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Chapter 1

Opportunities, Challenges, and Visions for AI Integration in Higher Education

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Based on existing research, this chapter summarizes the opportunities and challenges of AI integration into higher education. On the one hand, it explores how AI can empower higher education and contribute to achieving Sustainable Development Goal 4 (SDG4) by ensuring inclusive and equitable quality education for all, and promoting lifelong learning opportunities. On the other hand, this chapter also discusses the challenges of AI in higher education, including academic integrity risks, ethical concerns, and the digital divide. The effective integration of AI with higher education depends heavily on enhancing teaching personnel competencies, while also demanding ethical and responsible use of AI technology by stakeholders in higher education.

This chapter also presents a future vision for AI integration

in higher education. From this perspective, the chapter attempts to outline roadmaps, calling on policymakers, HEIs, and Edtech enterprises to act jointly to innovate higher education and reshape the new ecosystem in the AI era. UNESCO-ICHEI is poised to take a pivotal role by providing policy guidance and recommendations, promoting teaching personnel competency frameworks, fostering international multilateral collaboration, and supporting projects on effective AI integration in education. Only through collective action and system-wide commitment can we co-create a new ecosystem, fully harness the potential of AI, and accelerate the realization of inclusive, equitable, and quality education and lifelong learning for all.

1.1. Opportunities of AI for SDG4

AI holds intriguing promise as an enabling technology that could assist in progress towards the SDG4 of ensuring inclusive and equitable quality education and promoting lifelong learning for all. This section details the opportunities of AI applications to help advance education inclusion, enhance the quality of teaching and learning, and expand lifelong learning opportunities.

1.1.1. Inclusive and Equitable Education

Developmental factors hinder underdeveloped countries, regions, and marginalized groups from accessing quality higher education. However, emerging AI technologies offer new opportunities to create a more inclusive and extensive learning environment. If AI is considered a tool to support institutional reform, particularly in terms of expanding reach and promoting educational inclusivity, it can facilitate inclusive education in various ways:

Expanding Access to High-Quality Teaching

In underdeveloped countries and regions with limited educational resources and severe faculty shortages, a few HEIs often need to cater to a large number of learners. Institutions can significantly enhance management efficiency and broaden their scope by leveraging AI-supported infrastructure, extending the boundaries and capacity of institutional services[1]. Using AI's data insights and prediction capabilities, institutions can make informed decisions regarding resource allocation and planning. Additionally, AI can enhance efficiency and offer more possibilities in enrollment, course recommendations, and flexible and open learning pathways. For instance, offering AI-driven laboratories on virtual platforms can address equipment shortages in impoverished areas, enabling students to gain hands-on experience in STEM disciplines.

Promoting Inclusion in the classroom

AI can autonomously identify the personalized needs of diverse learners, offering adaptive suggestions to enhance classroom inclusivity and provide personalized support for students facing learning challenges [2]. For example, AI analysis based on behavioral cues and participation patterns can propose new approaches, recommend courses and learning paths, and assist institutions in the early detection of students facing academic challenges or considering dropping out. AI counselors can help students with cognitive difficulties grasp concepts, while intelligent agents can automatically adjust teaching strategies based on different learning preferences. Therefore, AI is conducive to creating a more inclusive teaching environment, allowing learners to feel recognized, valued, and empowered to unleash their potential.

Improving Accessibility for All Learners

AI, through machine learning and generalization capabilities, continuously optimizes language translation and speech-to-text conversion across different languages. Presently, machine translation tools can rapidly convert text into multiple languages, breaking down language barriers for non-native speakers. Features such as text-to-speech and subtitle generation provide more convenient learning opportunities for visually impaired individuals. The emergence of virtual embodiment technology for sign language translation opens new avenues for content comprehension. This significantly addresses the issue of marginalized and minority populations accessing the same educational resources, contributing to the creation of a more equitable environment where learners are no longer confined by educational accessibility gaps. With universal design principles and human empathy, AI-assisted tools facilitate safeguarding the right to quality education for all.

1.1.2 Quality Education

If AI technology is considered a tool to support teaching and enhance the quality of education, AI can serve as a powerful assistant for teaching personnel, significantly improving the learning experience, particularly in the following three aspects [3]:

Enabling Personalised Learning at Scale

One of the greatest potentials of AI in enhancing education quality is the fundamental expansion of personalised and adaptive education on a large scale. Intelligent tutoring systems can provide each student with a tailored learning path, exercises, and feedback. Virtual tutors act as personalised assistants, helping learners navigate core knowledge points. Advanced algorithms can analyze each student's strengths, weaknesses, interests, and emotions, adjusting teaching and resources accordingly to serve large classrooms of hundreds of individuals.

Creating Dynamic, Interactive and Engaging Learning Experiences

Through highly dynamic, interactive, and immersive learning experiences, AI contributes to increased student engagement. Intelligent tutoring systems offer role-playing exercises guided by conversational AI, allowing learners to experiment in realistic environments with immediate feedback on their actions. AI-adaptive courses gamify learning progress through points, leaderboards, and reward systems, unlocking new levels based on mastery levels. Chatbots facilitate interactive teaching, making education a unique social activity. These enhanced learning experiences can stimulate higher levels of engagement, creativity, and mastery of knowledge.

Utilizing Predictability of AI for Learning Diagnostic and Precision Teaching and Learning

With the support of learning analytics and AI technology, AI can predict difficulties students may encounter. AI-generated assessments and visualization features can identify knowledge gaps, improve teaching processes, and enhance individual learning outcomes through continuous optimization. AI teaching tools can strengthen targeted tutoring with a focus on individual needs. However, this requires educational institutions to have mature digital learning systems and infrastructure, and educators need appropriate guidance skills to utilize these predictive capabilities effectively.

1.1.3 Lifelong Learning

The rise of AI has created a demand for continuous learning and development. Educators and learners need to continuously enhance their skills to ensure efficiency and upgrading of impact in industrial transformations. Additionally, the requirements for AI literacy, related privacy, ethics, understanding, and usage drive people to continuously learn through HEIs, fostering new vitality in higher education. AI also holds significant potential in supporting lifelong learning for teaching personnel, enabling them to acquire new skills, concepts, and knowledge, and cultivating a culture of continuous self-improvement within the profession. For instance, teaching personnel can utilize GenAI for research work, requesting the latest abstracts of academic literature relevant to their disciplinary field and educational environments. Lifelong learning in the age of AI is learning to learn with GenAI, achieving the requirements of future society in the iterative process of knowledge and skills.

Leveraging GenAI Technology to Support Rapid and In-Depth Learning

According to *Guide of Generative AI in Education and Research* [4], GenAI technology can rapidly clarify key knowledge and learning paths in a particular domain, effectively enhancing learning efficiency and lowering the barriers to lifelong learning. This accelerates the accumulation of professional knowledge for anyone.

Learning Needs Driven by and Massive Knowledge Created by the AI Industry

The upgrading of industries has driven a substantial demand for talent. Consequently, based on their own research and knowledge frameworks, suppliers and developers of AI services will offer course resources to higher education and society, ensuring that the industry keeps pace with technological developments. This trend provides higher education with lifelong learning opportunities from the industry, enabling higher education to rapidly keep up with knowledge updates and iterations.

1.2 Challenges of AI in Higher Education

The impact of technology is always a double-sided sword. While students and young individuals tend to embrace technology optimistically, regulation at the national and institutional levels, and monitoring and assessment of ethical mechanisms are often lagging. This section will summarize the current overarching challenges in higher education.

1.2.1 Academic Integrity Risks

Emergent AI technologies raise pressing concerns regarding safeguarding academic integrity and promoting students' responsible use of AI. While AI has displayed the potential to enhance various aspects of teaching and learning, as discussed above, powerful GenAI models also enable new forms of misuse that could severely undermine the central aims of education if poorly managed and governed in higher education.

Specifically, if students excessively rely on LLMs such as GPT, there is a potential risk of hindering their higher-order thinking processing and internalization of knowledge during the learning process, consequently reducing the quality and efficacy of learning, creating opportunities for cheating and plagiarism. Students may be tempted to use LLM to complete entire assignments from start to finish. However, this circumvents key learning objectives – the mere copying of AI output impedes developing skills in analysis, synthesis, and articulation [5]. Overreliance on generative AI to shortcut academic work strips away opportunities for meaningful learning experiences that foster higher-order thinking skills. From the educational policy and administration perspective, it also poses new challenges in preventing technological misuse.

1.2.2 Ethical Considerations

Collecting vast student datasets poses pressing privacy risks that require safeguards and oversight. As products of their algorithms and training data, AI systems can perpetuate or amplify social biases if fairness is not proactively built into their design. The lack of transparency about how many AI models make decisions raises accountability concerns, especially when those decisions shape student trajectories. While AI could enrich learning, over-reliance may diminish human interactions crucial for socio-emotional development and mental health. Another major challenge is that many existing AIs have yet to reflect diverse cultures, languages, and socioeconomic backgrounds, so the relevance and usability of AI for underserved regions could be a concern.

In addition, from November 2022 to the present, several HEIs have experienced a shift in attitude towards banning the use of GenAI, to limited use of GenAI, and finally to providing support for the rational use of GenAI tools, which reflects a transformation in policy and ethical considerations. In the subsequent chapters of this white paper, we will elaborate on the regulatory changes in countries and institutions and the current concerns that need to be addressed at the ethical and regulatory levels of AI and GenAI.

1.2.3 A "Second-Level" Digital Divide

While efforts to increase access to technology and connectivity have reduced digital divides, the risk of inequities surrounding the ability to benefit from AI in education persists. Providing access to robust AI systems does not automatically confer the competencies to employ them productively and meaningfully. This risks privileging already-advantaged student populations concentrated in well-resourced institutions and districts. These privileged groups are more likely to gain early exposure and build literacy with potentially learning-enhancing AI technologies. With robust infrastructure, teacher readiness, curricular integration, and overall competencies to deploy AI effectively, advantaged students will make more progress[6]. Meanwhile, marginalised communities lacking access to AI technologies or capabilities could remain left out, with aggravating digital gaps, and widening disadvantages in innovation or connection to the modern workforce. Underserved learners could lag even further without focused efforts to build holistic AI readiness across resources, training, pedagogy, and infrastructure.

1.2.4 "Imbalance and Uncertainty" in Talent Development

Traditional higher education emphasizes cultivating students' professional skills. However, the advent of AI and GenAI has significantly increased the substitutability of knowledge-intensive jobs driven solely by professional knowledge [7]. Future work may require more collaboration between humans and machines, emphasizing stronger soft skills. However, currently there is no clear consensus in higher education on the development of future curriculums and talent cultivation. The ongoing debate raises issues about what talents higher education should nurture and what talents will be needed in the future. The alignment between talent and employment development may become imbalanced without changes in the training models and curriculum structures in response to future demands. Educators and institutions have yet to define specific measures or set goals to respond to the era of AI, resulting in a cautious and somewhat delayed response to AI integration in education. However, there is a shared need for understanding emerging technologies and developing AI-related literacy. How to respond to these needs and foster collaborative communication between institutions and industries is crucial; otherwise, the output of higher education may fall into a state of imbalance and uncertainty.

****Note:** The first-level digital divide refers to the gap in accessing information and communication technologies (ICT), that is, whether there is an opportunity to use technological tools and devices [6]. As more countries and regions have been able to access the Internet and devices than before, the concept of the digital divide has been further expanded. The second-level digital divide refers to the disparity in ICT competency[9]. In the realm of higher education, the competencies to use technology impact the quality of education.

1.2.5 A Need for Universal AI Literacy

Whether it is educators, or students, the universal awareness and gradually mastery of AI literacy is crucial. Educators and learners need to have a clear understanding of the opportunities and risks that AI presents for pedagogy, and identify the how AI impacts teaching and learning. At the same time, administrators and regulators of HEIs and stakeholders of HE should clarify the definition of AI literacy and its impact on different professional roles (such as engineers, doctors, teachers), and accordingly develop AI-related educational policies, norms and guidelines for institutional use. All parties must have a clearer understanding of the impact of AI on higher education and actively participate in the design and development of AI educational tools to create solutions that meet the needs of teaching and learning.[9][10]

1.3 Future Vision of AI Integration in Higher Education

The impact of AI, particularly GenAI, on stakeholders such as teaching personnel, institutions, and enterprises depends on the prudent and ethical usage of technologies. As teaching personnel provide the irreplaceable human skills of embodiment, creativity and ethical reasoning, inspiring students, and cultivating multidimensional development, AI fails to replace the unique role of humans in education. This human-AI collaboration, with teaching personnel firmly at the centre of steering AI's development ethically, can amplify the best of both. In addition, effective integration of AI into higher education will amplify the outcomes towards SDG4. Specifically, with proper oversight and governance, AI can help enhance talent cultivation mechanisms, support teaching innovation, and promote institutional management innovation. Therefore, UNESCO-ICHEI holds an optimistic attitude towards the positive development of AI in higher education or AI in collaboration with teaching personnel, envisioning the following aspirations.

1.3.1 AI Enhances Talent Cultivation Mechanisms

In the process of integrating AI into higher education, the talent cultivation mechanism for teaching personnel and students is an indispensable aspect. AI can assess students' classroom performance and learning behaviours to help them create personalised learning plans, thus maximising the principle of "teaching students in accordance with their aptitude" and fostering their ability to learn independently. Teaching personnel need to receive specialised training to understand the potential and limitations of AI systems and develop the necessary competencies to integrate them effectively into their teaching. A human-centered approach is essential for strengthening interpersonal collaboration and advancing more personalised, humanistic education for everyone.

This white paper focuses on the development of various competencies of educators and learners in the talent cultivation mechanism, with key areas including[11][12]

Technical competency: Learners need hands-on training to become adept at using AI technologies. They must understand how different systems work, their features and functionalities, and how to troubleshoot common issues. Hands-on workshops, in-depth manuals, and technical support can help teaching personnel build technical fluency.

Ethical competency: Learners must recognise the biases and limitations of AI systems, and understand appropriate vs inappropriate usage. Training should promote algorithmic awareness, critical thinking, and responsible oversight. Teaching personnel needs guidance on fostering safe, ethical learning environments despite AI's imperfections.

Assessment competency: Learners require training to assess learning alongside AI systems effectively. This includes understanding the data AI tools collect, interpreting algorithmic recommendations, recognising limitations of automated assessments, and providing holistic human feedback.

Co-learning mindset: Rather than fearing replacement, learners should be encouraged to adopt a co-learning mindset with AI as a collaborative partner. With continuous learning and adaptation, teaching personnel can remain responsive to innovations. A growth mindset focused on complementing each other's strengths is critical.

1.3.2 AI Supports Teaching Innovation and "AI + Teaching Personnel" Model

Certainly, HEIs and educators can not avoid AI integration in various forms in the education sector. From an optimistic perspective, AI holds the potential to assist teaching personnel in all aspects of teaching to transcend traditional teaching modes. Under ethical and appropriate contexts, the positive interaction between AI and teaching personnel in teaching mutually supports educational innovation in the following ways:

AI as an Educational Collaborator: As an assistant, AI can handle routine tasks, allowing teaching personnel to focus on curriculum development and other more creative work. Under the supervision of teaching personnel, AI can assist in classroom explanations, guided discussions, task assignments, and suggestions and feedback based on teaching objectives.

AI as an Assessment and Analysis Engine: By continuously evaluating teacher–student interactions and teaching effectiveness, AI can generate visualized data and analyses on knowledge gaps and participation. This enables teaching personnel to make targeted teaching decisions and scientific decisions based on data.

AI as a Co-Creator of Personalized Teaching Content: AI algorithms can summarize teaching materials, generate exercises, provide explanations, and offer personalized and customized teaching plans based on the analysis of learning resources.

AI as a Designer of Teaching Scenarios: AI can assist teaching personnel in designing highly attractive simulated environments, and creating personalised and adaptable teaching experiences that promote active learning through diverse scenarios and interactions.

AI as a Teacher Development Coach: Personalized AI coaching can provide teaching personnel with feedback on their teaching practices, lesson plans, and ito monitor financial management betterinteractions, helping them master new skills through reflection and practice.

AI as an Administrative Assistant: Handling daily administrative tasks such as organizing course materials and basic grading, AI assistants can simplify workflows, allowing teaching personnel to focus on high-quality teaching.

1.3.3 AI Assists Institutional Management Innovation

Regarding AI integration in higher education, AI not only stimulates talent cultivation and pedagogies but also innovates institutional management models. With its powerful cloud-based data storage capabilities, AI can rapidly analyse massive data sets, aiding institutional administrators in making scientific decisions.

Virtual Assistant: AI virtual assistant and automated processes can enhance institutional management efficiency. Automating routine tasks saves administrators more time for strategic planning and policy formulation. Virtual assistants can also provide timely support for students and staff, gather demands and feedback on administrative services, and improve the quality of campus services.

Optimising Admissions and Academic Assessments: AI has tremendous potential in institutional admissions. It can analyse students' academic backgrounds and characteristics, helping administrators to understand students more effectively and offer suggestions for recruitment strategies. AI can also assess the academic performance of enrolled students, track long-term changes in their academic achievement, and help HEIs improve teaching quality.

Financial Management: AI can assist HEIs in planning financial budgets, identifying potential ways to reduce costs, and optimising resource allocation. AI systems can also enhance financial transparency, enabling administrators to better monitor financial management.

Improving Research Incentive Models: AI can help HEIs better manage and utilise intellectual assets, adjust research incentive models, and promote research and innovation. AI can also break down disciplinary barriers, foster interdisciplinary collaboration, and contribute to curriculum reform.

1.3.4 Co-Creating a New Ecosystem of AI Integration in Higher Education

To realise the effective integration of AI into higher education, all stakeholders must jointly shape a supportive new ecosystem that enables teaching personnel to use AI effectively. This requires common action from governments and policymakers, HEIs, and enterprises to create conditions for empowering higher education with AI.

Governments and policymakers have a vital role to play in driving the integration of AI with higher education. They need to fund high-quality teaching personnel training programs and set competency standards for educators to deploy AI effectively and ethically. Policies must delineate appropriate versus inappropriate uses of AI to safeguard students. Supporting rigorous research on AI's impacts and teacher effectiveness is critical for evidence-based practice and policy. Governments must make concerted efforts to bridge digital divides, and one possible approach is promoting partnerships between industry and educational institutions, ensuring that even rural and remote areas have access to AI platforms and capacity-building resources. Monitoring policy impacts on educational equity will be crucial. Policymakers should foster dialogues and convene experts across disciplines to develop guidance and governance frameworks that uphold ethical values. Through multi-sector collaboration and system-wide strategy, governments can lead in steering AI's potential to benefit all learners equitably rather than further disadvantages.

Higher education institutions (HEIs) are also crucial in driving the effective integration of AI into higher education. Education leaders must prioritise upskilling teaching personnel on effective, ethical applications of AI by implementing comprehensive training programmes, Communities of Practices, mentorship programmes and self-directed learning resources. Instructional design teams can develop content that equips teaching personnel with technical fluency in AI systems, pedagogical integration strategies, ethical considerations, and assessment strategies in AI-enhanced teaching and learning. Ongoing professional development through workshops, certifications, and micro-credentials will enable continuous adoption of emerging best practices. Institutions can foster peer mentoring and collaboration by building professional learning communities focused on classroom AI implementation. Tenure and promotion policies could incentivise teaching personnel to publish action research on AI applications. IT departments need to ensure robust infrastructure, user support and monitoring to actualise good use of AI tools on campus.

EdTech enterprises are a critical link in the new ecosystem. Enterprises can carry out AI pilot projects, providing resources and technology for educational innovation and applying advanced AI systems in higher education. Specifically, by developing AI educational software and products, such as intelligent teaching management systems, chatbots, virtual tutors, and personalised learning platforms, enterprises can enhance the teaching experience and improve institutional management efficiency. They can also offer data analysis solutions to help institutions collect and analyse teaching management data and propose targeted improvements. Furthermore, enterprises can leverage industry advantages to collaborate with HEIs and research institutions, sharing technology and resources.

Teaching personnel in HEIs, as essential members in education, play a role in implementing, evaluating, advising, and negotiating in the co-creation of the AI integration ecosystem in higher education. To effectively apply AI technology, teaching personnel in HEIs should collaborate with industries to identify needs and co-design solutions related to teaching issues. This collaboration is crucial for AI products to empower education.

Strong partnerships are essential for a new higher education ecosystem. The AI industry and private sector need to collaborate with governments and HEIs to co-develop responsible practices and align with governance frameworks. All stakeholders should closely collaborate to advance policy advocacy and best practices and align with the vision of effective integration of AI into higher education, jointly shaping a thriving ecosystem.

1.3.5 Vision and Commitment of UNESCO-ICHEI

UNESCO-ICHEI, in collaboration with global partners, will promote the effective AI integration in higher education, unlock the potential of AI to empower educators, innovate higher education models, and organically integrate teaching personnel's competencies into AI technology. It will deepen the strategic capacity building of HEIs in the AI era, from policy guidance and professional development to technical support, ensuring the quality, equity, and lifelong learning opportunities of education.

Enhancing Teaching Personnel Professional Competencies and Literacy in Applying AI

As UNESCO-ICHEI's flagship project, the International Institute of Online Education (IIOE), has been committed to helping teaching personnel in developing countries improve their online and blended teaching abilities. In the future, IIOE will integrate AI technology in its course system to enhance the AI competence of teaching personnel.

Improving Talent Cultivation Mechanisms

UNESCO-ICHEI calls on partner institutions to formulate long-term talent development strategies, empowering teaching personnel through optimisation and upgrades of AI technology. Adhering to a human-centered approach, it will leverage the advantages of AI technology to provide personalised solutions for teaching personnel and students. IIOE will use micro-certification, among other means, to assess teaching personnel's use of AI tools and provide appropriate recommendations and feedback.

Promoting Teaching Innovation

IIOE will integrate various roles of AI in teaching, improve the efficiency of teaching personnel in handling routine tasks, unleash their creativity in curriculum development and design, enrich personalised teaching scenarios, innovate teaching methods, and enhance the quality and effectiveness of teaching.

Advancing Institutional Management Innovation

IIOE will offer a series of courses on AI innovation in institutional management, helping administrators upgrade their traditional methods, improve management efficiency, and make informed decisions in recruitment, resource allocation, and budget planning based on big data analysis.

Strengthening Partnerships and Ecosystem Construction

IIOE will mobilise global partner resources through a network of flagship HEIs worldwide, strengthen public-private partnerships and the collaboration between industry and education, and jointly build an ecosystem for the integration of AI into higher education.

Promoting the optimisation and upgrading of AI education products

IIOE works with the AI industry to explore emerging technologies such as AI, AR/VR and big data, as well as cooperates with HEIs and governments, to promote quality resources and AI tools for higher education.

Strengthening the UNESCO system's governance capacity for global higher education

HEIs and teaching personnel in developing countries should showcase their leadership in education transformation. In the future, the IIOE National Centers will expand the scale and ripple effect of the integration of AI in higher education, help teaching personnel to obtain sustainable professional development in the AI era, and strengthen UNESCO's governance capacity for global higher education.

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