and expertise	Staff are advised to commit sufficient time and expertise for constant and enduring change over the life of the system. Teams significantly underestimate resources needed nine out of ten times. Building AI systems requires greater resources initially that need to scale up quickly and significant dedication or resources through the life of the system.
AI ethics, accountability for organizational and societal values	Staff are advised to treat ethics as both a software design consideration and a policy concern. Moreover, they are encouraged to evaluate every aspect of the system for potential ethical issues. They should also account for organizational and societal values in all aspects of the system, from data collection, to decision making, to validation and monitoring of performance and effectiveness.

IV. Integration in Education and Associated Challenges

Learning process can be promoted and encouraged when students engage in reflection, dialogue, and justification of the knowledge or abilities that they have obtained. The efficacy of a course is boosted when learners are given chances to discuss and reflect on their acquired knowledge or skills, which enables them to "revise, synthesize, recombine, and modify their new knowledge or skills" (Sundberg and Holmström 2024.). In order to achieve that, university staff may use a variety of AI tools in order to enhance the teaching methods.

One of the obstacles in integrating AI tools into higher education involves the aforementioned ethical concerns, such as safeguarding privacy and data integrity, and addressing biases present in AI algorithms. Higher education institutions need to prioritize the establishment of ethical standards and stress the importance of transparency in AI applications, and cultivate an atmosphere conducive to ethical discussions regarding the societal implications of AI. It is crucial to guarantee that AI technologies are inclusive and fair, while actively promoting diversity to counteract the perpetuation of societal prejudices (Awwad 2024).

Another obstacle in integration AI tools into higher education is the lack of knowledge and experience among academic teachers. In the survey conducted in February 2024 among academic teachers in Warsaw, Poland, it turned out that none of the participants used AI tools in the assessment process or to create personalized learning approaches. Only 36 per cent of respondents stated that they had sufficient knowledge and skills for the use of AI technologies in the study process. 91 per cent of respondents stated that they felt the need to enhance their knowledge and skills in using AI technology in the study process if they were available. 91 per cent of academic teachers agreed that AI creates opportunities for the improvement of education/study process and 100 per cent agreed that AI posed challenges to the education/study process (Sieniawski 2024). Therefore, courses and additional trainings for academic teachers on the use of AI tools in higher education are necessary in order to keep pace with technological development.

Higher educational institutions need to proactively incorporate AI tools into teaching process in order to prepare students for their future jobs. Therefore, it is crucial that universities take action and develop strategies for the use of AI. As Atchley et al. noted, "to maximize the benefits of collaborative learning (between fully human teams and between teams that

include AI), pedagogical strategies must intentionally incorporate primary and secondary factors that encourage shared responsibility, interaction, and meta-cognitive skill development, enhancing student engagement and learning outcomes" (Atchley et al. 2024).

V. Conclusion

Questions of responsibility in AI involve multifaceted dimensions such as ethical and legal aspects, which complicates the assignment of accountability amidst the complex interplay of technology, individuals, and organizations. Transparency issues and debates over agency allocation between humans and machines further strengthen the complexity of responsibility allocation. Similarly, privacy concerns that stem from the reliance of AI on extensive datasets and technological advancements pose significant challenges, including the risk of privacy breaches and non-compliance with regulations such as GDPR, which strengthens the necessity to carefully handle these issues and for adherence to ethical standards.

In the second part, best practices were identified based on three examples of US universities. While the areas slightly differed, Yale University developed a set of principles in the ethical sphere of AI use that researchers and students need to be aware of:

- Protecting confidential information and oneself,
- Assuming that all information may be shared with public,
- Following academic integrity guidelines and institutional standards of conduct,
- Being alert for bias and inaccuracies,
- Protecting oneself and one's own credentials,
- Seeking support from the University.

The last part of the paper suggested that universities need to work on strategies how to integrate AI tools into education process. The learning process is enriched when students engage in reflection, dialogue, and justification of their acquired knowledge or abilities, which enhances the efficacy of a course. While universities may utilize AI tools to facilitate teaching methods, their integration faces ethical challenges such as ensuring privacy, addressing biases, and promoting inclusivity. Higher education institutions need to prioritize ethical standards, transparency in AI applications, and diversity promotion while actively incorporating AI into

teaching strategies to prepare students for future job requirements, and foster collaborative learning environment that enhances engagement and learning outcomes.

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Gazi
kitabevi

Merkez/Mağaza
53. Sokak No: 29
Bahçelievler / ANKARA
Tel : (0 312) 223 77 73 - 223 77 17
info@gazikitabevi.com.tr • www.gazikitabevi.com.tr

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Gazi Kitabevi
Sosyal Bilimler Serisi