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Harnessing the Era of Artificial Intelligence in Higher Education

A Primer for Higher Education Stakeholders

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Harnessing the Era of Artificial Intelligence in Higher Education: A Primer for Higher Education Stakeholders

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Foreword

No one in higher education should avoid the duty to assess opportunities and challenges of artificial intelligence (AI) and then take action simply because of fear of the unknown. For good or bad, everyone in higher education must acquire at least a basic understanding of AI to make informed decisions. When our societies, cultures, values, political systems, and economies face the incredible challenge of AI, our citizens legitimately expect guidance from higher education.

First, higher education institutions (HEIs) are not only engaged in the research and development that promotes further advancements in AI but also train most professionals who, directly or indirectly, will work in the AI industry or must adapt their skills to take advantage of AI. Ultimately, HEIs, particularly universities, should offer their capacities as a values-driven nest where AI can reside and evolve. Second, higher education can, moreover, help us all to have a critical approach to AI, empowering us to place AI at the service of human development, rather than passively and mindlessly waiting for whatever impacts it may have on our lives.

Both reasons substantiate the need for a Primer like this which UNESCO International Institute for Higher Education in Latin America & the Caribbean (IESALC) is pleased to offer to the wider community of higher education stakeholders worldwide. It aims to provide the basic information and tips that would allow higher education stakeholders to develop their thinking and policies regarding the use of AI to improve processes and outcomes at their institutions. It has been designed as both a comprehensive and comprehensible introduction to AI in higher education and a practical tool for guidance and reference. It also includes some urgent recommendations.

AI presents HEIs with yet another opportunity to demonstrate their value to our societies and people, as they did during the pandemic. HEIs are expected to be a lighthouse whenever a major crisis emerges. At UNESCO IESALC, we would be honoured if this contribution helps to keep the light on and for it to shine even brighter.

Francesc Pedró

Director, UNESCO IESALC

Highlights

Understanding artificial intelligence

There is no one universally accepted definition of AI. UNESCO's approach to AI, which would of necessity change over time to align with future developments, focuses on the imitation of human intelligence: "machines capable of imitating certain functionalities of human intelligence, including such features as perception, learning, reasoning, problem-solving, language interaction, and even producing creative work" (UNESCO, 2019b, p. 24).

AI has two capabilities: Artificial Narrow Intelligence (ANI) and Artificial General Intelligence (AGI). ANI, or weak AI, is the type of AI that has been achieved so far. Within ANI, machine learning is the most popular technique to the point that many times these two concepts (AI and machine learning) are used as synonyms. AGI, also called human-level AI or strong AI, is currently a theoretical type of AI that, if ever reached, would be comparable to human intelligence.

AI can also be categorized by its predictive or generative function. Predictive AI is a type of machine learning algorithm that analyses data and forecasts future events or results. In contrast, generative AI specializes in producing new content.

More reliable data, the greater quantity of data, algorithmic advances and funding are all factors driving recent interest in AI. The number of AI publications has experienced steady growth, constituting over 2.2% of all scientific publications in 2018 (Baruffaldi *et al.*, 2020). In 2021, almost half a million publications on AI were produced in English and Chinese (Stanford University, 2023). By 2030, the potential contribution of AI to the global economy is estimated at US$15.7 trillion (PWC, 2019). The volume of private investment in AI research and development dominates the field, even as governments are exponentially increasing financing for AI.

AI and learning, teaching and assessment

AI can be applied to learning, teaching and assessment in a range of ways. However, while offering exciting prospects to apply technology for positive change, there remain many risks and challenges.

Personalized learning provides students and teachers with individualized feedback, helps detect which students require further assistance, and boosts students' learning performance. AI tools for personalized learning provide personalized, adaptive instruction and can be used for individual course recommendations, helping students advance at their own pace, redirecting them to additional reinforcement materials when needed and providing feedback to their teachers on their progress. Personalized learning has a wide array of applications, such as intelligent tutoring systems, chatbots to support learning and teaching and virtual and augmented reality.

AI tools can support students who are blind or have impaired vision, are deaf or hard of hearing. They can support language inclusivity and provide emotional and practical support. Using AI, online platforms can identify patterns in student progression. Learning analytics are increasingly using AI to collect, analyse and report data on learning, teaching and assessment. With the popularization of ChatGPT, students are already turning to AI to help them with assessments. Another application of AI is robot-graders, or automated platforms that grade or assist teachers to grade assignments and give feedback to students.

Teaching staff at HEIs are the most likely to have their role affected by AI technologies and to have a central role in the integration of AI technologies in HE, particularly in relation to rethinking assessment and to teaching and upholding academic integrity. Teacher professional development is key.

AI and higher education administration and management

The impact of AI on higher education is already being felt strongly in the way that HEIs are governed and managed. Data can be used in AI tools that support learning and teaching processes; it can similarly inform governance and management processes and procedures, potentially making them more effective and efficient.

HEIs play an important role in shaping the responsible development and deployment of AI technology and it is essential to incorporate guidance on AI to address various aspects such as academic integrity, research ethics, and the broader implications of AI deployment.

The integration of AI into higher education involves considerations of both a technical and organizational nature. These include hardware resources, software requirements, data management strategies, personnel and skills, and security and privacy concerns.

The spread of AI is likely to affect many administrative roles within HEIs. These naturally include IT services, and also encompass admissions, student services, library, marketing, and finance. AI can be successfully embedded only with adequate training and a cultural shift.

High volume administrative tasks, from admissions to procurement, can drain human and financial resources for HEIs. AI can be used in scenarios where large pre-existing databases are available where machine leaning techniques can be applied.

Similar to the use of chatbots by students for administrative tasks or learning, prospective students can also benefit from AI-based applications that can solve their questions and guide them through the sometimes burdensome admission procedures. Additionally, AI can be used to identify students with potentially vulnerable profiles who might be at risk of dropout, allowing the HEI to use this information to take proactive measures to prevent it.

AI and research

Research on AI has greatly increased. Based on recent publication trends, there has been a surge in publications concerning pattern recognition and machine learning in the last five years. However, only 1.4% of articles on AI applications in higher education addressed issues related to ethics, challenges and risks.

AI is an interdisciplinary and complex field and should involve researchers from across many different areas of research, some of whom are predicting that the next breakthroughs in AI will be based on its interdisciplinary nature.

AI can be used by researchers for the lifecycle of a research project, from designing research through to data collection and analysis, and writing up/ presenting and disseminating research results. For example, machine learning (ML) and deep learning (DL) can be used to identify patterns and relationships within large datasets that may not be readily apparent to human researchers. Research using AI tools is supporting the Sustainable Development Goals, with examples provided in the chapter.

There are a number of challenges to using AI-powered tools in research, perhaps foremost among them the risks that could undermine the originality of knowledge production. There are also specific ethical challenges to using AI in research that are unique to higher education settings, such as institutional ethics review processes.

Practical Guide to Responsibly Integrating AI into Higher Education

AI is expected to bring about profound changes for the higher education sector, presenting numerous opportunities as well as serious and urgent challenges that must be addressed in the transition towards AI-driven systems. This chapter provides a Practical Guide targeted at higher education leaders, setting out actionable recommendations and steps that can be taken at an institutional level to adapt to AI in a responsible and ethical manner.

The Practical Guide has been designed with HEIs in resource-constrained contexts in mind, but it is also intended to be flexible and responsive to a range of local/ global institutional and regulatory situations. It signals actions that affect internal capacity building, institutional governance, teaching, research, and community engagement. These actions also include specific recommendations on gender equality that can lead to transformation by addressing the root causes of gender inequalities.

Key challenges for AI in higher education

The global take-up and development of AI in higher education is not evenly distributed. This is in line with the general AI divide between countries such as China and the USA where AI has been more concentrated, and regions such as sub-Saharan Africa, parts of Central and South Asia, and parts of Latin America where AI has not developed at the same scale.

in regions with resource constraints, data availability and compatibility pose significant challenges. For example, the lack of datasets on Africa that are suitable for machine learning purposes contributes to the structural inequalities faced by that region.

AI can help reduce bias in decision-making by reducing humans' subjective interpretation of data, but AI also scales bias. AI is built on data, and if the data itself is skewed, it can have negative consequences for the AI system. And, in the absence of a broader range of engineers and researchers, AI products might result in the proliferation of bias on a large scale.

The gender gap in science, technology, engineering and maths (STEM) fields starts well before higher education and is also manifested in societal norms and expectations. The participation of women in AI-related academic research is significantly lower than men. Besides unequal gender representation, AI can also create and increase racism and discrimination. Only by fostering a truly diverse and inclusive STEM environment can the creation of AI systems that are fair, unbiased, and effectively serve all segments of society, be ensured.

AI systems create issues of sustainability due to their consumption of natural resources. One conservative estimate is that ChatGPT training is equivalent to the monthly power supply of a small city.

Looking ahead, it can be expected that traditional approaches to higher education will be challenged by AI, possibly leading to some of the following outcomes:

- HEIs will create policies and guidelines on the use of AI in teaching, learning and assessment
- Modes of assessment will be rethought to integrate AI or identify alternative assessments
- The student experience will be enhanced through AI tools, the use of chatbots will proliferate in higher education, and more generative AI tools will be trained to assist students in their learning
- Roles in HEIs will change alongside a shift in the expectation of leaders, staff, and faculty
- Data-informed decision-making will become more prominent in HEIs that have a robust data architecture
- Research in higher education will add to knowledge about aspects of AI that are currently underexamined, and AI ethics training will be commonplace
- Many more courses on AI will be available, not only those training AI specialists but others that provide more general education on AI, ethics, and other aspects
- Educating the general public about AI will become part of HEIs' community engagement mission.

The ethics of AI in higher education

In 2021, UNESCO adopted the *Recommendation on the Ethics of Artificial Intelligence*, which includes 11 areas of policy action to guide Member States on operationalizing the values and principles set out in the Recommendation. This chapter outlines how each area of policy action could be understood and implemented through the lens of higher education. It connects to specific actions that HEIs can take, and these are discussed in detail in the Practical Guide.

Calls for HEIs to update their guidance on the use of AI in teaching, learning and assessment have become significantly more pronounced. In general, recent developments have increasingly led to calls from educators, policymakers and private sector leaders alike to provide more in the way of regulation and guidelines.

The large amount of data being collected and applied to build and maintain AI systems used in HEI can benefit students and institutions. However, this data also presents risks, if abused. It is essential to install the necessary safeguards to prevent data theft and undue modification. To this end, HEIs must have a data governance strategy when using AI in their institutions.

From an ethical perspective, there are three main areas where the dependence on data can create and perpetuate bias: in the process of labelling data, in the choice of dataset, and in the replication of cognitive bias. Furthermore, algorithms are being trained on highly biased male datasets, which yield discriminatory outcomes.

In the realm of AI, industry now dominates academia. This could potentially induce process and product efficiencies that reduce costs and effort, but the commercialization of AI may lead to its further development only in areas that are likely to generate profit for industry, thereby reducing the likelihood of academia leading 'blue skies' (basic) research.

Recommendations

One of the key issues for **higher education institutions** in the immediate future, regardless of location or resource level, is the need for HEI leadership to be equipped to advance in the responsible implementation of AI. The Practical Guide sets out detailed actions for responsibly integrating AI. To recap, these recommendations are:

- Build internal capacity;
- Develop a policy framework for AI;
- Innovate in pedagogy and skills training;
- Promote AI research and application;
- Mobilize knowledge and communities around AI;
- Improve gender equality for AI and higher education.

While wide-ranging, the Practical Guide should be seen as a flexible set of tools that should be contextualized in the local reality and adjusted as AI technology develops.

For **governments and policymakers**, the recommendations are to be applied on a wider scale:

- Build capacity within policymaking structures to better understand AI, its possibilities, limitations and risks;
- Foster interdisciplinary and cross-sectoral spaces for discussion on AI issues, and actively engage a wide range of stakeholders;
- Regulate AI, with emphasis on the ethical and safety implications of AI, and provide guidance to HEIs about the use of AI;
- Fund training and development for AI courses and AI ethics courses in higher education;
- Fund interdisciplinary research on AI and incentivize research collaboration across borders;
- Assure that HEIs have the required connectivity and infrastructure to deploy AI tools;
- Ensure that higher education quality assurance processes are updated and that they include AI ethics.
- In cases where governments regulate curriculum/guidance to HEIs, include critical thinking as a meta-skill to be taught across all courses;
- Introduce policies and programmes to overcome marginalization of people in AI based on their gender, race/ethnicity or other factor.

1

Introduction

Introduction

As a series of technological developments designed to imitate human cognition and decision-making, artificial intelligence (AI) is profoundly reconfiguring every aspect of societies, economies, and labour markets. AI is an example of technology developing faster than institutions can respond, with limited time and resources to foresee the implications. With the advent and rapid development of generative AI in the early 2020s, the use and application of AI has never been greater, and the dynamism this has produced also means that the risks and implications for equity and diversity of knowledge have also never been greater.

Higher education has the potential to play a significant role in shaping the current era as the skills and technologies to develop AI are advanced, knowledge about AI is generated and shared, and people are supported to adjust and adapt in the face of this and other technological changes. Yet, to date, AI has not been widely integrated into higher education institutions (HEIs), developing fastest in a limited number of countries with huge global gaps remaining, particularly in resource-constrained contexts and in countries where the infrastructure of connectivity that underpins AI technology is not assured.

Furthermore, the ethical dimensions of increased AI application are only beginning to be understood. In recognition of the impact of AI on all levels of education, a 2019 International Conference on Artificial Intelligence and Education co-organized by UNESCO brought together representatives from Member States, international organizations, academic institutions, civil society, and the private sector to reach agreement on necessary adaptations to the AI era, exchange information and lessons learned, build international cooperation and examine the potential of AI to meet Sustainable Development Goal (SDG) 4 on inclusive and equitable quality education.

The resulting *Beijing Consensus on Artificial Intelligence and Education* (UNESCO, 2019a) was the first document to offer guidance and recommendations for responding to the opportunities and challenges brought by AI in relation to SDG 4. Since the adoption of the Beijing Consensus, UNESCO has committed to investigate the implementation of AI in education, including higher education. This is vital in a context where AI tools in education are being rolled out in the absence of checks, rules and regulations (Giannini, 2023). Furthermore, UNESCO draws on its unique mandate to be a leading voice in promoting the ethical development of AI that is for the benefit of humanity and the environment. Following extensive global consultation, UNESCO member states adopted the *Recommendation on the Ethics of AI* in 2021, setting forward a unanimously approved framework for the development and use of AI technologies (UNESCO, 2021c).

As the key institution for knowledge creation and dissemination in societies around the world, HEIs should be leading the way in ensuring that AI works for humans, holding people's goals and values at its core, and being used to support planetary sustainability. As such, and following UNESCO's commitment to further research and support the implementation of AI in education, and to do so guided by ethical values and principles, UNESCO's Institute for Higher Education in Latin America and the Caribbean (UNESCO IESALC) offers this AI Primer for higher education stakeholders.

The Primer is targeted at the global higher education community including, but not limited to, policy and decision makers across government, academia, regulators, and quality assurance professionals. The Primer provides a detailed study of what AI is, how it is currently used across the functions of higher education, and how to grapple with some of the impacts and ethical dilemmas arising from the spread of AI. Throughout the Primer, evidence of AI design, implementation and impact in higher education is provided under the following headings:

- **Understanding what AI technology entails**, recent developments in AI, as well as its common applications;
- **AI in higher education learning, teaching, and assessment**;
- **AI and higher education administration and management**;
- **Research on AI**, AI-powered tools for research, and research on the SDGs using AI;
- **AI from higher education to the labour market**, discussing the future of work, female participation in the AI labour market, competencies and skills for the AI era, and lifelong learning;
- **Key challenges for AI in higher education**, including consideration of global inequality in the distribution of AI, issues relating to inclusion and diversity, and sustainability;
- **The ethics of AI in higher education**, with particular attention to the application of the UNESCO Recommendation on the Ethics of AI.

The Primer pays attention throughout to the gendered dynamics of AI and higher education. This particularly affects females, who are under-represented in science, technology, engineering and mathematics even before reaching higher education. This has implications for female participation in AI research and in the AI labour market. Gender and other forms of bias within datasets used in AI are also a contributing factor to ongoing structural inequalities.

In addition, it sets out an extensive Practical Guide for HEI leaders providing actionable recommendations and tools to support the responsible implementation or deeper integration of AI in higher education. The Practical Guide lays out the steps needed to conduct an AI audit, innovate in pedagogy and skills training, develop and apply AI, mobilize knowledge and communities around AI, and improve gender equality for AI and higher education.

1.1 Methodology

This Primer, one of the first globally comprehensive guides for higher education stakeholders in AI, was developed through a multi-phased literature review undertaken between March 2021 and June 2023 to systematize the main elements characterizing the links between AI and higher education. A wide range of data sources were consulted to inform the Primer including academic literature (books, journal articles, preprints, and conference papers); policy and practitioner reports; HEI and other actors' websites; blog posts and newspaper/magazine articles; and attendance at/recordings of seminars and events. Emphasis was placed on incorporating work by UNESCO relating to AI, in particular in relation to its ethical aspects, and to build on this by making connections with higher education.

Given the rapidly developing nature of AI and similarly knowledge about AI and higher education, the methodology went beyond a traditional focus on solely peer-reviewed materials in its use of some sources (e.g. preprints). The reliability of non-peer-reviewed sources was assessed by verifying the trustworthiness of the publisher or consulting multiple sources to confirm and triangulate data. Examples of AI use in HEIs have been included throughout the Primer to illustrate the global scenario. Sources consulted for this report were in English and Spanish, the two working languages of UNESCO IESALC.

The search strategy was undertaken in three phases. The first phase (March to September 2021) was exploratory. It aimed to provide evidence of AI trends in higher education by introducing concepts, categories, processes, and literature which were relevant to understanding what AI technology entails. The state of AI within the higher education sector and the prospects of AI designs for higher education were briefly reviewed. In this phase, the needs, opportunities, limitations, and concerns regarding AI implementation, guided by the policy areas established in the Beijing Consensus on Artificial Intelligence and Education, were examined along with some of the positive and negative implications of AI in higher education, including ethical concerns.

In the second phase (October 2021 to May 2022), the initial draft underwent internal review, during which time additional references were sought both to update the information to include the latest available, given the rapidly changing nature of the field and to further develop the sections relating to the uses of AI in higher education. The third phase (October 2022 to June 2023) involved more focussed research using search engines and online databases of scholarly material (such as Google Scholar) to identify relevant and up to date cases and studies. For example, for equality and diversity and AI, examples of AI use in higher education from outside the Global North, and emerging applications of AI such as ChatGPT, were consulted. Overall, more than 300 sources have been used in this Primer.

Although significant efforts were made to be globally and culturally inclusive in the Primer, for example, purposive searches for literature authored by women and cases of HEIs outside of the Global North, it is acknowledged that the overall suite of examples and sources nevertheless reflect a tendency towards the Global North and to research/knowledge produced in English. UNESCO IESALC remains committed to addressing this imbalance in future work. The phased literature search strategy enabled the identification of numerous relevant works, a strategy that was enhanced by suggestions made by the wide range of reviewers. Nevertheless, another limitation of the research is that some relevant literature may have been unintentionally omitted. In addition, while the accuracy of non-peer-reviewed sources was carefully examined, no guarantee of total validity can be made. Given the fast-paced nature of this field, new applications are being developed nearly every day, which makes it challenging to maintain a fixed perspective.

Harnessing the Era of Artificial Intelligence in Higher Education: A Primer for Higher Education Stakeholders

2

Understanding artificial intelligence

Understanding artificial intelligence

This chapter provides an overview of AI. It reviews various definitions of AI and sets out the UNESCO perspective that is adopted in the Primer. The chapter provides a categorization of AI and sets out a sample of AI subfields or techniques. Recent developments in AI are introduced to contextualize why it has become such a talking point and information on common applications of AI in people's everyday lives, economic activities, and education, is provided. Humans play a crucial role in AI as they not only design and programme these systems, but also provide the data that form the basis for AI learning and decision-making processes. Moreover, human judgment is vital for contextual understanding and ethical considerations, areas where AI, despite its advanced capabilities, still falls short.

During its 70 years of life, AI has gone through cycles of optimism (or springs) and cycles of pessimism (or winters). The first cycle of AI optimism started in the mid-1950s, right after AI was coined; AI research received significant funding. However, by 1974, the high expectations of the mid-50s disappeared and so did funding (first AI winter). The second cycle of optimism started with the rise of expert system technology but in 1987, expert systems limitations became widely known, and the second AI winter started. This winter ended shortly in 1993 and to this day, the third spring of AI is being experienced, due to several reinforcing drivers which generated this renewed interest in AI over the past two decades (Executive Office of the President, 2016; Perez *et al.*, 2017).

2.1 What is artificial intelligence?

There is no one universally accepted definition of AI. Multilateral organizations, tech companies, and academia have taken different approaches in the matter. Professor John McCarthy from Stanford University (USA), considered one of AI's founders and the one who first coined the term, defines it as "the science and engineering of making intelligent machines, especially intelligent computer programs" (Stanford University, no date, para. 2). Similarly, Google's definition is very straightforward: "the science of making things smart" (Google, no date, para. 2). Other definitions like the one by AI Watch are more technical, incorporating data as a critical element: "AI systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information derived from this data and deciding the best action(s) to take to achieve the given goal" (Delipetrev, Tsinaraki and Kostić, 2020, p. 5).

On a different note, Yoshua Bengio, one of the world's leading experts in AI from the University of Toronto (Canada), relates AI with human capacity: "[AI is] about making computers … do the things that humans can do but our current computers can't" (Google Canada, 2017). Amazon, on the other hand, links it to human intelligence and defines it as "a field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem-solving, and pattern recognition" (Amazon, no date, para. 1).

Box 1:

UNESCO's approach to AI

UNESCO's approach to AI focuses on the imitation of human intelligence: "machines capable of imitating certain functionalities of human intelligence, including such features as perception, learning, reasoning, problem-solving, language interaction, and even producing creative work" (UNESCO, 2019b, p. 24).

The need to retain a flexible interpretation is underlined by the UNESCO Recommendation on the Ethics of AI, which states that "a definition would need to change over time, in accordance with technological developments" (UNESCO, 2021c, p. 10), addressing instead the features of AI that are of importance for its ethical dimensions. In this sense, AI systems are approached as "systems which have the capacity to process data and information in a way that resembles intelligent behaviour, and typically includes aspects of reasoning, learning, perception, prediction, planning or control" (UNESCO, 2021c, p. 10).

This approach also takes into account that technology is never neutral: it inherently showcases and favours specific worldviews, reflecting distinct ways of understanding and knowledge. This principle also applies to the latest generative AI models and tools (Giannini, 2023).

2.1.1 Artificial Narrow Intelligence (ANI) and Artificial General Intelligence (AGI)

There are multiple ways to classify AI, for example by architectural design or autonomy levels. For the purposes of this introductory overview, this Primer offers two categorizations based on the two current capabilities of AI and the functionalities of these capabilities.

AI has two capabilities: Artificial Narrow Intelligence (ANI) and Artificial General Intelligence (AGI). ANI, or weak AI, is the type of AI that has been achieved so far. One or a few specific tasks are executed autonomously within a predefined environment or framework defined by humans, such as speech, image, or facial recognition used in search engines, translators, personal assistants, and others (Delipetrev, Tsinaraki and Kostić, 2020). ANI is a machine intelligence and is not identical to human intelligence because it can only perform specific tasks and is not able to reason on its own.

AGI, also called human-level AI or strong AI, is currently a theoretical type of AI that, if ever reached, would be comparable to human intelligence (Fjelland, 2020). Nick Bostrom, a Swedish philosopher, even adds a third category of AI: Artificial Superintelligence (ASI). He defines ASI as "any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest" (Bostrom, 2014, p. 24).

Another way to classify AI is by its functionalities or stages, which are: reactive machines, limited memory, theory of mind, and self-awareness.

Reactive machines are the primary type of AI that stores memories or experiences; they solely react to a current scenario (Chaudhari *et al.*, 2020). The most famous example of a reactive machine is IBM's Deep Blue computer, which was able to play chess and beat international grandmaster Garry Kasparov. Reactive machines are taught one thing or task and are rarely applied to other scenarios. Following the example of Deep Blue, this machine is unable to play any other game, just chess.

A second type by this classification is limited memory. This type is the widespread AI in current society. Unlike reactive machines, limited memory stores information for a short time and reacts to it. For example, autonomous vehicles or self-driving cars use the information of their surroundings and automatically make decisions such as stop or turn (Vatan, Sharma and Goyal, 2019).

The third type is theory of mind. This refers to understanding emotions, needs, beliefs, and thought processes. Currently, there are no examples of theory of mind (Cuzzolin *et al.*, 2020); however, there are robots that are paving the way. For example, Kismet is a robot that can recognize emotions based on the movement of facial features and react to it. However, the robot did not develop actions that were personalized for different actors, and neither could the robot reason about their emotional state (Cominelli, Mazzei and De Rossi, 2018).

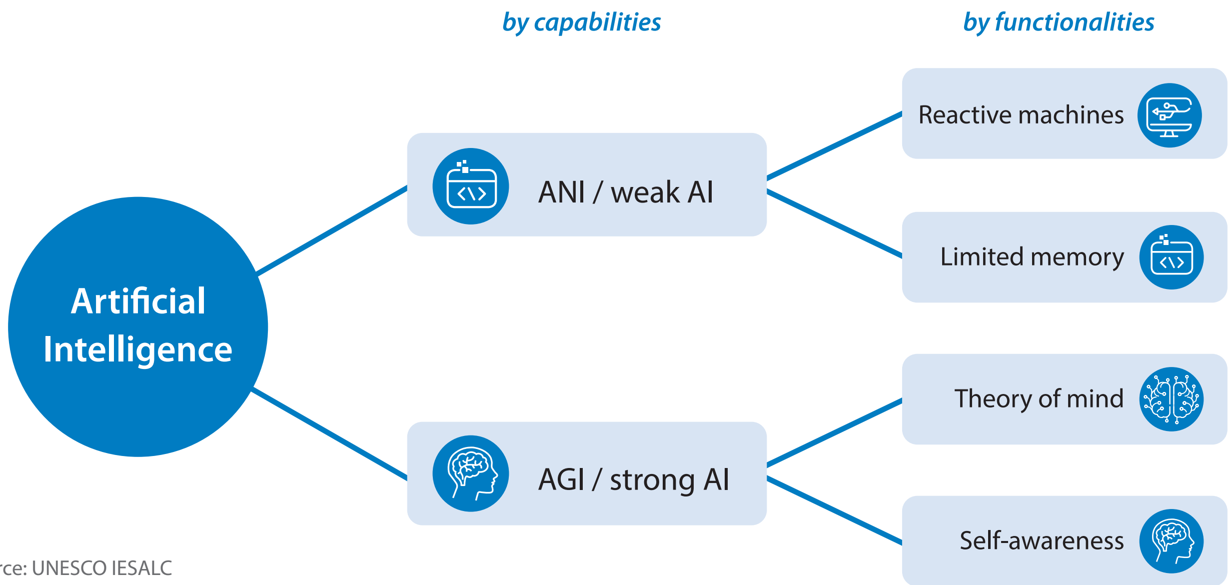
Finally, self-awareness would be the last stage of AI, a machine capable of recognizing itself as a machine and its feelings and thoughts (Chaudhari *et al.*, 2020). As with theory of mind, these are theoretical categories as they do not exist in real life, at least for now.

Both classifications can be linked together: ANI is linked to reactive machines and limited memory, while AGI connects to the ideas of theory of mind and self-awareness as shown in Figure 1.

2.1.2 Generative and predictive AI

AI can be generative as well as predictive. Predictive AI is a type of machine learning algorithm that analyses data and forecasts future events or results. On the other hand, generative AI specializes in producing new content. Predictive AI employs statistical algorithms to analyse past data and forecast outcomes for new data. In the context of higher education, predictive AI finds applications in areas such as

Figure 1 – Classifications of AI



Source: UNESCO IESALC

personalized learning platforms, managing student enrolment, promoting student success, and aiding student advisement.

Generative AI uses advanced deep learning methods, like neural networks, to generate human-like content. General Adversarial Networks (GANs), on which generative AI is based, train two neural networks simultaneously: a generator network that creates new content and a discriminator network that evaluates the content and provides feedback to the generator (Aydın and Karaarslan, 2023). Variational Autoencoders (VAEs) work by compressing the input data into a lower-dimensional space and then generating new data points by sampling from this space. Within higher education, generative AI is increasingly being used for creating instructional content, providing automated assessment feedback, and facilitating rudimentary support services (Pelletier *et al.*, 2023). Moreover, faculty and staff can use generative AI tools to develop proposals and translate their work to reach international audiences. Thus, the potential impacts of generative AI stretch across the broader spectrum of academia.

The Primer addresses both types of AI. Predictive AI, for example, is used more in personalized learning, a major topic discussed in chapter 3 on learning, teaching and assessment. Applications and tools that generate content i.e., generative AI, are prominent in the Primer considering the debate it has generated in the higher education sector since the emergence of ChatGPT and similar tools (see section on common applications of AI). Although the concept of generative AI is not novel, recently available tools have made it accessible and more user friendly, significantly increasing public attention as can be seen in the impressive adoption rate of the application (NeJame *et al.*, 2023).

The potential of generative AI tools to amplify human biases, thereby perpetuating unfair systems, could arguably be more potent than other AI technologies (Pelletier *et al.*, 2023). When used in any of the functions of higher education, teachers, students and administrators should do it carefully, as discussed in the chapter on the ethics of AI in higher education. For instance, even if AI tools can help teachers create content for their classes, this content may sometimes contain inaccuracies or not adhere strictly to established pedagogical methods (Webb, 2023). Moreover, it has been proven that there is not enough evidence of good performance when using AI to grade exams (Webb, 2023).

2.2 Techniques and subfields of AI

In this Primer, when referring to AI, it is the ANI form that is referred to because this is the type of AI that exists today. Within ANI, machine learning is the most popular technique, to the point that many times these two concepts (AI and machine learning) are used as synonyms. Precisely because of that, it is essential to describe briefly other AI techniques before focusing on machine learning.

2.2.1 Other AI techniques

This first technique is symbolic logic. It refers to rules engines, also called inference engines or if-then models, which apply logical rules to populate new information (Griffin and Lewis, 1989). For example, most chatbots use this type of system, in which the script is already set or humanly hand-coded, with pre-defined prompts and answers. This type of AI is commonly used in online chat functions, for example to determine the nature of a customer's problem through a series of closed questions, before they are referred to as appropriate to a human agent. For example, the government of the city of Buenos Aires's chatbot (Boti) uses symbolic logic to give citizens a quick answer to their queries (see Figure 2). The COVID-19 pandemic has likely spurred the adoption of chatbots as many aspects of society switched from being in-person to online (Shoufani, 2022).

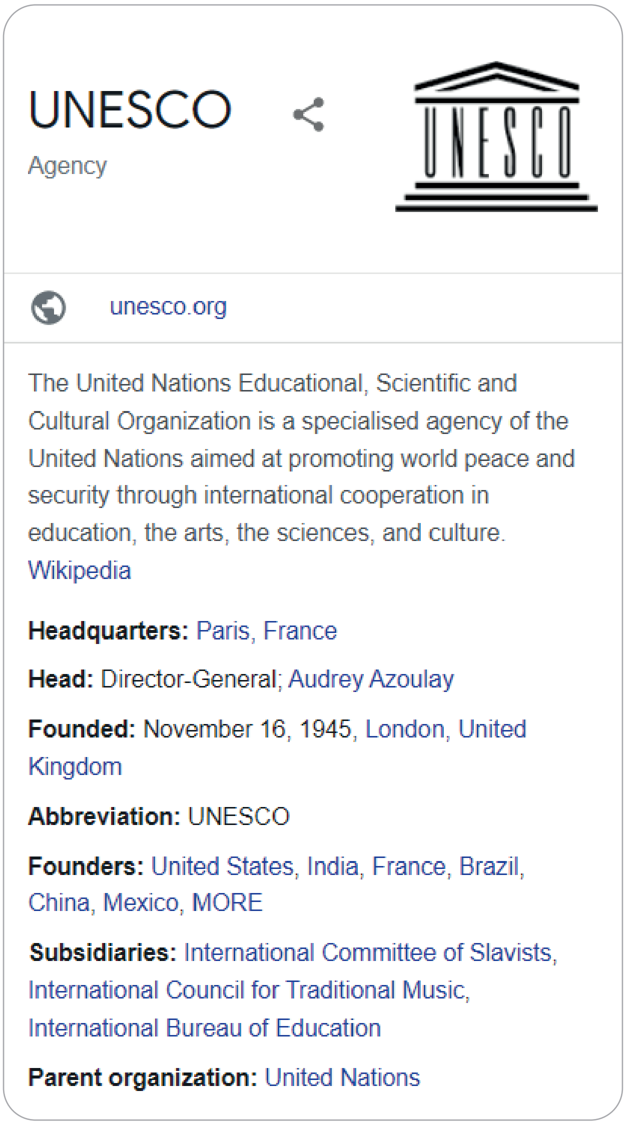
Figure 2 – The chatbot Boti

Source: http://buenosaires.gob.ar/boti

A second technique is the expert system, which can reproduce the decision-making process of an expert (Hodhod, Khan and Wang, 2019). Expert systems are built on top of inference engines plus a knowledge base to deliver specialist decision-making ability, using if-then technology with a larger set of possible scenarios/outcomes. These systems are used in a wide variety of ways: to diagnose heart diseases, anaemia, diabetes, and to diagnose faults in engineering, career guidance, establish credit limits, among others (Leonard-Barton and Sviokla, 1988; Hodhod, Khan and Wang, 2019). Although they are intended to emulate a human expert, they are not meant to replace humans but rather assist them in their decision-making process. The most common example is MYCIN, an expert system for recommending treatment for bacterial infections by answering several questions with multiple options (Al Hakim, Rusdi and Setiawan, 2020). Following this expert system, a physician could identify the bacteria and therefore determine the best treatment possible.

Finally, another example of non-machine learning AI is a knowledge graph (KG). Similar to AI, there is no universally accepted definition of a KG. Moreover, it is not an easy concept to convey (Ehrlinger and Wöß, 2016). Another definition published by Stanford University (USA) refers to a KG as a "compelling abstraction for organizing world's structured knowledge over the internet, and a way to integrate information extracted from multiple data sources" (Chaudhri, Chittar and Genesereth, 2021). A widely used example of a KG is the Google Knowledge Panel. In 2012, Google introduced knowledge graphs to make their search engine better, a way to easily and rapidly uncover new information (Singhal, 2012). Through Google's KG, the knowledge panel links the search query with additional relevant information. For example, Figure 3 shows the Google knowledge panel for the search query "UNESCO", which contains a description of the organization, information about its foundation, the headquarters, and more. Wikidata is another example of a KG in action.

Figure 3 – Knowledge graph for the query "UNESCO"



2.2.2 Machine learning

As mentioned above, machine learning (ML) is a technique or subfield of AI that has seen significant progress in recent years. Using ML, "computers learn and recognize patterns from examples, rather than being programmed with specific rules" (Google, no date, para. 1) as with classical programming. Similarly, Microsoft defines ML as:

"The process of using mathematical models of data to help a computer learn without direct instruction. It's considered a subset of artificial intelligence (AI). Machine learning uses algorithms to identify patterns within data, and those patterns are then used to create a data model that can make predictions. With increased data and experience, the results of machine learning are more accurate—much like how humans improve with more practice" (Microsoft, no date, para. 1).

Computers using ML are able "to think and learn on their own" (Alzubi, Nayyar and Kumar, 2018, p. 1) without human interference; they are autonomous to create knowledge and make links among different data. The following illustration (Figure 4) shows the difference between classical programming and machine learning. In classical programming, programmers give the rules and the data, to give answers as an output. On the other hand, with ML, the program receives the data and the answers expected from the data and, as a result, produces rules by identifying patterns between the two. In other words, the "ML system is trained, rather than explicitly programmed" (Delipetrev, Tsinaraki and Kostić, 2020, p. 11).

Figure 4 – Difference between classical programming and machine learning

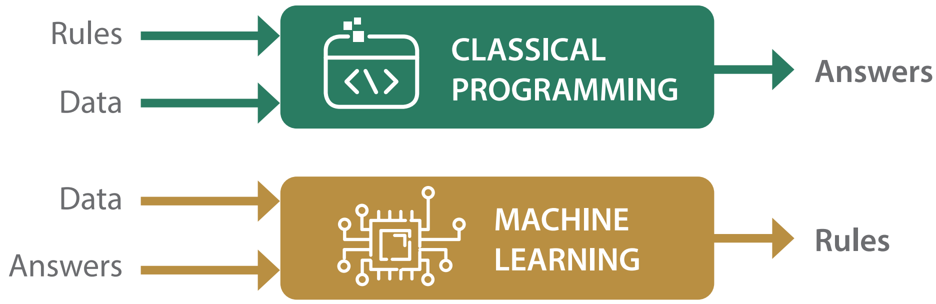


Figure: UNESCO IESALC | Source: (Craglia et al., 2018)

In classical programming, setting the rules is crucial for a positive outcome. For example, a programmer sets rules for a program to identify country flags and hardcodes one by one, considering their proportions, contained geometric shapes and the expected colour palette within each shape. Then, when presented with an image of a flag (and only a flag), the program should be able to determine if it fulfils any of these predefined characteristics.

On the other hand, using ML, the programmer gives the system images of cats and non-cats and tells which one is a cat (label); the system then learns with these examples and identifies the rules behind what makes a cat and what does not (Delipetrev, Tsinaraki and Kostić, 2020). These rules are then used to identify subsequent cat images. Thus, for ML to correctly learn what a cat is, it needs vast amounts of data to generate these rules. Now that humans generate more and better-quality data than ever before, ML models are more accessible to create.

The cat image recognition example is a typical illustration of supervised learning, which is one of five ML types. Supervised learning models use a labelled training data set to learn and identify the underlying rules; with this learning, the model is then fed with unlabelled data to predict an output (Uddin *et al.*, 2019). Moreover, supervised learning can be used for two types of problems: classification and regression. The cat image recognition example lies within the first category because it classifies a discrete variable: cat or non-cat. In contrast, for regression supervised learning models, the output is a continuous variable, a number; for example, a prediction on house prices. In this case, the model is fed with training data about houses (square footage, location, number of rooms and bathrooms, features) with a label (price), the system then identifies the rule or model, and when presented with new data on houses predicts a price value.

Large language models, or LLMs, are a type of supervised learning. ChatGPT, for example, works over an LLM which uses a computer algorithm to analyse natural language inputs and make predictions about the following word based on its previous observations. It continues this process, predicting subsequent words one after another until it completes its answer. This means that the underlying technology is just providing the best prediction to the input. Despite their human-like performance, LLMs remain unreliable and therefore their application should be considered responsibly and with an ethics-based approach.

The second type of ML is unsupervised learning. In this case, the machine discovers patterns in a dataset without pre-existing labels or without a human telling the machine what to look for (Choi *et al.*, 2020). Continuing with the cat example, a machine would be given images of animals, and the model on its own would cluster or categorize the images by different types of animals (cats, dogs, birds). It "reads" the pictures and "sees" the differences between the characteristics of (in this example) cats, dogs and birds. This is why the more data provided, the greater the chance of the differences being correctly identified.

Another example of this approach is when an AI automatically groups a large set of users in an online platform based on their recorded actions and preferences, which can then be used to recommend similar products to each group or predict behaviour. These are examples of clustering problems, but unsupervised ML can also cover other types of problems such as anomaly detection (e.g. fraud detection by identifying unusual patterns in customer's purchasing behaviour), association (e.g. shopping recommendations based on similar purchases by other users), among others (Salian, 2018).

The third type of ML is semi-supervised learning. It is called semi-supervised because it uses both labelled and unlabelled datasets (Choi *et al.*, 2020). Combining labelled and unlabelled datasets creates better classifiers than only unlabelled data and demands less human effort than only labelled datasets. Semi-supervised learning gives higher accuracy at less cost.

Reinforcement learning is when a model learns to perform a task by maximizing rewards by trial and error and aims to detect the best path to achieve the desired outcome (Choi *et al.*, 2020; Delipetrev, Tsinaraki and Kostić, 2020). The easiest way to explain it is with an example of training an algorithm to play and win a game. In this case, the algorithm would be introduced to a game. At first, the algorithm may fail and lose (trial and error), but as the algorithm continues playing, it learns how to win the game (get rewards) and find the best way to win it (achieve the desired outcome).

Finally, deep learning (DL), a type of ML that requires less data, can process more data resources and often produce more accurate results than other ML techniques (Chui, Kamalnath and McCarthy, 2020). This type of ML uses layers of software (often called neurons) that form a neural network. This network breaks down data and then trains itself to process and learn data from each layer to the other (Goodfellow, Bengio and Courville, 2017). It is called "deep" to refer to the network's many layers and is used to break down information and produce new information. However, DL is easier understood with an example: a machine is given a picture; DL breaks down the information and identifies layers of it from fundamental ones (e.g. edges) to more complex ones (e.g. letters or faces).

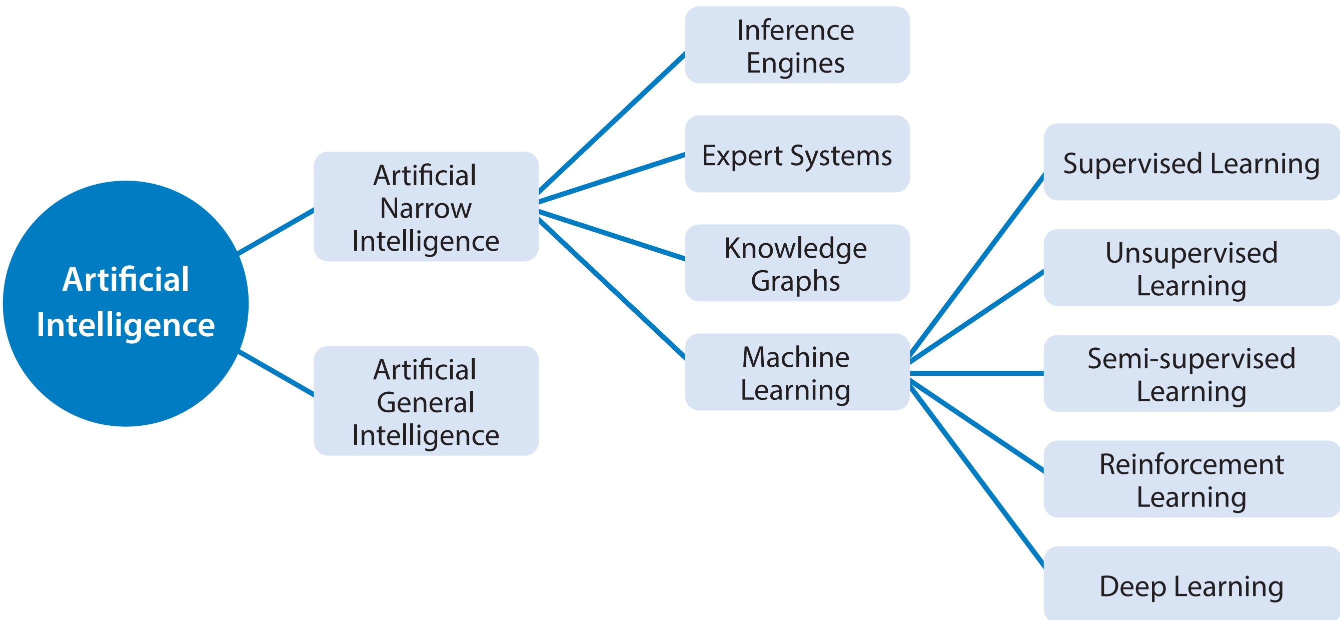
The following illustration (Figure 5) summarizes all the concepts mentioned above and the relationships between them:

2.3 Recent developments in AI

Even though AI has not reached the theory of mind or self-awareness stages, in recent years it has become more relevant than ever before. The number of AI publications experienced steady growth in the research field, from 10% growth rate a year from 2005 until 2015 to 23% after that, making AI publications over 2.2% of all scientific publications in 2018 (Baruffaldi *et al.*, 2020). In 2021, almost half a million publications on AI were published in English and Chinese (Stanford University, 2023). It is important to note that most AI publications come from a limited range of countries, mainly the USA, China, and the UK (Sánchez-Céspedes, Rodríguez-Miranda and Salcedo-Parra, 2020). Moreover, research and publications come mostly from a limited number of specialties, especially computer science, which also shows the current lack of multidisciplinary in AI-related research (Bates *et al.*, 2020).

In addition, the number of AI patent applications has greatly increased since the mid-2010s, growing more than 30 times from 4,617 in 2015 to 141,241 in 2021 (Stanford University, 2022). Patent analytics give insights into technology trends; therefore, it can be said that AI technology is rapidly advancing in the world (WIPO, 2019). Since 2013, more than half of AI inventions have been published. The interest in AI by academia and businesses has been matched in investments in AI companies over recent years. From 2013 to 2018, the number and size of AI deals soared, and overall investments rose by 75% annually (Gerbert and Spira, 2019). Moreover, in 2019 alone, "privately held AI companies attracted nearly $40 billion in disclosed equity investment… because some transactions

Figure 5 – Artificial intelligence concepts and relationships



Source: UNESCO IESALC

do not have publicly disclosed values, total transaction value could have been significantly higher—as much as $74 billion" (Arnold, Rahkovsky and Huang, 2020, p. 7).

Uptake of AI has begun to rapidly increase. By 2030, the potential contribution of AI to the global economy is estimated at US$15.7 trillion (PWC, 2019). 84% of executives[1] believe they will not achieve their growth objectives unless they scale AI, and 75% believe they risk going out of business in 5 years if they do not scale AI (Accenture, 2019).

2.3.1 Drivers of recent interest in AI

More reliable data, the greater quantity of data, algorithmic advances and funding are all factors driving recent interest in AI.

First, the world now has more and more reliable data than ever before. Nowadays, cell phones, smartwatches, social media platforms, online shopping websites, security systems, learning management systems and even thermostats collect vast amounts of reliable data. The amount of data created is expected to continue growing rapidly in the following years (Reinsel, Gantz and Rydning, 2018).

For AI, data is its fuel; it needs enormous amounts of it to learn from it and provide services based on it, for example, giving tailored recommendations on streaming or online shopping. Because data is so vital to AI systems, some have identified it as the new oil (The Economist, 2017). This is also why social media platforms do not charge their users directly but instead use their data, selling it to third parties as part of advertisement and market research services. To handle this immense amount of data, AI needs more computing power than ever before. The graph below (Figure 6) shows the steady increase over the past decades (TOP500 Supercomputer Database, 2023).

In addition to these exponential increases in data production, computing power and data storage, algorithmic advances have also contributed to the resurgence of AI (Executive Office of the President, 2016). Algorithms are a set of step-by-step instructions for solving a problem (Negnevitsky, 2005), problems such as filtering spam in an email inbox or what content to show in social media feed. Algorithms are an essential aspect of AI; there is no AI without them. With additional computing power, algorithms have become more complex and have enabled the more popular AI techniques such as machine learning and deep learning.

Figure 6 – Supercomputer Power (FLOPS), 1993 to 2022

The number of floating-point operations carried out per second by the fastest supercomputer in any given year.
This is expressed in gigaFLOPS, equivalent to 10^9 floating-point operations per second.

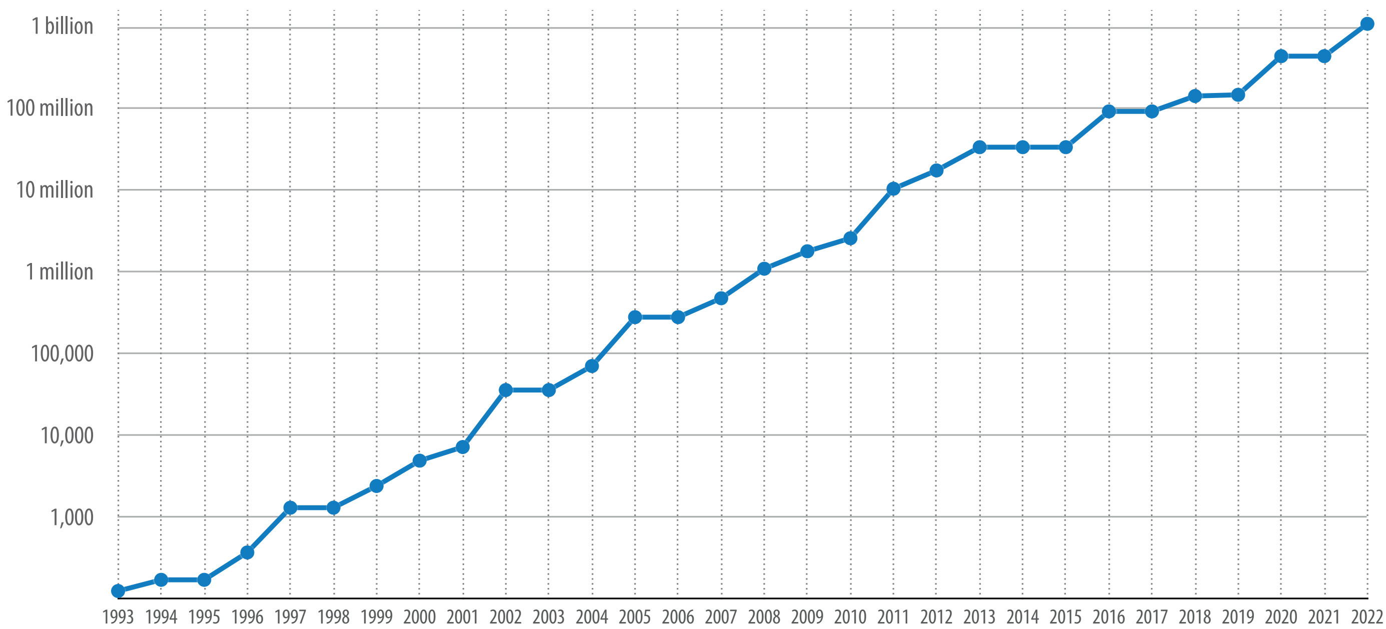


Figure: UNESCO IESALC | Source: TOP500 Supercomputer Database (2023)

1 Survey data from 1,500 C-suite executives from companies with a minimum revenue of US$1 billion in 12 countries around the world across 16 industries: Banking & Capital Markets (100) Chemicals (100) Communications (100) Consumer Goods & Services (100) Energy (Oil & Gas) (100) Healthcare (Payers) (100) High Tech (100) Industrial Equipment (100) Insurance (100) Life Sciences (Pharma & Biotech) (100) Metals and Mining (100) Retail (100) Software & Platforms (100) Travel & Transport (Hotels & Passenger) (100) Utilities (100)

Another driver of AI today is its funding. Despite limited funding and resources allocated to AI in previous years, AI has nevertheless developed rapidly (Roser, 2023b). Today, private sector investment has increased rapidly: investments in 2021 were around 30 times larger than in the previous decade (Roser, 2023b). Even though private investment decreased in 2022, the volume of business investment in research and development on AI dominates the field, even as governments are exponentially increasing their investment in AI research; for example, Singapore with US$150 million, the UK with US$355 million from 2017 to 2018 and the European Union doubling its funding to between 2018 and 2019 (Perez *et al.*, 2017; Galindo-Rueda and Cairns, 2021; Stanford University, 2023).

2.4 Common applications of AI

A typical example of how AI is used in human life today is virtual assistants (e.g. Siri, Alexa). They use machine learning to learn from their mistakes and provide better recommendations and predictions to their users.

Another common example is chatbots, which are software that interacts or chats with users in a conversation (Hatwar, Patil and Gondane, 2016). The most prominent chatbot in the early 2020s is ChatGPT[2]. ChatGPT and other similar tools are large language models (LLM) that allow people to interact with a computer in a more natural and conversational way. These LLMs use natural language processing to learn from Internet data, providing users with AI-based written answers to questions or prompts. They are trained on large text datasets to learn to predict the next word in a sentence and, from that, generate coherent and compelling human-like output in response to a question or statement.

Both pre-programmed and machine learning-based chatbots are used across the different functions of education, although around two thirds of educational chatbots are used for teaching and learning (Okonkwo and Ade-Ibijola, 2021).

However, not all chatbots use the same AI technology: some use inference engines, while others use more sophisticated techniques such as machine learning to learn from their interactions with users. Similarly, email providers use inference engines and machine learning to organize and filter emails and, most recently, to predict the text of emails or remind users when to reply to one.

Social media platforms rely heavily on AI by learning from users' interactions with their platforms, their preferences and thus providing tailor-made recommendations of new content (Sadiku *et al.*, 2021). For example, this allows online streaming platforms to recommend videos or songs based on previous choices. Similarly, ridesharing apps use AI to match drivers with riders, predict estimated times, and identify optimal pickup locations, among other functions (Ghahramani, 2019).

Semi-autonomous driving is another example of AI with the autopilot function, which enables a car to steer, accelerate, and brake automatically within its lane (Tesla, no date). These efforts are expected to lead to the general use of autonomous vehicles that is only possible using AI (Ondruš *et al.*, 2020). Nevertheless, there are issues with the safety of such vehicles, since their programming can fail to see a person that behaves in an unpredictable manner, for instance crossing the street in the middle of the road. This can create accidents and also raises ethical questions (Bates *et al.*, 2020).

In finance, AI is used to make predictions that decide which customer can be eligible for a loan by learning from the financial history of similar customers, personalizing a client's portfolio, predicting its needs, trading in the stock market, or detecting fraud, among others (Cao, 2020). In healthcare, AI can read medical images such as CT, X-rays, and others, identifying patterns that correlate with specific pathologies at a lower cost and faster than professionals and improving diagnosis (Park *et al.*, 2020).

In higher education, AI is becoming more present with major trends in this sector including personalised learning, the use of technologies such as Virtual Reality (VR) or Augmented Reality (AR), and the nascent rise of the metaverse or multiverse (Andreoli *et al.*, 2022). Intelligent tutoring systems are AI-powered e-learning systems that provide customized learning techniques for various students according to their needs and capacity (Akyuz, 2020). The following chapters of the Primer take a deep dive into the ways that AI is being used in learning, teaching and assessment, administration and management, and research. These chapters also outline some of the risks and challenges involved with the introduction of AI into higher education.

2 There is an important difference between typical chatbots and ChatGPT. While a typical chatbot operates based on predefined rules and responses, ChatGPT is trained on an extensive dataset comprising diverse sources, allowing it to generate contextually relevant and coherent responses, going beyond the predefined rules and responses. Additionally, ChatGPT has a higher degree of language understanding, provides more nuanced answers, and engages in multi-turn conversations with users. Its ability to grasp context, comprehend complex queries, and generate creative and context-aware responses sets it apart from conventional chatbots, enabling more natural and dynamic interactions (Mineduc Chile, 2023). This has turned ChatGPT into 2023's "go to" application for students in higher education.

3

AI and learning, teaching and assessment

AI and learning, teaching and assessment

According to a Microsoft – Times Higher Education survey, almost 90% of respondents consider that AI will have a significant or very significant impact on curricula and pedagogy (Pells, 2019). Given these expectations and the current applications of AI, the Beijing Consensus calls for governments and other stakeholders to be mindful of the potential and also the risks of AI to support learning, teaching and assessments. The Beijing Consensus also asserts that although AI provides opportunities to support teachers, human interaction must remain at the core of education because teachers cannot be displaced by machines.

As such, this chapter presents areas where AI can be applied to learning, teaching and assessment through personalized learning, including intelligent tutoring systems, chatbots to support learning and teaching, and virtual and augmented reality; learner inclusion and wellbeing; and analysing and assessing student progress. The chapter also discusses the importance of teacher professional development. Throughout the chapter, examples of how HEIs in a range of countries have adopted AI tools are provided, and some of the risks and challenges to deploying AI are outlined.

3.1 Personalized learning

Personalized learning helps provide students and teachers with individualized feedback, helps detect weak-performing students who require further assistance to avoid drop-out, and boosts students' learning performance (Keller *et al.*, 2019; Rouhiainen, 2019). AI platforms can help students advance at their own pace, redirect them to additional reinforcement materials when needed and provide feedback to their teachers on their progress (Vincent-Lancrin and van der Vlies, 2020). This personalization can overcome some of the problems when the course's general progression speed is matched to the average student, leaving some struggling and others feeling unchallenged.

Personalized learning has a wide array of applications, which can be grouped into three overarching approaches: systems-based, learner-based, and blended (Fake and Dabbagh, 2023). These are described together with an overview of how each can be used in higher education in Box 2. A systematic literature review of 39 studies on personalized learning in higher education found that 53% of all models or frameworks are delivered through personalized e-learning; 21% are integrated into existing learning management systems or e-learning; 16% are built into a recommender system; and 11% are built into an intelligent tutoring system (Fariani, Junus and Santoso, 2023). Almost half (49%) of the models use personalized teaching material, whereas 29% relied on a learning path (the sequence of learning), 17% on strategies to facilitate learning processes and 5% on the learning environment which, in this context, refers to game elements in game-based learning (Fariani, Junus and Santoso, 2023).

Certain disciplines in higher education, such as Biotechnology, have mobilized AI to better serve the need of multidisciplinary learning through individual learning frameworks identified through AI (Goh and Sze, 2018). In disciplines with one clear goal in learning outcomes, like foreign language acquisition, AI can also assist with personalizing the learning process to reach their proposed learning goals more efficiently. In the case of 82 Japanese students learning English, students who adopted AI in their learning outperformed those who did not by 32 points out of a 990 scale in the Test of English for International Communication (TOEIC). The student survey also gave credit to the effectiveness of AI. However, there is a significant difference in the specific skill applied by AI, as shown in Figure 7.

Figure 7 – Student perceptions of AI effectiveness in learning skills in the English language

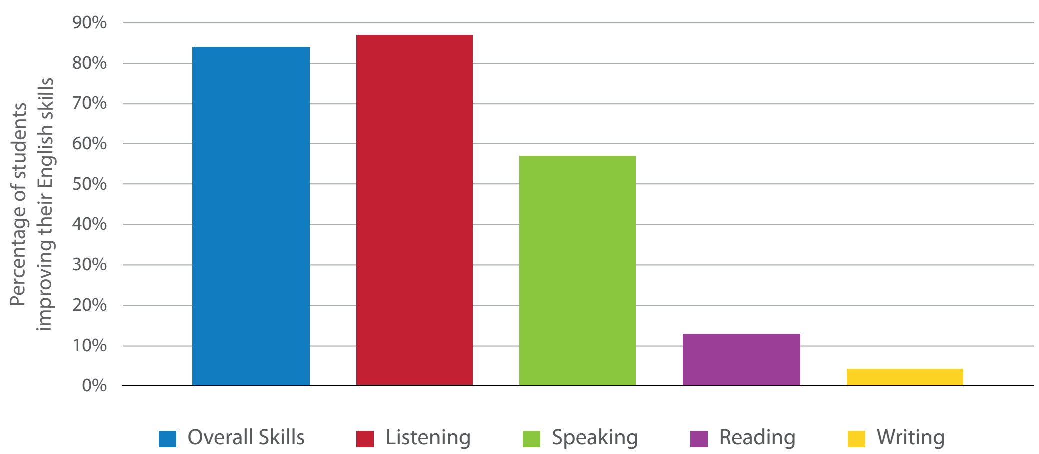


Figure: IESALC | Source: (Obari, Lambacher and Kikuchi, 2020)

Box 2:

Approaches to personalized learning

Systems-based approaches

Systems-based approaches are learning experiences that are personalized by systems. These may support personalization based on learner preferences and learning styles, with studies suggesting that they can increase user speed and satisfaction. However, there is less evidence on the effectiveness of systems-based approaches, particularly when the use of personalized learning is not aligned to course objectives or learning outcomes.

Systems-based approaches can be used with AI tools to:

- Provide immediate feedback on predefined tasks
- Recommend other tasks to support learners' goals and/or achieve competencies
- Adapt assessments based on previous performance
- Identify learning styles and patterns by collecting data on student interaction and log data in virtual learning environments
- Measure performance e.g. through pre- and post-learning assessments or by ensuring a minimum level of competency before advancing to the next course content element.

Learner-based approaches

In contrast to systems-based approaches, learner-based approaches are guided by learners, who decide the parameters for personalization. In these cases, learners create or co-create personalized learning environments, which may increase student motivation and self-regulation skills and could nurture lifelong learning skills. Limitations of these approaches include lack of time from the side of learners and, in cases where technology is used, lack of understanding and/or willingness to engage with tools.

Examples of learner-based approaches include:

- Build a personalized learning environment using the technology or tools of their choice (e.g. social media, search engines, videos, blogs, online articles)
- Co-create curriculum materials (teachers and students working together)
- Create personalized learning plans in collaboration with teachers/mentors

Blended approaches

Blended approaches to personalized learning mix systems and learner approaches, making use of systems while respecting students' agency and ownership of their learning processes. With blended approaches, technology is not the determinant of the learning experience but a facilitator of learning that can take place in different contexts.

Blended approaches have been used in a range of ways:

- Train students to interpret and make use of personalized learning dashboards to improve their learning
- Offer students either a customizable or personalized learning environment based on an assessment of their cognitive styles
- Prompt self-directed learning based on learner data including their location, learning history, available time, and interests

(Fake and Dabbagh, 2023)

As previously noted, AI can be used to make recommendations of courses based on each student's history of successes and failures with different types of learning materials and pedagogical approaches. A simple example of this use of AI is the predictive algorithm used by Georgia State University (USA) to flag when students sign up for courses outside areas that could contribute to their declared majors (primary area of study) and which, according to historical data from past students, would probably undermine their performance in the courses that do. The algorithm was used to trigger meetings between the students and academic advisors to find possible course alternatives (Marcus, 2014)

At the University of Technology Sydney (Australia), faculty have created a program that tracks face and eye movement, keyboard activity and mouse movement during online lectures to capture students' immediate response or level of engagement to the content (Bamford, 2020). With this information, faculty can make adjustments in the current lecture or prepare more engaging content for the next ones so that students are kept with their attention in class, thus setting the foundation to improve students' learning outcomes. Yet, over-reliance on AI systems may be dangerous: they are liable to make mistakes and, as is discussed elsewhere in the Primer, they can only be as good or reliable as the data used to train them (Alam and Mohanty, 2022). Important to mention that data privacy and ownership are also vital when using such applications.

3.1.1 Intelligent tutoring systems

Intelligent tutoring systems (ITS) are computer-based systems that leverage AI to provide personalized, adaptive instruction that mirrors the benefits of one-on-one tutoring, and their objective is to monitor and provide support to learners (Amokrane *et al.*, 2008). The basic architecture of an ITS is shown in Figure 8. ITS enable personalized learning paths for individuals while also giving instructors the ability to monitor students in real-time and provide assistance when needed, while students gain access to a diverse range of customized learning resources (Escotet, 2023).

Given their characteristics, the advantage of ITS lies in their capability to manage the interactive and personalized elements of individual learning (Hone and El Said, 2016), tracking progress, creating content and enabling assessment. A component of the way that ITS assess students' progress and knowledge by analysing data is knowledge tracing, which uses inputs during problem-solving exercises to trace knowledge. Most knowledge tracing models depend on exercise tags and their outcomes, regardless of whether the exercises were answered correctly or not, in order to learn and make predictions about future interactions (Fazlija, 2019). One of the key advantages of ITS is that they can generate content (exercise sheets for example), taking into account the appropriate parameters, like difficulty level of the question, for example, for each student. Another advantage of ITS is their ability to provide automatic grading and various forms of assessment. This empowers students with the choice to continuously receive feedback by engaging in self-testing through automatically generated tests and practice problem solving (Fazlija, 2019).

ITS work best in narrowly defined domains with an abundance of data, for example in mathematics education (UNESCO, 2018). By analysing individual learners' responses and adapting the instruction accordingly, ITS can provide targeted and tailored support, leading to improved learning outcomes. For example, in the Faculty of Engineering and Information Technology at Al Azhar University in Gaza, an ITS was designed for the Computer Science course with the aim to provide tutoring for students (Marouf *et al.*, 2018). In India, Amrita University's AMMACHI Labs has developed an ITS for vocational education and in the UK, the Open University has developed OpenEssayist, an ITS designed to provide feedback on draft essays (Van Labeke *et al.*, 2013). According to a literature review, personalized learning systems, such as ITS predominantly incorporate content from engineering courses (39%). This is followed by subjects such as science (21%), health science (16%), and mathematics (12%). Other subjects such as social studies (2%), art and languages (7%), and business studies (3%) were less frequently chosen (Malema Ambele *et al.*, 2022).

3.1.2 Chatbots to support learning and teaching

AI-powered chatbots can also provide a form of personalized learning and support for students. For example, chatbots can reply to students' enquiries and redirect them to the right content and resources while replicating the grammar and wording of a human conversation. During the COVID-19 pandemic in the Universidad Veracruzana, a multi-campus university in México, a chatbot was developed to aid in the tutoring of students of the Bachelor's Degree in Computer Systems and Administrative Systems of the Faculty of Accounting and Administration (Galindo Monfil *et al.*, 2022). The University of Bolton (UK) has the chatbot 'Ada' which has delivered personalised learning and assessment for 70,000 students as well as answering questions on curriculum content and attendance requirements (Ada - Bolton College's AI Chatbot, 2019).

Figure 8 – Basic architecture of an Intelligent Tutoring System

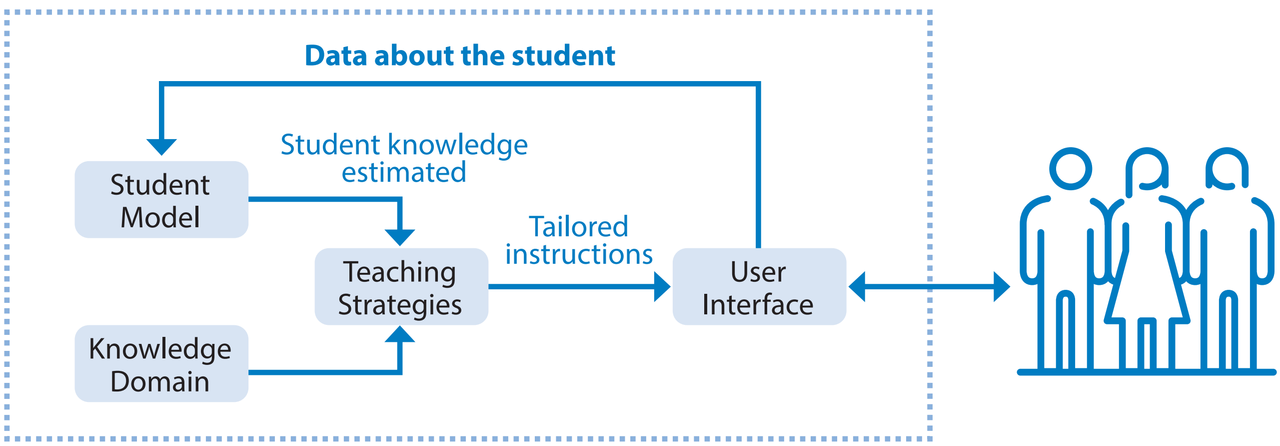


Figure: UNESCO IESALC | Source: (Morales-Rodríguez et al., 2012)

QuestionBot, a chatbot used at New South Wales University (Australia) since 2019, can, for example, provide answers to students based on similar previous questions that a human already answered. It can also search the course materials, including automatically transcribed lecture recordings, and return the exact part of the text or video where the answer is likely to be found (based on keywords). It can also reply to practical questions where the answer depends on who is asking them, such as "when is my tutorial" and "what are the topics on my next exam", for which it needs to link the student to the appropriate resources (e.g. tutorial agendas, exam timetables, course outlines). For all its answers, the bot provides its own confidence score, and it offers the option of reporting them as 'useful' or 'not useful'. This feedback allows the bot to gradually improve its accuracy over time (MSAUEDU, 2019). This level of customization of the learning materials, applied to hundreds of students at a time, would have been impossible for a human professor (MSAUEDU, 2019).

For the Faculty of Information Technology of Ho Chi Minh City University of Science (Viet Nam), the development of their FIT-EBot responded to three challenges: students repeatedly asking questions e.g. on programmes, regulations, scholarships, assignments; searching for information which could be difficult and time-consuming; and the high administrative workload for staff and faculty in responding manually to students (Hien *et al.*, 2018). While the chatbot has been effective, its developers note that it is restricted by current database structures at the university and the need to collect more training data for it to be more useful (Hien *et al.*, 2018). This is a reminder of the critical importance of the human involvement in AI development, as also discussed in the chapter on 'Understanding artificial intelligence'.

Chatbots are also an increasingly common use of AI to support teaching. They often act as a type of virtual tutor or teaching assistant, alleviating professors of the need to perform certain (often more administrative) tasks and addressing contexts with high instructor to student ratios (Essel *et al.*, 2022).

One early example of the possibilities of using chatbots to support teaching was tested in 2016 at Georgia Institute of Technology (USA) when an AI chatbot named 'Jill Watson' started responding to students' basic online questions without the students realizing that it was a software, this only being revealed by the professor at the end of the semester (Georgia Tech, 2016). This app later acquired additional functionalities, such as linking students with their peers, aiming to increase motivation and support networks that would help reduce the high dropout rates in online courses (Georgia Tech, 2016). Jill Watson was also rolled out to be applicable for any course and, despite having required a considerable time investment for its initial development, once created, its adaptation to new courses was a matter of a few hours per course, showing the potential for scaling such solutions (Georgia Tech, 2016).

More recently, in 2021, researchers at Kwame Nkrumah University of Science and Technology (KNUST) (Ghana) found that use of the chatbot they developed, called KNUSTbot, improved academic performance for students who engaged with it, compared to students in a control cohort who engaged with the course instructor (Essel *et al.*, 2022). The immediacy of the feedback provided by KNUSTbot, the ability to interact with it at any time, and the ease of use – the chatbot was delivered using WhatsApp, a widely used application that the researchers confirmed that all students on the course were already familiar with – were positive factors affecting the experimental group.

Students reported that learning was interesting, interactive and improved their confidence and understanding (Essel *et al.*, 2022). The study's authors underlined the importance of digital literacy training for both students and faculty in order for chatbots to effectively support teaching and student self-efficacy. Also, while the chatbot provided rapid responses, students also reported concerns about being provided with outdated or irrelevant information and/or superficial or short responses (Essel *et al.*, 2022), leading to questions as to whether chatbots can support conceptual learning or are limited to responding to technical queries.

Though this can potentially be useful for any HE context, chatbots can be best exploited when benefiting from economies of scale, as the algorithms improve with frequent use, although they may retain certain errors and biases. Chatbots can also fit the need for low price, entirely virtual and/or massive courses, in which personalized attention from teachers may not always be feasible. The aforementioned KNUSTbot was developed to address high student to instructor ratios and was developed using zero-coding techniques, an approach that may be suitable for HEIs with limited financial and human resources (Essel *et al.*, 2022). This can allow students to get the answers and resources they need from any place, 24/7, which can help particularly those in rural areas, assuming they have access to an internet connection and digital devices, or who cannot attend full-time or daytime courses. To provide the benefits of chatbots to students who do not have access to the internet, KibutiBot, launched in April 2023, is providing service through SMS. Mbeya University of Science and Technology (Tanzania) and Mzumbe University (Tanzania) are piloting this service for their students.

3.1.3 Virtual and augmented reality

Virtual and augmented reality (VR and AR) can be driven by AI technology and may be used as interactive tools that support more personalized, practical, interactive and immersive learning experiences (Escotet, 2023). AI can support VR environments to train and evaluate specific disciplines, such as recreating surgical procedures (Vincent-Lancrin and van der Vlies, 2020). AR does not require special equipment and can offer three-dimensional experiences that can be accessed on a range of devices. Although the use of AR and VR is expected to be the largest advanced technology growth in education based on expected increases in expenditure on these tools (Roumate, 2023), they are not yet widespread in higher education.

AR has potential for improving distance learning due to the ability to access tools using mobile devices. For example, Mohawk College (Canada) has delivered learning modules using AR for some technician courses where students are unable to relocate to the campus for family or financial reasons (Lewington, 2020). This also has the benefit of allowing students to practice real-world skills in a virtual environment where errors can support learning rather than endangering students or others. Nevertheless, the development costs and required level of technical expertise for VR and AR are currently barriers to their integration in higher education, especially in resource-constrained contexts.

3.2 Learner inclusion and wellbeing

AI tools have already been used by HEIs to improve learning inclusion and wellbeing. Examples are provided in Box 3. As interaction with an AI tool can be potentially done via text or voice commands, this can help students with hearing or visual impediments. AI apps of voice recognition and transcription can also help students with hearing difficulties, whether in online learning based on a pre-recorded video or in traditional lectures where lipreading or sign language live translation might not be possible, providing instead real-time captioning. This type of tool could also help incoming international students who may still struggle with oral comprehension of the local language. Language inclusive interventions could play a role in improving equity and access to information for all citizens, not only those in higher education. Chatbots have also been used to identify students who may be at risk of poor wellbeing and provide them with emotional and practical support.

Box 3:

Examples of AI tools designed to support inclusion and wellbeing

- The University of California San Diego (USA), the first HEI to use an AI-powered application called Aira that delivers real-time visual descriptions for people who are **blind or have low vision** (Piercey, 2018).
- Researchers at Rochester Institute of Technology's National Technical Institute for the Deaf (USA) worked with Microsoft to build custom language models that learned how domain-specific words are pronounced, and then in 2018 trialled AI-powered real-time captioning and translation through Microsoft PowerPoint to support students who are **deaf/hard of hearing** (Roach, 2018).
- Kara Technologies, a start-up created at the University of Auckland (Aotearoa New Zealand), has developed an online platform that uses AI that translates content into sign language, providing more learning opportunities for students with **hearing impairments** (University of Auckland, 2020).
- The University of Copenhagen (Denmark) has developed an AI-powered free software that simplifies complex texts for people with **dyslexia and other reading difficulties**, helping them in their educational journeys (Jensen, 2019).
- Since 2016, Beijing Union University (China) has utilized a voice-to-speech AI tool that provides **subtitles** during lectures, appearing on a screen in real-time (Vincent-Lancrin and van der Vlies, 2020).
- The National University of San Marcos (Peru) developed an AI news broadcaster that, once a week, broadcasts the news of the university in **Quechua** (Fernández Arribasplata, 2023). Although all universities in Peru use Spanish as the medium of instruction, around a quarter of the population speaks Quechua (Cuenca and Sanchez, 2023).
- In 2017, a team of psychologist and AI experts at Stanford University (USA) developed WoeBot, a therapy chatbot assisting users in **tracking their emotional state and gaining self-awareness**. This chatbot is available for anyone and is especially targeted for young adults in college and graduate schools. It is a free service and available in the English language (Eve, 2020)[3].
- The Multimedia University of Malaysia developed ChatWithMe, a chatbot that can identify the emotions of the user as well as who might be **at risk of suicide**. Moreover, it is capable of steering them towards mental health professionals (Multimedia University Malaysia, 2022).

3 As noted in section 7.2, emotion-based AI has been criticised by academics as facial expressions are not indicators of emotions. Cultural and social context should be taken into account as well.

3.3 Analysing and assessing student progress

A survey of 464 participants conducted by a private education company in 2022 suggests that AI will have the greatest impact on testing and assessment, with 75% of respondents stating that the main reason to adopt AI in higher education is improved learner outcomes (HolonIQ, 2023).

Standard online platforms for teaching and learning can already analyse and track students' progress. Using AI, these platforms can also identify patterns such as why a student is not progressing, whether it might be linked to a lack of time commitment, of motivation to take tests or of the clarity of the materials, or whether it is a matter of timing and insufficient repetition, with short-term memory not having yet turned into long-term memory. For example, a team of researchers in Malaysia and Oman applied a set of machine learning algorithms based on students' cumulative GPA, attendance, and grades from the first exam as well as pre-requisite courses as a way to create a monitoring tool for academic progress (Khan *et al.*, 2021). A field test of the model found it to be efficient, identifying students whose final results might have been unsatisfactory and enabling the instructor to provide personalized support to those at-risk students (Khan *et al.*, 2021).

The field of learning analytics, which studies how to use digital data and computational analysis techniques to measure, collect, analyse and report data on learning, teaching and assessment (Tsai, no date), is increasingly using AI to advance its analytical functions, for example through the use of text mining and other natural language processing methods (Gašević, Dawson and Siemens, 2015). However, any use of AI in learning analytics (and learning analytics in general) should not only pay attention to the outcomes but to the learning and teaching process, otherwise they risk emphasizing measures that are weakly related, if at all, to learning progression. An example given is the analysis of the number of times a student logs in to an HEI's learning management system (Gašević, Dawson and Siemens, 2015). Despite the opportunities that AI presents to galvanize larger datasets, more data does not equate to better data: it is also important to consider the theoretical or conceptual constructs behind large-scale data analysis as well as the ways that such analysis can be actionable (Wise and Shaffer, 2015).

Assessment is another pivotal point in which AI will have an impact on student progress. With the popularization of AI in 2023 through ChatGPT, students are already turning to it to help them with assessments. When students are aware of/using ChatGPT, this tends to be mainly for exploratory purposes or to use it as a learning aid (Liu, Bridgeman and Chan, 2023; Pizarro Milian and Janzen, 2023). In many cases, students are using ChatGPT productively and responsibly, and call on teachers and HEIs to support them to use AI tools in their learning (Liu, Bridgeman and Chan, 2023). This is not universal, and there are many instances of students using AI tools to cheat (Sullivan, Kelly and McLaughlan, 2023). For example, a 2023 survey conducted in the USA found that 43% of the 1,000 university students surveyed have utilized AI tools like ChatGPT, with half of these users leveraging AI assistance for assignments or exams. Among the 216 students who incorporated AI tools into their academic work, half primarily completed their work independently but used AI for specific parts, while 30% relied heavily on AI for the bulk of their assignments, making revisions as necessary. Furthermore, 17% of these students submitted work produced by AI without making any modifications (Richards, 2023).

Another use of AI is robot-graders, or automated platforms that grade or help teachers grade assignments and give feedback to students (Keller *et al.*, 2019). However, with AI, such a platform can even go beyond grading test results, gradually adapting the level of difficulty over time or proposing additional materials that target the individual knowledge gaps of the student. The impact of these materials on the student's future performance can be further tracked and used to filter the more recommended materials to help improve grades. At the same time, AI can also ensure that what has been learned is remembered in the long term, scheduling refresher exercises along the monitoring process, when the data from tests show that the student starts to forget the content.

The main risk in using AI tools for grading is that "due to education's inherent complexity, it cannot be reduced to a set of purely quantitative variables and methods" (Alam and Mohanty, 2022, p. 25), and taking data or code at face value may lead to solutions that are oriented towards technology rather than pedagogy. It could also lead to an unhelpful cycle whereby students use AI to produce writing and other type of academic work and then AI, in turn, assesses this work, practically removing the human element from the process. Also, while AI grading tools may be helpful in resource-constrained settings where class sizes are large, it could also be demoralizing for students to have their work assessed in an automated way.

AI-empowered grading systems can automatically assign (or suggest) grades in real-time, not just as a final evaluation at the end of the course but throughout the entire learning process, reducing teachers' administrative tasks resulting from feeding the results of evaluations into institutional

Box 4:

Rethinking higher education assessment practices in the era of ChatGPT

HEIs and educators have expressed concern about the increased risk of plagiarism and cheating if students use ChatGPT to prepare or write essays and exams. This may have deeper implications for subjects that rely more on written inputs or information recall, areas that ChatGPT can better support (UNESCO IESALC, 2023a). HEIs have been implementing different strategies in response:

- Banning ChatGPT in assessments (or completely banning it)
- Deploying other software tools to check for AI-generated text
- Changing exam-based assessments to oral, handwritten or invigilated formats
- Using assessments that are difficult for ChatGPT to produce e.g. podcasts, laboratory activities, group work, reflections, grading participation, scaffolded assignments
- Updating guidelines to allow the use of ChatGPT in assessments, sometimes with conditions e.g. it may be used to support planning but AI-generated text may not be used in the final output; it is permitted but usage must be disclosed
- Creating new forms of assessment using ChatGPT (see the Practical Guide for examples of how ChatGPT can be integrated)

(Sullivan, Kelly and McLaughlan, 2023; UNESCO, 2023c; UNESCO IESALC, 2023a)

There is no right or wrong answer when it comes to dealing with AI tools such as ChatGPT in HE assessments although with time, more HEIs may choose to adapt or integrate ChatGPT than ban it. Assessment practices in higher education do need to be rethought and this process should be done in a way that is consistent with the HEI's existing values. It is also important to question why students may turn to ChatGPT to produce assessments and what HEIs can do to promote academic integrity and the importance of learning (UNESCO IESALC, 2023b).

databases which can then serve for internal reporting and credit recognition purposes. However, the use of tests in online teaching and learning platforms should not become a one-size-fits-all solution. While AI-based tools can be helpful for monitoring and reinforcing the consolidation of learning, many other skills, such as the capacity to explain complex topics or manipulate equipment, are still better evaluated by human professors.

3.4 Teacher professional development

Teaching staff at HEIs are the most likely to have their role affected by AI technologies. In a Canadian study of 410 HE stakeholders, 50% of faculty and educational staff said that this was the case – more than other groups such as senior administrators and those in both student-facing and non-student-facing roles (Janzen, 2023). While 72% of faculty had tried out an AI tool in the Canadian case, this may not mirror the range of global experiences – a UNESCO IESALC poll of almost 1,300 people (of whom 61% identified as HE teachers or researchers) found that 43% had not tried out ChatGPT (Janzen, 2023; UNESCO IESALC, 2023b). The reasons for the lower take-up could include lack of time, concerns or fears around using AI technology, or because ChatGPT is not available in some places.

The results of these two surveys demonstrate the central role of teachers in the integration of AI technologies in HE, particularly in relation to rethinking assessment, and teaching and upholding academic integrity. As UNESCO has noted, many of the HEIs' responses to ChatGPT point to the need for training for teachers (and students), potentially requiring the commitment of resources and time (UNESCO, 2023c). This call is reinforced by students who have called for support from teachers in learning how to use AI tools responsibly (Liu, Bridgeman and Chan, 2023).

Strategies for supporting teacher professional development can be found in the Practical Guide, including concrete suggestions for using generative AI to enhance teaching and learning. At the institutional level, HEIs can foster an environment conducive to teacher professional development by:

- **Providing or developing resources, starting at the introductory 'what is AI' level, and including tips or advice on using AI** according to the regulations and technological availability at the HEI. Such resources can combine materials developed externally by trusted sources, such as UNESCO IESALC's free online short course on ChatGPT and higher education[4] or other MOOCs, with materials that are specific to the needs of the HEI.

- **Creating opportunities for faculty, staff, together with students and other stakeholders, to discuss the impact of AI** on the HEI and co-construct strategies to adapt and adopt to AI.
- **Organizing workshops, forums, and other types of training events to learn about AI tools** – how to use them, their limitations, the HEI's policy for use. These could cover the use of different AI tools or focus on a specific tool.
- **Actively encouraging and considering incentivizing** (e.g. reallocating staff or faculty time to 'buy' them out from other activities) **staff and faculty to invest in their ongoing professional development in relation to AI**. This might be done through peer support and informal mentoring to increase skill level and share good practices for teaching and ways of using AI tools. Professional development can be undertaken at multiple levels: within faculties, at institutional level, or among supra-institutional communities of knowledge.

Additionally, it is crucial to provide training to all internal colleagues on AI ethics. This should encompass not only the technical aspects of AI applications (suitably adjusted depending on level of technical expertise) but also address biases related to gender, race, and cultural factors.

4 https://campus.iesalc.unesco.org/inicio/blocks/coursefilter/course.php?id=215

Harnessing the Era of Artificial Intelligence
in Higher Education:
A Primer for Higher Education Stakeholders

4

AI and higher education administration and management

AI and higher education administration and management

The impact of AI on higher education is already being felt strongly in the way that HEIs are governed and managed. This chapter focuses on the most common uses of AI in higher education administration and management. It covers institutional administration and management, student administration, and institutional services and support.

4.1 Institutional administration and management

4.1.1 Institutional and data governance

Just as data can be used in AI tools that support learning and teaching processes (see chapter 3), it can also inform governance and management processes and procedures, potentially making them more effective and efficient. For example, AI-powered tools have been developed to optimize scheduling by tracking how teaching rooms are booked on campus and suggesting improved allocation strategies. Many HEIs have implemented business intelligence (BI) tools that collect, process and analyse large amounts of data to support decision-making. In HEIs and higher education systems experiencing an increase in the digitalization of processes – student records, virtual learning environments, management information systems and more – there is always more data available to HEIs that could be processed using AI tools (Beerkens, 2022). Countries that were already more predisposed to measuring performance in higher education (e.g. adherence to international university rankings, existence of national research assessments) are among those leading the way in using AI tools to provide metrics and dashboards (Williamson, 2019; Beerkens, 2022).

In publicly funded HEIs, accountability, compliance and transparency are key features, which is relevant in the context of integrating AI because of the need this creates for robust data governance (Jim and Chang, 2018). Data governance at institutional level requires both technical and organizational change: the first ensures appropriate IT solutions, data quality and security/protection, whereas the second relates to understanding why data is being collected and for what purposes and how to turn the data into useful and meaningful analysis. In turn, both require IT and other personnel who can work with data and understand the higher education context, and leadership that understands how AI works and puts value on evidence-informed decision making (Broucker, 2017; Jim and Chang, 2018; Beerkens, 2022).

Whereas the use of AI-informed outputs could be empowering to students by giving them greater choice, more personalization and customization, at institutional governance level, such tools could run the risk of inducing competition and focus on performance comparison (Williamson, 2019). Furthermore, for AI tools to effectively support decision-making, there needs to be sufficient data that is reliable, computing infrastructure to manage the data, and sufficient financial and human resources – a combination that is not always readily available, for example in low-resource HEIs. This issue is particularly acute in the case of data collection and processing (Sharma *et al.*, 2022).

4.1.2 Guidance on using AI

HEIs play an important role in shaping the responsible development and deployment of AI technology and it is essential to incorporate guidance on AI to address various aspects such as academic integrity, research ethics, and the broader implications of AI deployment. By establishing clear policies and guidelines, HEIs can lead the way in ensuring that AI technologies are utilized ethically, transparently, and for the benefit of all stakeholders in the education ecosystem. Guidance on AI is beginning to be accepted – in July 2023, for example, a set of AI Principles was adopted by 24 research universities in the UK. These cover AI literacy (see also chapter 6), upskilling staff, ethical and equitable AI use, academic integrity, and collaborative working (MacGregor, 2023).

However, the popularization of generative AI in 2023 has to date spread faster than most HEIs have been able to adapt their governance structures. According to a UNESCO survey of just over 450 education institutions around the world, approximately 13% of universities have some kind of guidance on AI and 20% of respondents were not able to say whether their HEI had issued policies or guidance (UNESCO, 2023d). Similarly, a survey of 410 faculty, staff and leaders from Canadian HEIs found that only 11% reported that their institution had a policy for AI technology and 32% were unsure (Janzen, 2023). This indicates a lack of understanding and agility on the side of institutions and, without guidance, there are risks of unplanned implications of AI use in relation to safety, knowledge diversity, equity and inclusion (UNESCO, 2023d).

One key area where AI guidance is necessary is **academic integrity** (also discussed in chapter 8). With the increasing availability of AI-powered tools and services, HEIs need to establish policies and regulations to ensure fair and ethical academic practices. This includes guidelines on preventing plagiarism, detecting AI-generated content, and ensuring that AI technologies are used appropriately in student assessments. For example, in early 2023, Tec de Monterrey (Mexico) issued guidance on the use of ChatGPT for their faculty and students and encouraged professors to discuss the appropriate and ethical use of ChatGPT in class (Longino Torres, 2023). These guidelines include how to appropriately use AI, how not to use it and the steps to follow once there has been a misuse (University of Rochester, 2023). Abu Dhabi University (UAE) has provided guidance for teachers and students as well as offered faculty training, and is also working on a GPT-4 integration into the university's systems (Abu Dhabi University, 2023).

Research ethics is another significant aspect to address when including AI in guidance, as also discussed in chapter 5. HEIs should establish guidelines to ensure the ethical use of AI in research, including issues related to privacy, data security, bias mitigation, and transparency. This helps to uphold ethical standards and ensure that research conducted using AI technology adheres to ethical principles and safeguards. HEIs that have issued guidance on AI exemplify the proactive approach taken towards responsible AI integration. For instance, some institutions like the University of Helsinki (Finland) have developed specific AI ethics committees or boards to oversee the ethical implications of AI in research and teaching (University of Helsinki, no date). These committees often consist of experts from various disciplines and play a vital role in evaluating AI projects, ensuring compliance with ethical guidelines, and promoting responsible AI practices.

Furthermore, HEIs have issued guidelines on **AI transparency and accountability**. This includes providing clear explanations of how AI technologies are used within the institution, the data sources used, and the decision-making processes involved. The Australian National University has established the Autonomy, Agency, and Assurance Innovation Institute (3A Institute) that focuses on responsible AI development. They have developed frameworks and guidelines for AI accountability, including ethical considerations, safety, and human values in AI systems (Australian National University, no date). Such transparency helps build trust among students, faculty, and the wider community regarding the responsible use of AI in educational and research contexts.

4.1.3 Automating administrative tasks

High volume administrative tasks, from admissions to procurement, can drain the human and financial resources of HEIs, often having to be processed in specific workload peaks throughout the year. AI can be used for scenarios in which large pre-existing databases are available where machine leaning techniques can be applied. AI can be part of a range of simplification options, though more straightforward solutions, such as workflow apps, desktop automation, or robotic process automation, can be enough for the most predictable and high-volume processes.

The main use of AI to automate administrative tasks in HEIs has been through the deployment of public-facing chatbots. Using chatbots or other virtual assistants, students can ask questions regarding campus services, course schedules, booking rooms and resources, IT queries, etc. These simple interactions can liberate administrative staff resources in low-value activities such as forwarding publicly available information or solving frequent questions.

For example, the University of Murcia (Spain) has a chatbot that responds to questions about campus and areas of study, which was able to answer more than 38,000 queries 91% of the time, saving the administrative staff time to take on other activities and giving students timely answers for their queries (Rouhiainen, 2019). Similarly, the University of Buenos Aires (Argentina) has developed a chatbot that provides potential students with comprehensive information about all 13 faculties and six colleges, procedures for distance learning, virtual campuses, the university's history and all other aspects related to the university life (Pignatelli, 2021).

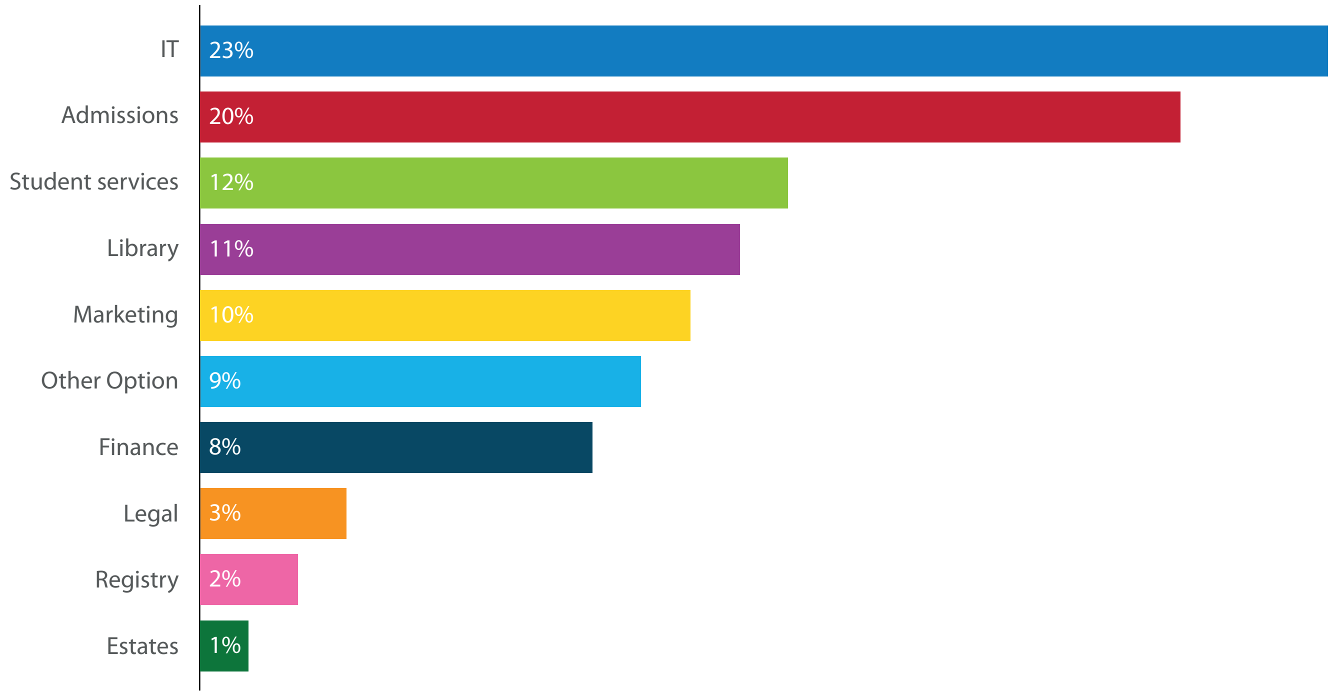
4.1.4 AI and the higher education administration workforce

Among the 111 participants in a Microsoft–Times Higher Education survey on AI and higher education, 42% believed that no staff would be laid off due to AI in the next 10-15 years (Pells, 2019). In contrast, 15% of HEI leaders indicated that they may take on more staff in the next 10-15 years as a result of AI developments (Pells, 2019). At the same time, and as shown in Figure 9, the spread of AI is likely to affect many administrative roles within HEIs, naturally including most IT services, and also encompassing admissions, student services, library, marketing, and finance.

As has been the case with the implementation of new technologies in service-providing institutions in the past, new efficiency gains do not necessarily lead to a reduction of the overall number of staff but rather to a relocation of human and financial resources from low value-added repetitive tasks to core operations (teaching, research, expanded services to students, etc.).

AI can only be successfully embedded if there is adequate training and a cultural shift. Faculty and staff should be trained primarily on how to use the AI tools that the HEI is

Figure 9 – Which administrative roles within the university do you foresee being significantly affected by AI?



Percentage of respondants giving this answer. Respondents could choose up to three responses.

Figure: UNESCO IESALC | Source: Times Higher Education

implementing, and also on the benefits and shortcomings of those tools (Grajek and 2019-2020 EDUCAUSE IT Issues Panel, 2020). The right mindset or AI culture is necessary so that the community is open to integrating AI solutions in the institution (IBM Services, 2018). Strategies to integrate AI culture as part of higher education's institutional practices may vary from the broader societal contexts and learning and operations patterns from the past; different cultural foundations may also result in different AI cultures. Nevertheless, this does not diminish the importance of establishing AI cultures, even in diverse forms.

4.2 Student administration

4.2.1 Student services

From the point of view of students, an added value of AI tools that provide services is access to an instant response 24/7, without depending on office opening hours (which of course can remain in place for more complex queries). There is added value when these applications identify the user posing the question and adapt the answer to their specific situation. For instance, an AI could recognize a student asking questions using natural language such as "Where is my next lecture?" and find the answer in real-time based on the database of courses where the student is registered, or "Can I sign up for this course?" and determine eligibility based on the credits already completed by the student.

Box 5:

Use of AI chatbots to provide student services

The University of Canberra (Australia), for example, has created AI chatbots that can help with IT queries and other information requests from students or HR questions from staff (Perry, 2018). For its part, Deakin University (Australia) offers an application to its students that provides them with personalized information, from upcoming deadlines and the voice-activated management of reminders to library bookings and reading recommendations based on their current courses, or updates on activities happening on campus at the moment (Deakin University, 2019). Similarly, Continental University (Peru) has developed ContiBot, a chatbot that provides information on timetable, grades or any other academic information in real time to their more than 60,000 students spread across four campuses, three of which are located in small and medium-sized cities in the Andes (Universidad Continental, 2020).

4.2.2 AI in admissions and financial aid

Like chatbots used by students for administrative tasks or learning, prospective students can also use AI-based applications to solve their questions and guide them through the sometimes burdensome admission procedures. A private company that specializes in this kind of chatbot serves more than 100 campuses, proving how widespread admission chatbots are (Pappano, 2020). According to the company, a key aspect of this success is that applicants know they are not interacting with humans and therefore have the freedom to ask anything without feeling embarrassed (McKenzie, 2019). The University of Cape Town (South Africa) implemented a chatbot to aid in admission and orientation processes. The chatbot is able to answer questions on issues anticipated in a varied range of topics including challenges in connectivity students might have, and financial aid opportunities. In those cases where the chatbot is unable to answer the question, the query is directed to a live agent (Somdyala, 2023).

In recent years, there has been an increase in AI use for admission and scholarship decisions. These enrolment management algorithms can assist HEIs, for example in tailoring the cost of attendance, according to the financial capacity of the students (Engler, 2021). When it comes to admission decisions, it is important to point out that AI is based on data, and data is not an objective matter (Dixon-Román, Philip Nichols and Nyame-Mensah, 2019). This means that making admissions decisions that are implicated by the biases embedded in the databases powering AI, may have a negative impact on learners' future choices (Berendt, Littlejohn and Blakemore, 2020). Research also suggests that these algorithms generally reduce the amount of scholarship funding offered to students (Jaschik, 2021). These programs are very good at calculating exactly how much a student can afford to pay, meaning they may drive enrolment (Engler, 2021). However, these algorithms are not programmed to account for unexpected costs or emergencies, which may have negative implications for students' financial capacity to continue studying. When success criteria are established based on the data of a majority group, AI systems can inadvertently develop implicit biases and tend to exclude minority groups by default.

4.2.3 Increasing student retention and reducing dropouts

AI can be used to identify students with potentially vulnerable profiles who might be at risk of dropout, allowing the HEI to use this information to take proactive measures to prevent it (Vincent-Lancrin and van der Vlies, 2020). An AI tool can use aggregated data to identify which early academic underperformance levels correlate with higher dropout chances. For example, in the Pontificia Universidad Javeriana de Cali (Colombia), an AI tool was used with aggregated data to identify which levels of early academic underperformance and other variables correlate with higher chances of drop-out with 93% accuracy (Reinoso Castillo, 2019). Some AI tools used in this way account for gender, such as a machine learning model developed for Universidad Complutense de Madrid, a large public university (Spain) (Segura, Mello and Hernández, 2022). This model found significant gender differences in dropout rates in the first year of study, with men more likely to drop out than women in general, and in particular in Arts and Health Sciences subjects (Segura, Mello and Hernández, 2022)[5].

Analysing data such as logs showing when and how students engage in online learning environments can help the development of interventions that will reduce dropout rates and increase retention rates (Araka *et al.*, 2020). HEIs can then use these and other indicators to trigger early interventions from academic advisors. As such, AI can be used to collect and determine students' behavioural patterns, but it is then a human task (for faculty and staff) to follow up further and provide relevant intervention to reach students, especially in the field of student affairs (Barret *et al.*, 2019). As an example, the University of Trás-os-Montes e Alto Douro (Portugal) developed an EDU.IA project which aims to enhance tutoring activities through the application of data analytics and AI (Silva *et al.*, 2022). By determining the probability of dropout for each student, the tutoring programme can proactively plan activities and provide support to those at risk. Academic records from the past fifteen years are integrated into a data warehouse, which feeds the inference algorithms. The selected algorithm then predicts future academic performance based on a comparison of current and previous students' grades (Silva *et al.*, 2022). HEIs can then use these and other indicators to trigger early interventions from academic advisors, as is the case at the University of Canterbury (New Zealand), for example (New Zealand/1 News, 2020).

Another use of predictive algorithms is identifying incoming students that may have a higher risk of dropout, for example, based on the results from previous students from the same high schools. At one (unnamed) US university, the enrolment rate increased by 20% when under-prepared students were identified by an AI program to be further channelled to additional preparational strategies (e.g. summer prep course,

5 This model has only been replicated experimentally, there is no available information specifying its impact on admissions in a real-life scenario.

additional tutoring, special courses, mandatory meetings with college counsellors, etc.) (Gehring, Hsu and Ai, 2018). Georgia State University (USA) has used these markers to offer a seven-week summer session to certain students before they start their first year of college, resulting in nine out of ten of these students successfully completing the first year (Marcus, 2014).

Despite the growing use of early warning systems that use predictive models based on AI algorithms, less attention has been paid to students' expectations of such systems. Researchers at the Universitat Oberta de Catalunya (Spain) evaluated students' experiences of using the university's predictive system that uses historical data such as previous grades obtained and the number of courses/credits they are enrolled in to provide them information about their likelihood of failing a course using a traffic light system (where green is no risk, amber is intermediate and red shows high possibility of failed) (Raffaghelli *et al.*, 2022). This research demonstrated a disconnect, finding that when students started with higher expectations around technology, they had lower levels of technology acceptance after using the early warning system, suggesting the need to better support and train students and/or to introduce advanced technologies in stages to gradually acclimatize users (Raffaghelli *et al.*, 2022).

4.3 Institutional services and support

4.3.1 IT infrastructure

It is important to underline that the integration of AI into higher education involves considerations of both technical and organizational aspects. This includes hardware resources, software requirements, data management strategies, personnel and skills, security and privacy concerns, among others.

The vast processing power required by AI (see also the section on AI and sustainability) and requirements for data storage and up to date computing hardware raise issues of affordability and accessibility for HEIs in resource-constrained environments. There may also be a related risk of fewer qualified personnel if such hardware/infrastructure is already limited, providing limited opportunities for training and skill development. In addition, the digital divide (see also chapter 7) means that the basic internet connectivity and electricity supply is not guaranteed everywhere. An option proposed for businesses in resource constrained settings that could also apply to HEIs is to work on designing and implementing technology that does not require access to complex neural networks or basic science (Kamiya, 2023). And, while an MIT (USA) professor has developed a way to programme more accessible computer chips to run deep learning algorithms (Hao, 2020), this still requires plentiful storage.

Cloud computing can be an option for resource-constrained HEIs as well as for HEIs in settings where there are shrinking IT budgets and escalating IT needs to cut costs on implementing AI on campus. Some benefits of cloud computing include:

- **Mobility**: In the cloud-based classroom students and faculty can go back or refer to all of the course content in the cloud.
- **New services**: Virtual classrooms via online learning and video conferencing. Cloud servers will make this possible no matter what device the student is using.
- **Storage**: Scalable cloud storage offers HEIs the ability to expand storage capabilities quickly. This option also offers businesses continuity and disaster recovery (Pardeshi, 2014).

However, cloud systems have challenges as well (Bonderud, 2020), security being one of the most important.

Data management is fundamental to leveraging AI services in higher education. Since the COVID-19 pandemic, HEIs worldwide are increasingly digitalizing their operations and relying on digitally sourced data (Komljenovic, 2022). However, HEIs might be working with different digital platforms, some developed by them, and others procured from external companies. This could mean that data may be stored differently or with different protocols, making it difficult for HEIs to harness their data power. Data management and interoperability become critical, as they enable data exchange between two or more systems by adhering to common standards or protocols.

US-based education technology non-profit EDUCAUSE sets security as the number one IT issue for HEIs (Grajek and 2019-2020 EDUCAUSE IT Issues Panel, 2020). This is followed by privacy – as HEIs digitalize, they have more and more information on their students, faculty and staff, information that may be sensitive or that individuals simply do not want to be shared. The more an institution relies on AI for its core or sensitive processes, the more it will have to consider measures such as automated backups, redundancy of capabilities, and maintenance. To implement the IT infrastructure needed to deploy AI, HEIs need to have professionals able to either develop or contract the necessary systems, considering the challenges mentioned above. Moreover, HEIs need to secure funding to maintain (or update) the quality of IT systems required for AI implementation in the HEIs, the number three IT issue for HEIs according to EDUCAUSE (Grajek and 2019-2020 EDUCAUSE IT Issues Panel, 2020).

4.3.2 Library services

Another area where AI can be integrated in HEIs is in library services. HEIs have integrated online chatbots on their library websites to assist students in their queries (Young, 2019) and are leveraging AI to scrutinize digital collections, pinpoint topics and entities, attribute metadata, and promote non-textual search (Holland, 2020). For example, the AI application HAMLET (How About Machine Learning Enhancing Theses?) uses machine learning to power experimental, exploratory interfaces to the thesis collection of MIT (USA) (Yelton, 2018).

Advanced automation functions enable libraries to use AI to check out, sort, and return physical materials (Shoufani, 2022). A collaboration between librarians and scientists in Singapore led to the development of robots such as Aurora, which scans library bookshelves to find mis-shelved, misplaced and missing books, producing a report with the findings of each scan (Senserbot, 2022). Another use of AI in library services is intelligent warehouse management, which can be more efficient in the use of library space than the traditional theme- and alphabetic-based sections, thanks to three characteristics: (i) automatic book circulation and paper document management, (ii) random book storage (that is, placing it in the next available slot – and updating the database accordingly – rather than in a pre-determined location), and (iii) automatic counting, checking and sorting of books (Yu *et al.*, 2019).

4.3.3 Careers services

Besides its use within the traditional HE learning environment, AI can also help recent graduates in their work search, an area in which HEIs often offer additional services to their students and alumni. This can vary in terms of complexity, from helping to build a resumé (CV) to matching skills from graduates with their demands in the labour market or giving insights for salary negotiation. For instance, AI could give recommendations to improve students' resumés based on the terms of reference of specific jobs and could also review role descriptions as listed on the resumé and the applicant's LinkedIn profile and highlight the more important facts to include in the resumé (Biron, no date).

AI has also been used in the context of extra-curricular training in areas such as mock job interviews, analysing video recordings from participants, and providing them with feedback in areas such as the use of their voice, use of keywords, or non-verbal communication, Duke University (USA) has adopted this line of AI mediated services (Burke, 2019). This feedback can be helpful for all kinds of future interviews, particularly for virtual interviews that will be analysed (or directly conducted) by an AI similar to the one used for the training exercise.

5

AI and research

AI and research

The link between AI and research in higher education is two-fold. The first relates to research on AI whereas the second is about research using or supported by AI tools. Research on AI has greatly increased over the past 20 years, including dedicated AI conferences, preprints, peer-reviewed journal articles, patents and citations (Stanford University, 2021).

5.1 Research on AI

The largest volume of publications on AI comes from HEIs in China, representing nine of the top ten institutions based on number of publications with the tenth based in the USA (Stanford University, 2023). The distribution of different types of AI publications globally has varied over time: if in 2010, the number of conference papers and journal articles were similar, by 2021, fully 60% of AI publications were journal articles (Stanford University, 2023). This shows the maturity of the field given that journal articles publish confirmed findings usually validated by peer review, whereas conference papers may reflect more work-in-progress.

Based on recent publication trends, there has been a surge in publications concerning pattern recognition and machine learning in the last five years. Pattern recognition publications have approximately doubled since 2015, and the number of machine learning papers has seen an about fourfold increase. In 2021, beyond these two subjects, the next most prolific AI research fields were computer vision, with 30,075 publications, followed by algorithm-related studies with 21,527 papers, and data mining, contributing 19,181 articles (Figure 10) (Stanford University, 2023).

It is important to mention that despite this increase, only 1.4% of articles on AI applications in higher education addressed issues on ethics, challenges and risks (Zawacki-Richter *et al.*, 2019). A significant portion of the research on AI in higher education appears to be conducted by computer scientists, who, not surprisingly, concentrate on the elements of the tools, algorithms, their validation, and application. They seem less focused on the effects these have on learning outcomes (Bates *et al.*, 2020).

Some publications on AI take an explicitly interdisciplinary approach. During the COVID-19 pandemic, for example, a framework for multidisciplinary research on AI and the pandemic was developed which identified the possibilities for such research on three levels: molecular, clinical, and societal (Luengo-Oroz *et al.*, 2020). However, as an interdisciplinary and complex field, AI should involve researchers across many different areas of research, with some predicting that the next breakthroughs in AI will be based on its interdisciplinary nature (Kusters *et al.*, 2020; Zhuang *et al.*, 2020; Hajibabaei, Schiffauerova and Ebadi, 2023).

Figure 10 – Number of AI publications by field of study (excluding other AI) 2010-2021

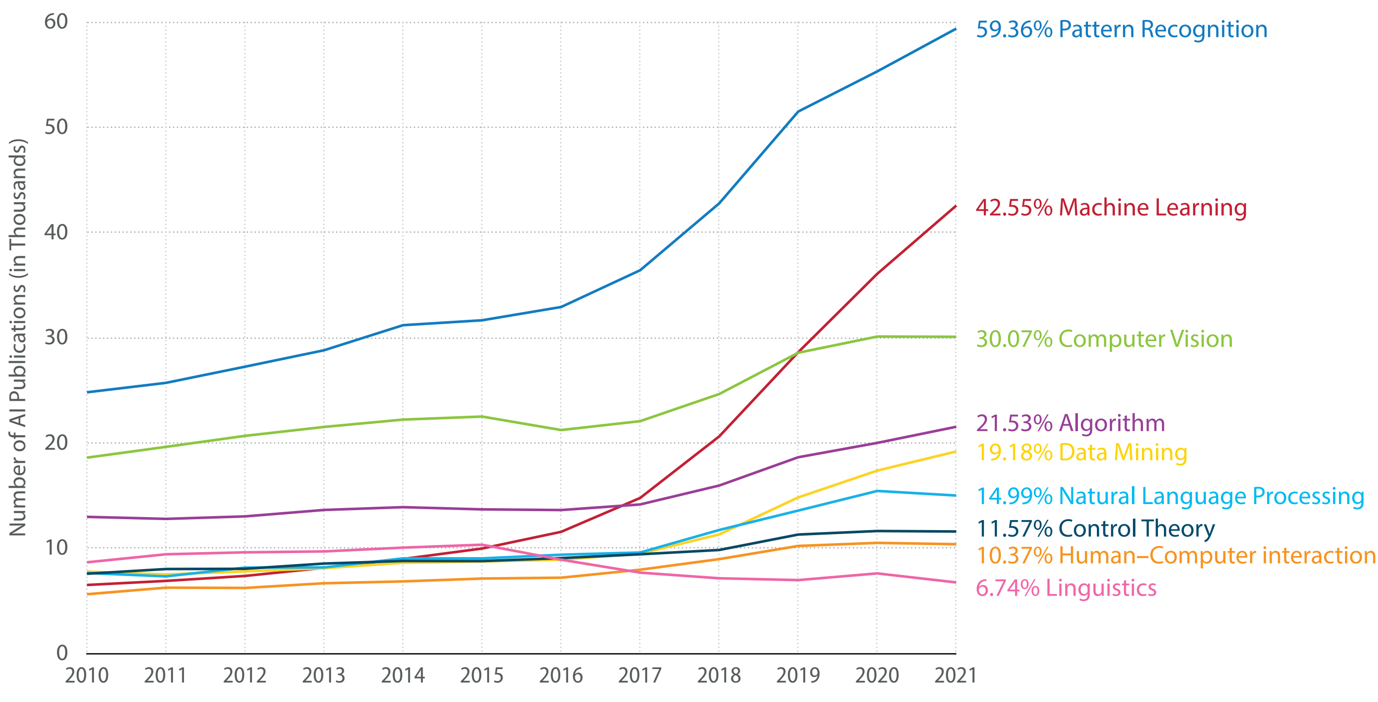


Figure: IESALC | Source: (Stanford University, 2023)

5.2 AI-powered tools for research

AI can be used by researchers throughout the lifecycle of a research project, from designing the research through to data collection and analysis, and writing up/presenting and disseminating research results. For example, both machine learning and digitisation can help researchers go through very large datasets, find patterns, predict scenarios, and scanning information. These actions can potentially aid researchers in the design and writing process as well as assist in scrutinizing search engines more efficiently and disseminating the findings. However, human intervention and control are critically important.

5.2.1 Research design

AI can assist in the design process of a research project. Generative AI tools could help in formulating initial hypotheses or designs based on given data, thereby offering a diverse range of starting points for a project. AI tools can support humans with stimuli, fostering lateral thinking and promoting creativity, both of which are crucial during the research design process (Figoli, Mattioli and Rampino, 2022). ChatGPT for instance, if prompted with suitable information, may be able to come up with initial research frameworks. The quality of any response from generative AI tools, however, depends on the quality of the input provided by the human user, a reminder of the critical importance of human intervention in guiding and making responsible use of AI. In this sense, AI tools can be used as a starting point from which the researcher subsequently develops the research.

On a more practical note, AI-driven document search tools can search through large amounts of literature and academic papers to quickly find the most relevant and up-to-date research. For example, an open-source AI web app was created in 2023 as an LLM based research assistant that allows human users to have a conversation with a research paper and directly ask questions to the paper (Patnaik, 2023). In addition, AI tools can highlight key points in articles, recommend databases or related academic papers and sort or organize large numbers of papers (e.g. by field of study, date range). In the case of this Primer, AI tools were used to support some of the research design: queries were entered into ChatGPT to provide prompts on structuring some of the ideas; Consensus was used to identify certain parts or arguments of some academic papers; and DALL.E (an image tool) was used to generate the cover artwork.

5.2.2 Data collection and analysis

Machine learning (ML) and deep learning (DL) can be used to identify patterns and relationships within large datasets that may not be readily apparent to human researchers. They can also be used to make predictions or build scenarios based on those identified patterns, thus enabling researchers to make informed decisions or generate new hypotheses. Examples of the application of ML and other AI tools in research are provided in the section on research on the Sustainable Development Goals. AI can also reduce the burden of research by scanning information currently held on paper. Through optical character recognition, AI can transform the images of scanned documents into searchable data with high accuracy, helping researchers go through paper records faster.

When working with already digitized information, AI-based search engines help researchers go through the information**.** For example, Google Search and Google Scholar are search

Box 6:

Leveraging AI tools to co-design interdisciplinary research

A research team at Delft University of Technology (Netherlands), École Polytechnique Fédérale de Lausanne (Switzerland) and the Institute of Robotics and Mechatronics, German Aerospace Centre (Germany) used ChatGPT-3 to co-design a robot to support agricultural crop harvesting. The research proceeded in two phases, with ChatGPT deployed in the first phase of ideation. A researcher interacted with ChatGPT to first identify future challenges for humanity, with subsequent prompts based on the researcher's decisions on narrowing the focus further to the point that ChatGPT had made suggestions for the technical design specifications of the robot. In the second phase, the human research team optimized the code proposed by ChatGPT, finalized the design and built the robot. The robot was then tested on real-world crop picking tasks.

Through this process, the researchers could connect to areas of knowledge outside their personal expertise and connect them, offering good potential for making interdisciplinary fields (such as robotics) more accessible. On the other hand, this presents risks of misinterpretation or oversimplification and could reinforce existing biases. The research team concluded that AI tools should be leveraged by researchers but "in an ethical, sustainable and socially empowering way" (p. 564).

(Stella, Della Santina and Hughes, 2023) engines using AI that allow researchers to find specific content, primarily through their advanced searching option. Consensus is a search engine built by researchers that uses AI to extract and distil findings from scientific research (Consensus, no date). Other AI-driven platforms exist that use millions of semantic connections and conceptual links from millions of books, articles, databases to help researchers find resources and connections that might have been overlooked (Yewno, no date).

5.2.3 Drafting and dissemination

After data collection has been completed, AI can assist researchers with the writing process. Whereas some researchers have found that tools such as ChatGPT can generate a well-structured or at least a standard abstract (if given precise and accurate instructions), others have identified significant limitations in using it to support writing (Rahman *et al.*, 2023). For example, ChatGPT may provide fabricated references, cannot adequately synthesize literature and tends to produce formulaic text (Cotton, Cotton and Shipway, 2023; Rahman *et al.*, 2023). Because LLMs such as ChatGPT draw from information on the internet which could be unreliable (e.g. research that contains outdated or inaccurate theories/data), they may present inaccurate or incorrect information as accepted knowledge (UNESCO, 2023c).

Other possible uses of AI tools at the drafting and dissemination stage can include helping to identify errors in a manuscript and detecting plagiarism, false statistical results, or unreported information (Enago Academy, 2020). AI tools can help the text flow better by identifying similar-sounding paragraphs or sentences. Finally, many AI-powered tools help researchers track and manage references. For instance, there are some application which allow users to generate references immediately from a variety of sources.

Box 7:

Can AI be an author of academic research?

The spread of ChatGPT and its possible uses in research design and drafting processes has led to an ongoing debate about whether a non-human author can be considered a contributor to the creation of knowledge. This is more than a technical issue, because the question of authorship connects to the question of originality, the value of academic work being based on producing original knowledge and also being able to specify how that originality should be attributed (Nakazawa, Udagawa and Akabayashi, 2022).

Yes

AI tools can make a significant contribution to research including generating text that may be deemed good enough quality to be published (Cotton, Cotton and Shipway, 2023). ChatGPT has already been cited in papers as a co-author, although not without controversy (Teixeira da Silva, 2023). The emerging consensus is that AI tools can be acknowledged in publications but not with the status of (co-)author.

For example, the editors of the journal *Accountability in Research* released a draft policy in January 2023 proposing that authors could use what they call NLP systems (AI systems based on natural language processing such as ChatGPT that generate new content) but would have to disclose and describe how these systems had been used in the text. Furthermore, authors would have to accept full responsibility for factual and citation accuracy. Such disclosures should be made in the Methodology section of the text and among the references, and authors are provided a template to submit the text generated by NLP systems as supplementary material (Hosseini, Rasmussen and Resnik, 2023).

No

The main argument against allowing AI tools to be authors in research is that they cannot take responsibility for the content or integrity of academic papers.

A March 2023 review of three large publishers of academic research, Springer Nature, Taylor & Francis, and Elsevier, found that all had updated their authorship policy in response to the growth of AI tools, but that none allowed ChatGPT to be an author or co-author (Rahman *et al.*, 2023).

The editor-in-chief of the journal *Science* issued a letter in January 2023 clarifying that text written by ChatGPT is not acceptable because it would fail the journal's policy on originality. As all authors have to certify that the work is an original, this condition would not be met if ChatGPT was used as the text would be plagiarized from ChatGPT. Authors also have to certify their accountability for the research in the paper, another test that ChatGPT would not pass. In addition, *Science* has updated its editorial policies to specify that "text generated by ChatGPT (or any other AI tools) cannot be used in the work, nor can figures, images, or graphics be the products of such tools" (Thorp, 2023, p. 313).

AI tools can allow for translation to and from a variety of languages, which may have equity benefits in terms of expanding access to knowledge produced in different languages and supporting researchers to publish in languages other than their main working language. A number of machine translation tools are based on open-source neural machine translation models, offering opportunities for researchers in low-resource settings to support the development of AI as well as expanding the number of languages that can be translated. HEIs around the world are supporting these efforts. For example, Kyrgyz Technical University (Kyrgyzstan) has provided data to a team of volunteers who are creating a Kyrgyz language voice assistant, the University of Helsinki (Finland) maintains the OPUS project that compiles multilingual content with a free licence to train the translation model, and a research group at the Indian Institute of Technology Madras (India) provides translation models to support over 20 Indic languages (Giner, 2023; Lee, 2023).

AI can facilitate the dissemination of research results. AI-powered platforms can intelligently determine the best times to post research findings on social media, ensuring they reach the maximum number of interested parties (Zalani, 2022). They can also automate the sharing process across various platforms. Other tools can personalize email marketing campaigns to make sure the right content reaches the right audience at the right time. Additionally, AI can assist in creating visually engaging representations of research data, improving audience comprehension and engagement.

For readers, AI can greatly improve their experience of engaging with research. AI-powered recommendation and visualization tools present readers with relevant, easily digestible information tailored to their interests and comprehension levels. AI text analytics can help identify the keywords of the research. Additionally, features such as automatic transcription, translation, and interactive chatbots make research results more accessible and personalized.

5.3 Research on the Sustainable Development Goals using AI

AI has potential to aid higher education in working towards the Sustainable Development Goals (SDGs), following the commitment of UNESCO to examine how AI could support the provision of inclusive and equitable quality education as well as the Beijing Consensus' guidance and recommendations for responding to the opportunities and challenges brought by AI in relation to SDG 4 (UNESCO, 2019a). This potential is quite visible in research already being done by HEIs around the world who have leveraged AI to contribute to all 17 SDGs. Three examples are provided in this section.

In connection with SDG 3, good health and well-being, the COAST Project created by Makerere University's AI Lab and Infectious Diseases Institute (Uganda) developed end-to-end AI and data systems to improve the management and recovery from the COVID-19 pandemic. The project also aims to create inclusive and equitable datasets (COAST Project Uganda, 2021). Unknown at the time of formulating the SDGs, COVID-19 has since threatened decades of progress in global health, making research to improve pandemic response and recovery times, speed up scientific discovery and help with disease prevention and improve wellbeing essential to achieving this goal.

SDG 6 concerns clean water and sanitation and SDG 17 focusses on partnerships for the goals. Whereas SDG 6 focusses on ensuring the availability and sustainable management of water and sanitation for all, SDG 17 emphasizes the need to mobilize funding and support through partnerships that particularly benefit developing countries. Furthering both goals, researchers from York University's Institute for Global Health Research and School of Engineering (Canada) partnered with Médecins Sans Frontières (MSF) to create the Safe Water Optimization Tool (SWOT), a free and open-source AI application to improve safe water supply in refugee camps. SWOT provides site-specific information on water to produce evidence-based water treatment recommendations. Based on user feedback and field learning from a large refugee camp in Bangladesh, a second version of the tool was launched in late 2022 (Water Canada, 2022).

In relation to SDG 15, life on land, researchers from the Universities of Glasgow (UK) and Cape Town (South Africa), with the help of more than 2,000 volunteers and the Field Museum of Natural History (South Africa), developed an algorithm to track wildebeest migration and prevent poaching in Africa. Wildebeests are the major driving force in the Serengeti National Park ecosystem, hence the importance of tracking and preserving them (Torney *et al.*, 2019). By supporting animal conservation and providing a foundation for evidence-based action, this research supports the SDG 15 goal of halting biodiversity loss.

5.4 Risks and implications of using AI in research

A number of the challenges of using AI-powered tools in research have been mentioned earlier in this chapter, perhaps foremost among them the central issue of originality. The risks of using tools such as ChatGPT in the research process include the possibility that it will generate fake references, produce mediocre or insufficiently specific text, and be subject to plagiarism. All of these are risks that could undermine the originality of knowledge production, which, as previously noted, underpins the specific added value of research and particularly academic research (Nakazawa, Udagawa and Akabayashi, 2022; UNESCO, 2023c). It has been suggested that moving away from the current individualistic model of originality (attributed to individual authors) towards a more distributed or collaborative understanding of research as involving humans, research environments and AI could be a way of reframing the current ethical dilemma (Nakazawa, Udagawa and Akabayashi, 2022). However, the prevailing view at the time of writing this Primer has focussed more on the ways to use AI tools to assist research while the overall process remains fully under human control (Rahman *et al.*, 2023).

There are also specific ethical challenges of using AI in research that are unique to higher education settings, such as institutional ethics review processes. At HEIs that have committees responsible for research ethics (known by various names such as research ethics committees/boards or institutional review boards), there are rules or guidelines governing ethics that frame the conditions in which research can be undertaken. These commonly apply to research with human subjects and aim to provide assurances that researchers are acting ethically and in turn, that HEIs are trustworthy (Samuel and Derrick, 2020). However, existing processes may not account for research using AI because there is no common understanding of how to manage, process and interpret data predictions in an ethically responsible way and no assurances of whether algorithms are interpretable or have transparency (Jia, 2020; Samuel and Derrick, 2020).

In contexts where AI in higher education has made more progress, there remain significant ethical challenges such as ethics processes lagging technological developments or unresolved issues about whether ethics governance should cover only the researcher or the product they may create (Jia, 2020). In China, the government's proposed risk-based approach to governing research ethics has been seen by some as potentially harming scientific development, but experts have made the case instead that more education and capacity development for researchers, policymakers and those working in industries that are impacted by AI would be a way to balance the urge to continue cutting-edge research with stronger ethical considerations (Jia, 2020). In other countries where research as a function of HE is rapidly emerging, awareness of research ethics in general is much lower, suggesting a longer journey towards integrating ethical procedures on the use of AI. In Malaysia, for example, issues such as research misconduct and irresponsible authorship/publication practices are key challenges to research integrity (Chau, Chai and Veerakumarasivam, 2021).

Harnessing the Era of Artificial Intelligence in Higher Education: A Primer for Higher Education Stakeholders

6

AI from higher education to the labour market

AI from higher education to the labour market

Although the demand for AI knowledge and skills in the labour market has grown only recently, all societies are undergoing digitalization of some kind (Squicciarini and Nachtigall, 2021). This calls for updated educational practices, ethical contemplation, critical thought, responsible design methodologies, and fresh skills, considering the impact on job markets, employability, and civic engagement (UNESCO, 2021a).

This chapter discusses the relationship between AI, higher education, and the labour market. It covers the future of work and its implications for higher education, paying attention to female participation in the AI labour market. The chapter also reviews the skills needed for the AI era, both the technical skills needed to train AI professionals and the transversal skills that all students (and citizens) should have. Finally, it discusses the implications of AI for lifelong learning.

6.1 The future of work and implications for higher education

As AI becomes more and more relevant in the job market, more AI-related professionals are going to be needed (Ernst, Merola and Samaan, 2018; Lane and Saint-Martin, 2021). This trend can be observed, for example, in the clear upward number of AI-related job vacancy postings (Squicciarini and Nachtigall, 2021). Figure 11 shows the increase in AI job postings from 2014 to 2022 in selected countries of the Global North, illustrating growth over time across all the national settings (Stanford University, 2023). AI and Machine Learning Specialists top the list of fastest growing jobs (World Economic Forum, 2023).

There is also evidence that AI is transforming the landscape of jobs, substituting some tasks traditionally performed by humans, while concurrently creating new tasks that come with fresh skill requirements (Acemoglu *et al.*, 2019); in other words, some tasks are taken over by algorithms and new tasks are being created, in part, to create and manage these algorithms. By analysing data on occupational tasks in the United States and Europe, 2023 research has determined that approximately two-thirds of existing jobs are susceptible to some level of AI automation (Hatzius *et al.*, 2023). Furthermore, it is estimated that generative AI has the potential to replace as much as one quarter of the current workforce, which, when extrapolated globally, suggests that around 300 million full-time jobs could be exposed to automation due to generative AI (Hatzius *et al.*, 2023).

The disruption AI is causing and may cause in the future in the labour market is not new. With every new technology (e.g. conveyor belt, cars, computers, internet) introduced into the world, jobs have been replaced (e.g. bank tellers, factory workers, travel agents, typists). It is expected that AI will enhance or complement high-skilled jobs rather than replace

Figure 11 – AI Job Postings (% of all job postings) by geographic area, 2014-2022

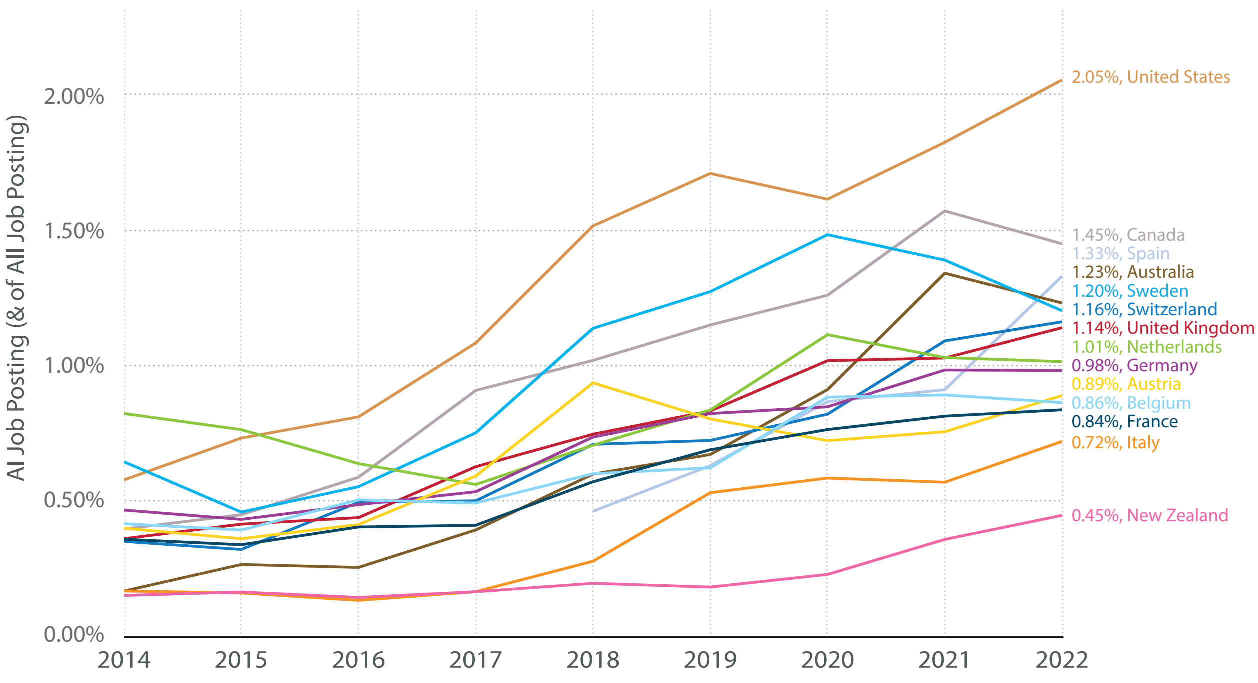


Figure: IESALC | Source: (Stanford University, 2023)

them, leaving high-skilled professionals with more time for non-routine tasks such as innovation, creativity, reasoning, and the interpersonal aspects of work. In addition to more jobs in AI, high-skilled jobs such as lab technicians, engineers, statisticians, accountants, and programmers are among the occupations most exposed to AI (Lane and Saint-Martin, 2021). As AI permeates more aspects of people's lives and economic activities, it is expected that the job market will need more professionals specialized in AI to run and manage it within organizations (Ernst, Merola and Samaan, 2018).

However, AI is not going to create only more AI-related jobs. It is still unclear what these new jobs would be (Frank *et al.*, 2019), but it is expected that some are going to be related to skills in which AI does not excel, such as creative and social intelligence, reasoning skills, critical thinking and interpersonal skills (McKinsey, 2018; Lane and Saint-Martin, 2021). Fields that may have potential growth due to AI (beyond AI itself) include cybersecurity and privacy, renewable energy, healthcare and telemedicine, data analysis and management, robotics and automation, blockchain technology and cryptocurrency, content creation and digital marketing, and e-commerce (Escotet, 2023). Moreover, jobs are going to be affected differently in countries across the world depending on income level, demographics, and industry structure. It is also expected that there will be a decrease in the number of jobs for those with just a secondary level education (McKinsey, 2018).

With the anticipated shift in occupational exposure to AI, there are also predictions about how this will change demand for higher education graduates. A 2019 survey found that 94% of respondents (computer science academics, university leaders, and chief technology/information officers) believe that AI will increase or greatly increase demand from employers for university graduates, primarily in computer science (see Table 1) (Pells, 2019). The same study identified languages as the discipline likely to be most negatively affected by AI, followed by an array of social sciences subjects. In the wake of the recent upsurge of interest in AI, HEIs in the USA – one of the leading countries in AI development in higher education – are investing significantly in recruiting faculty members with AI or computer science backgrounds (D'Agostino, 2023). Some HEIs are complementing expansion of computer science expertise with other areas where AI can be embedded, which range from health, social justice, business, law and the arts (D'Agostino, 2023).

Furthermore, it is important to consider the role of higher education in training the AI trainers and developers of tomorrow. The curriculum and content taught in HEIs can play a pivotal role in shaping the future of the workers in the AI labour market, indicating the importance of addressing biases in AI algorithms and fostering ethics in AI development among other areas. By incorporating comprehensive education on these subjects, students can develop a deeper understanding of the potential ethical challenges and biases that AI systems may encounter, equipping future AI practitioners with the necessary tools to design and develop AI systems that are not only technologically advanced but also ethically sound and unbiased.

As AI operates within complex ecosystems of knowledge, innovation, commerce, and emerging regulations, higher education needs to be supported by governments, whose policies should be designed to concurrently tackle a variety of issues to formulate solutions and regulations, as well as to foster or bolster innovation ecosystems (Pedró *et al.*, 2019). For instance, the monitoring and forecasting of the demand for jobs and specific skills can help policymakers and HEI

Table 1 – Impact of AI on HE disciplines

In which disciplines will demand for graduates be **most positively** affected by AI?	
Computer science	55%
Medicine	9%
Engineering	8%
Business and management	8%
Allied health	4%

In which disciplines will demand for graduates be **most negatively** affected by AI?	
Languages	26%
Business and management	14%
Law	14%
Geography	7%
Psychology	5%

Table: IESALC | Source: (Pells, 2019).
Note: only top five disciplines included, responses coded as 'other' excluded. Respondents were able to choose up to three responses.

allocate resources and adapt courses and programmes. Students and teachers can greatly benefit from having real-time information on the trends in skills demand and the educational and career paths that can lead to in-demand positions.

Box 8:

How governments can support higher education to build AI capacity

The government of Singapore's programme 'SkillsFuture Singapore' uses AI in its goal of "**1.** Help individuals make well-informed choices in education, training and careers. **2.** Develop a high-quality integrated system of education and training that responds to constantly evolving needs" (Ministry of Manpower Singapore, 2014). The programme offers, amongst other resources, a series of apps for students to choose modules that meet their labour market goals or to learn more about career opportunities and what path they would require. According to a report from the Asia-Pacific Economic Cooperation, Singapore was found to have a comparatively small gap between the proportion of workers with digital skills (supply) and the proportion of job posts requiring digital skills (demand) (APEC, 2020).

6.1.1 Female participation in the AI labour market

Women represent only 22% of AI professionals globally (World Economic Forum, 2021) and only 20% of employees in technical roles in machine learning companies and 6% of professional software developers are women (UNESCO, 2023a). In selected top multinational technology companies, the highest proportion of women in leadership roles was only 33%, with the lowest at 6% (UNESCO, 2021d). Even if the trend has been improving since the mid-2010s, female representation in leadership roles in the broader technology sector is still skewed towards men who held 76% of leadership roles in 2021 (World Economic Forum, 2022).

It is not only that there is lower female participation in AI jobs but that women are discriminated against in terms of funding for technology development more generally. For example, a mere 2.3% of venture capital investment from 700 global technology companies was allocated to businesses established by women in 2020 (UNESCO, 2021d). This lack of funding reinforces the biases within technologies as male entrepreneurs who design solutions from their own experience, therefore tending to develop male biased technology (Criado Perez, 2019).

Box 9:

Higher education training on AI to meet changing labour market needs

The higher education sector can include more training on AI to meet changing labour market needs (Ma and Siau, 2019). The #EDUCASTEM initiative developed by UNESCO in partnership with different stakeholders at the national level aims to improve education for girls at secondary and primary level in STEM fields, especially girls from rural backgrounds. The initiative includes teacher training in several subjects including AI. Constant training will allow teachers to build their practice more confidently and to include these subjects and technologies in their teaching practice. Similar initiatives could be replicated at higher levels of education (UNESCO, 2023b).

Some initiatives to promote the participation of women in the wider technology industry exist. For example, She Code Africa seeks to boost the potential of young girls and women across Africa by providing them with the necessary technical and soft skills to excel in STEM fields (She Code Africa, no date). In a similar fashion Laboratoria, a Peruvian social enterprise, provides training for women mostly coming from underprivileged backgrounds, helping participants of the programme land jobs in the tech industry (Laboratoria, no date). AI tools could also be used to improve female participation in the AI labour market. For example, in the Republic of Korea a new career management platform for female engineers was designed using AI, big data and blockchain technologies (Jang and Kyun, 2022).

6.2 Skills for the AI era

As the development of AI expands, this shift also needs to be accompanied by HEIs focusing on training students both in specific skills to improve knowledge and competency in AI as well as meta-skills (social, emotional, and higher cognitive skills). These include creativity, analytical/critical thinking, emotional intelligence, communication, teamwork, problem solving, decision making, leadership, open-mindedness, and collaboration (Manyika and Sneader, 2018; Marr, 2020; Strack *et al.*, 2021; World Economic Forum, 2023).

It is also crucial to prioritize digital literacy and critical thinking skills, enabling individuals to question not only the "what" but also the "why" and "who benefits or is harmed" behind the information they encounter, especially in the age of AI-driven algorithms on social media platforms. By empowering students, teachers, and other stakeholders in higher education, HEIs can fulfil their commitment to nurturing active contributors who can enhance science, the economy, and other domains, ultimately building better societies and sustainable economies (UNESCO IESALC, 2023b).

The following sub-sections provide more detail on the types of skills that HEIs can prioritize to support students to be equipped for the AI era.

6.2.1 AI skills for AI jobs

Demand for courses on AI is growing rapidly, more than doubling to over 6,000 in the case of courses taught in English in the four-year period between 2018 and 2022 (OECD.AI, 2022). In 18 top universities across nine countries, there has been more than 100% increase in courses offered to enhance practical AI between 2016-17 and 2019-20, which reflects an increase of about 60% in students' participation in entry-level AI courses, and an increase of just over 40% in the offering of practical AI skills courses at the graduate level (Stanford University, 2021).

The relative penetration rate of AI skills – the extent to which AI-related skills have been adopted or integrated within a specific context or population – in selected countries shows that India has the highest relative AI skill penetration rate at 3.23 times the global average, followed by the United States (2.23 times), Germany (1.72 times), and Israel (1.65 times) (Stanford University, 2023). Breaking this down by sex underlines the ongoing differences between men and women: across all sampled countries, men tend to have a higher relative AI skill penetration rate than women (Stanford University, 2023). Although in some countries the AI skill penetration rate for females is higher than for males in other countries (e.g. Indian females have a higher AI skill penetration rate than males in most other sampled countries), the difference between males and females within countries is stark, often reflecting a two- or three-fold gap for females.

Higher education programmes and courses must be flexible enough to react to and shape new developments in the AI sector. HEIs can also use data on labour market demands not only in order to provide the teaching of AI skills (see also Box 10), but also for grouping them in higher education programmes that match the different types of professional profiles that the labour market is demanding, such as AI for applications, robotics or programming (Squicciarini and Nachtigall, 2021). The main challenge in this goal is the need for a continuous update of the curricula aimed at future AI professionals. Adjusting existing curricula or adding new provision also offers opportunities for HEIs to consider how to increase interdisciplinarity in teaching and learning. Interdisciplinarity, applying AI to other fields and other fields to AI, can help harness the potential of AI for good in both scientific and social aspects (Kusters *et al.*, 2020). HEIs can also consider how AI skills could be taught beyond degree/diploma programmes, for example through MOOCs or shorter certifications.

Figure 12 – Relative AI skill penetration rate by gender, selected countries, 2015-2022

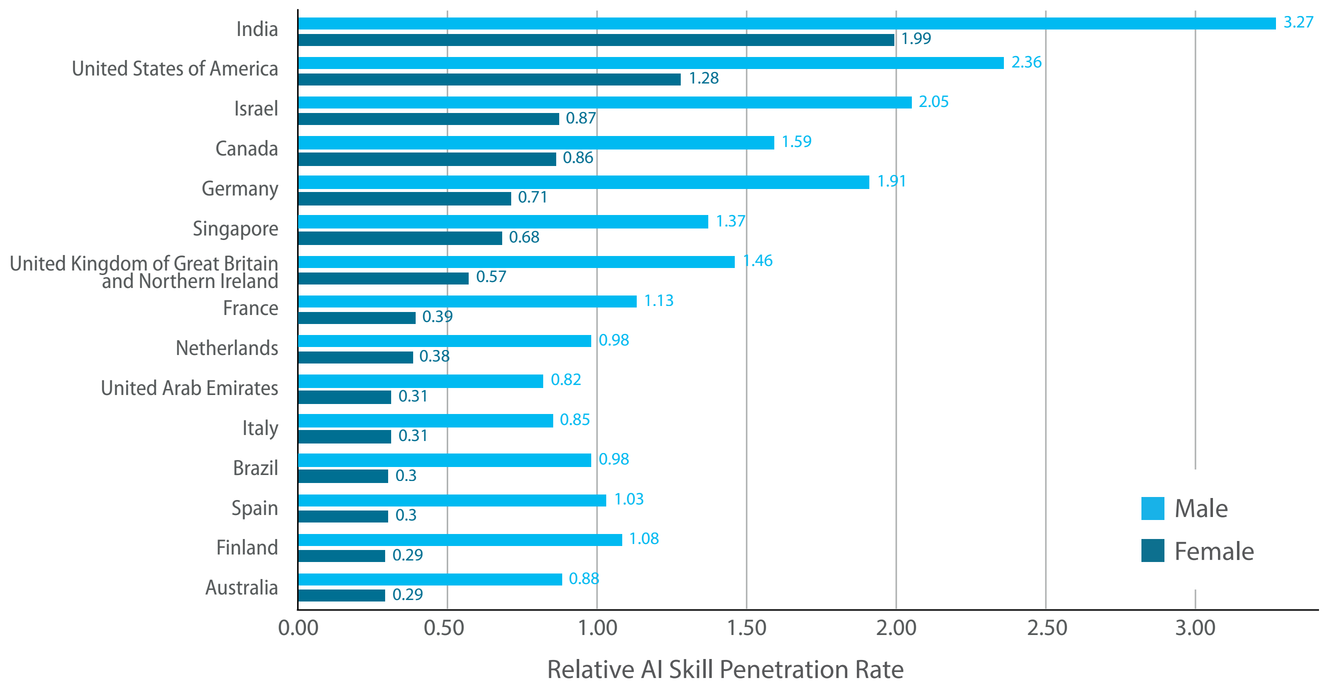


Figure: IESALC | Source: (Stanford University, 2023)

Box 10:

What skills are currently being taught in AI specific postgraduate courses?

- Application of AI
- Autonomous driving / Electromobility / Intelligent transportation
- Bioinformatics
- Cloud / distributed computing
- Coding / Programming (e.g. Python, TensorFlow)
- Data analysis/analytics/science
- Data mining
- Data protection / management, including big data management
- Data structures and algorithms
- Data visualization
- Deep learning
- Image/Text/Vision/Voice Computing/Systems
- Information retrieval / theory
- Internet of things
- Law of computer technology
- Leadership / management of start-ups / AI companies
- Machine learning
- Natural language processing / Neural networks
- Optimization
- Robotics
- Sensing / sensors
- Simulation modelling
- User experience and interface design
- Web application development

The AI skills/knowledge areas are taken from AI-specific courses that form part of the curriculum of Master's degrees in AI from a convenience sample of HEIs with established reputations in this field: African Institute for Mathematical Sciences (Cameroon, Ghana, Rwanda, Senegal, South Africa, Tanzania), Carnegie Mellon University (USA), Indian Institute of Technology Hyderabad (India), Tecnológico de Monterrey (Mexico), Tsinghua University (China), University of Edinburgh (UK). Mathematics and statistics courses are excluded from the list. Websites were reviewed on 7 June 2023.

In China, colleges of AI are being established in HEIs at the same time as universities are aiming to increase enrolment in graduate programmes in AI (Yang, 2019). Existing AI programmes are being expanded to reach "AI + x", where AI is integrated with other fields so that students can be trained to understand theories and methods related to AI and its applications, as well as the use of AI in non-science subjects (Yang, 2019). Similarly, in Singapore, a multidisciplinary approach is adopted for students in the Information Systems Technology and Design (ISTD) Programme, adding value by providing future technologists with Humanities (including the Arts) and Social Sciences training. Students are also placed through mandatory real-life projects as well as real-life experiences through capstones and internships (Magnanti and Natarajan, 2018).

6.2.2 Transversal skills

While enhancing training of AI professionals is a prerequisite for exploiting the potential of AI, society at large can also benefit from a more widespread understanding of the basic functioning, potential benefits, and challenges of AI: in other words, **AI literacy** (UNESCO, 2020). In UNESCO's Recommendation on the Ethics of Artificial Intelligence, Article 101 indicates that "Member states should work with international organizations, educational institutions, and private and non-governmental entities to provide adequate AI literacy education to the public on all levels in all countries in order to empower people and reduce the digital divides and digital access inequalities resulting from the wide adoption of AI system" (UNESCO, 2021c, p. 16).

AI literacy is a goal that exceeds the scope of higher education systems, but which higher education can also address, within its own capacities. For example, a group of 24 research universities in the UK published a set of principles regarding AI that include, as a top priority, that universities will commit to building skills in AI literacy among both staff and students (MacGregor, 2023).

The introduction of AI literacy elements into non-AI specific programming can include:

- **The transformation of curriculum and textbooks in all disciplines at all levels to meet the needs of students' key competencies' development in the AI era.** Many professional profiles will not need to develop AI tools but will be their users and can therefore benefit from a basic understanding of its functioning, particularly in order to identify mistakes, biases and other intrinsic aspects of AI learning processes.

- **The introduction of basic AI development training when this can provide an added value to the future interdisciplinary professionals**. For example, the East China University of Political Science and Law opted to provide training in Python, which can be easier for these students as it relies on building blocks of pre-existing code (third-party libraries) without the need to code every line or a deep understanding of the underlying technology (Liu and Huang, 2019).
- **Social sciences professions that require analytical skills can use AI to automate their research (in sociology and political science, analysing big data on socioeconomic indicators**; in law, identifying jurisprudence matching certain criteria and going beyond a simple keywords search, etc.). Art students can also benefit from awareness of the emerging use of AI in their field. For example, every year, the Workshop on Artificial Intelligence for Art Creation (AIART) gathers examples of this nature.
- **A shift in training efforts, emphasizing the skills that one cannot automate, such as creative and critical thinking** (Vincent-Lancrin *et al.*, 2019) instead of the skills that one can (classifying large amounts of data, making decisions based on clear predefined scenarios, repetitive actions, etc) (Vincent-Lancrin and van der Vlies, 2020) and are therefore at risk of becoming obsolete: AI's focus should be to enhance human intelligence there where it is most useful, not to substitute it in all areas (Holmes, Bialik and Fadel, 2019).

Another important transversal skill is **AI ethics**, which is increasingly being taught in HEIs. For example, from a total of 51 higher education courses on AI in the USA, bias is covered in 87% of overall course syllabi, automation and robots in 71%, law and policy in 55%, consequences of algorithms in 45%, privacy in 32%, futures of AI in 26% and history of AI in 19% (Garrett, Beard and Fiesler, 2020). However, this is far from universal: a survey of 26 universities in Cameroon, Ghana, Namibia, Nigeria, Senegal, South Africa and Uganda found that only three (11.5%) HEIs offered AI ethics as a course or programme (Onyejegbu, 2023).

Data literacy is a crucial skill to develop in higher education in the age of AI. Data literacy encompasses the individual's capacity to utilize data effectively, engage in critical reflection, extract meaningful insights, explore and comprehend data, and facilitate meaningful conversations and shared understanding. Data literacy enables individuals to make informed decisions based on data, navigate ethical considerations surrounding data usage, enhance employability in data-driven industries, foster critical thinking and problem-solving abilities, and adapt to the constantly evolving

Box 11:

Overcoming challenges to integrating AI ethics into higher education

At HEIs in nine countries in Eastern Africa (Kenya, Tanzania and Uganda), Southern Africa (Namibia, South Africa), and Western Africa (Cameroon, Ghana, Nigeria and Senegal), researchers have identified a series of challenges to integrating AI ethics in higher education and have also identified some possible solutions to these challenges.

Challenges

- Minimal research themes specific to AI ethics
- AI ethics, when taught, is embedded in general research methods
- Lack of local case studies to support training on AI/AI ethics
- Limited capacity within HEIs in AI ethics
- Lack of well-equipped AI labs or hubs with technical tools
- National regulatory bodies have not made the inclusion of AI ethics mandatory
- Protracted processes for approving or accrediting new programmes or departments
- Available frameworks for AI ethics are global and may exclude African experiences/perspectives

Possible solutions

- Establish AI labs at HEIs that can provide relevant curriculum content and create space for experiential learning about AI ethics
- Offer training/courses on AI ethics to undergraduate and postgraduate students
- Use online learning to expand the reach of AI ethics programming
- Engage experts who understand the local context and deploy a train the trainer model to build capacity
- Advocate for national regulatory bodies to make it mandatory for HEIs to include AI ethics in their curricula
- Advocate for governments to create AI ethics standards and regulations, which can be 'glocalised' from existing frameworks
- Advocate for governments to equip HEIs with technical tools, labs, and up-to-date books and resources

(Nakatumba-Nabende, Suuna and Bainomugisha, 2023; Onyejegbu, 2023) landscape of data and AI technologies (Glukhov, Deryabin and Popov, 2020). In certain programmes, data literacy training can focus on developing analytical skills, while in others, it may emphasize the ability to critically evaluate and consume data (Berdahl, 2023). In any case, data literacy training should be included throughout the programmes taught at HEIs.

Professional and technological skills are among those identified by a UNESCO public consultation of 1,200 people on the futures of higher education, they are one of five areas of future skills that can be developed in higher education, although not exclusively in this domain (Chacón *et al.*, 2023). However, when combined with 'accelerators' that are expected in higher education – **critical thinking, problem solving, and application of knowledge** – students will be supported to achieve personal and societal goals.

Critical thinking is often assumed to be taught; however, historically, it has not been explicitly documented in HEI transcripts, making it difficult to assess whether students have actually developed these skills (Van Damme and Zahner, 2022). In some cases, HEIs absolve themselves of responsibility, suggesting that students should have acquired these skills during their high school education (T. Williams, 2022). On average, only 45 percent of university students[6] demonstrated proficiency in critical thinking, while one in five displayed only emerging skills in this area (Van Damme and Zahner, 2022). Nevertheless, the importance of critical thinking is being amplified in the context of the rapidly changing labour market as a result of AI and technological development (Lincoln and Kearney, 2019). As students become more used to personalization in other aspects of their life, critical thinking offers a way to guide students to become more discerning in their self-directed learning rather than encouraging passive consumption of information (Park, Kim and Lee, 2021), as the example in box 12 demonstrates.

Box 12:

Enhancing critical thinking skills using AI tools

A study with journalism students in Tajikistan found that their critical thinking and writing abilities improved after being introduced to both the tool ChatGPT-3 and training in the ethical, technical, and practical sides of using AI in journalism. Depending on students' willingness to engage with AI tools, this study suggests the possibility of enhancing critical thinking with the assistance of AI and with the interactive nature of the tool providing ideas and refinements that lead to deeper reflection and promoting collaboration.

(Irfan, Murray and Ali, 2023)

Figure 13 – Future skills and beyond: a theory of change

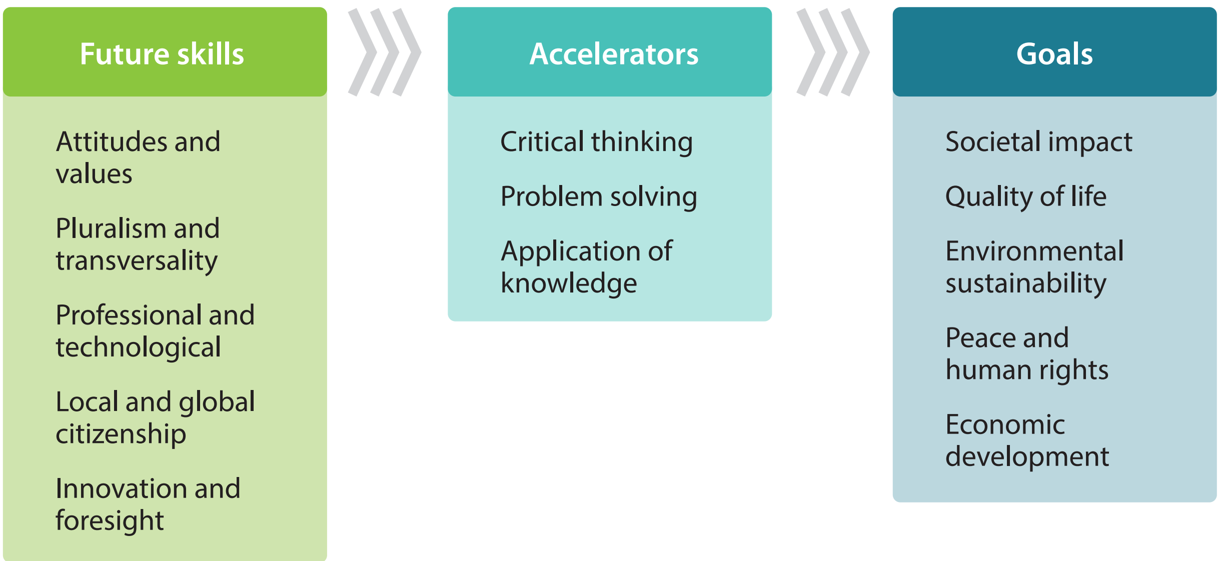


Figure: IESALC | Source: (Chacón *et al.*, 2023)

6 The sample of students, confined mostly to campuses in the US, with only a fraction coming from the other five countries taking part – Chile, Finland, Italy, Mexico and the UK.

6.3 Lifelong learning

As AI progresses, workers may need to reskill or upskill to adapt to new jobs and labour market possibilities. In that sense, lifelong learning becomes an even more important component in higher education, in which the focus should be on competencies rather than on skills throughout life (Ernst, Merola and Samaan, 2018). This might happen sooner than expected: in 2020, 94% of business leaders said they expected employees to pick up new skills on the job by 2025, a sharp uptake from the 65% reported in 2018 (World Economic Forum, 2020). Reskilling or upskilling can be done by higher education in conjunction with governments which have greater capacity to create adult upskilling and reskilling programmes at scale (Strack *et al.*, 2021).

In order to further the mission to promote lifelong learning and ensure access for all, higher education may also design specific AI-related programmes – from basic to professional – offered to support re-entry to higher education for stay-at-home parents, retirees, etc. The use of online and distance methods is an important way to provide fair and continuing educational opportunities and a range of AI applications have been used to support online education/lifelong learning. In the realm of higher education (which also provides lifelong learning opportunities), a systematic review of empirical research from 2011 to 2020 found that two thirds of AI applications were related to predicting learning status, performance or satisfaction with the remaining one third focusing on recommending resources, automatic assessment, and improving the learning experience (Ouyang, Zheng and Jiao, 2022). The online environment requires student-centred learning, leading the review authors to conclude that AI technology is most effectively used as part of a larger system of learners, instructors, information and resources (Ouyang, Zheng and Jiao, 2022).

In lifelong learning, AI can be used to help students in the creation of educational paths that match their needs and interests (Vincent-Lancrin and van der Vlies, 2020). As is already the case in the algorithms that recommend videos, songs, and products to consumers, AI can identify patterns based on previous students' paths and ranking among the declared preferences of students, and the essential competencies that a specific career path may require. For example, the University of Southern California (USA) developed PAL3, an AI tool that analyses a person's current knowledge and skillset and recommends continuous learning options to accomplish their goals (USC, 2014). The goals for PAL3 are; 1) to prevent skill decline and increase information retention 2) to practice and build knowledge and skills 3) to track skills persistently and 4) to monitor, engage and motivate the student (University of Southern California, no date).

In a 2023 study of the role of HEIs in lifelong learning, 20% of open/distance HEIs reported using AI to enhance lifelong learning in higher education, with Latin America & the Caribbean based HEIs reporting the most use of AI by world region (UNESCO Institute for Lifelong Learning and Shanghai Open University, 2023). AI has the potential to foster lifelong learning ecosystems, for example by using AI-driven platforms for continuous professional development, drawing on learning analytics as noted in the example above, and developing personalized learning pathways that cater to diverse learner needs.

7

Key challenges for AI in higher education

Key challenges for AI in higher education

In the use and development of AI-supported systems for higher education, there are global tensions between their problem-solving potential and the unequal distribution of AI; inclusion and diversity issues; and the links between AI and sustainability. Being aware of the scope and limitations of these technologies is a crucial step in enabling conditions and designing strategies from multiple perspectives. This chapter provides an overview of the key challenges for AI in higher education. It ends with a discussion on the possible future(s) of AI and higher education.

7.1 Global inequality in the distribution of AI

There are two main concerns regarding global inequality in the distribution of AI. The first concern relates to broader issues of access and equity in terms of the uneven distribution of internet availability, cost and speed. AI and technology in general require a system set-up and properly functioning; access to the internet, to electricity and digital devices that will allow the end user to communicate with the technology, in order to meaningfully engage with the technology.

Almost half of the world's population does not have access to fixed broadband internet or are not able to use it effectively (UNESCO, 2023c) and 600 million people globally lack access to electricity. However, instead of prioritizing the delivery of electricity to these households, the focus seems to be more on training AI models (Van Wynsberghe, 2021). Some initiatives exist to account for infrastructure inequality, for example KibutiBot, an offline chatbot developed in Tanzania that provides information and educational resources using SMS instead of internet connection (Saimon, 2023). Yet, the rapid scaling of generative AI indicates that digital exclusions may increasingly need to be seen as both digital and AI exclusions, where the divides may expand rather than contracts over time.

The second concern, which is the focus of this chapter, relates to the uneven distribution of teaching, learning and research on AI among countries. The global take-up and development of AI in higher education is not evenly distributed, in line with the general 'AI divide' (Yu, Rosenfeld and Gupta, 2023) between countries such as China and the USA where AI has been more concentrated and regions such as sub-Saharan Africa, parts of Central and South Asia, and parts of Latin America where AI has not developed at the same scale. Countries with higher GDPs typically possess more resources to finance research and development, enabling them to implement cutting-edge AI technologies. However, countries in the Global South are also showing determination to leverage AI, as evidenced by various national strategies, including India's AIForAll initiative (Yu, Rosenfeld and Gupta, 2023). Nevertheless, the 2022 Government AI Readiness Index[7] shows a tendency for countries in the Global North to be more prepared than countries in the Global South in using AI for public services (see figure 14).

Figure 14 – 2022 Government AI Readiness Index

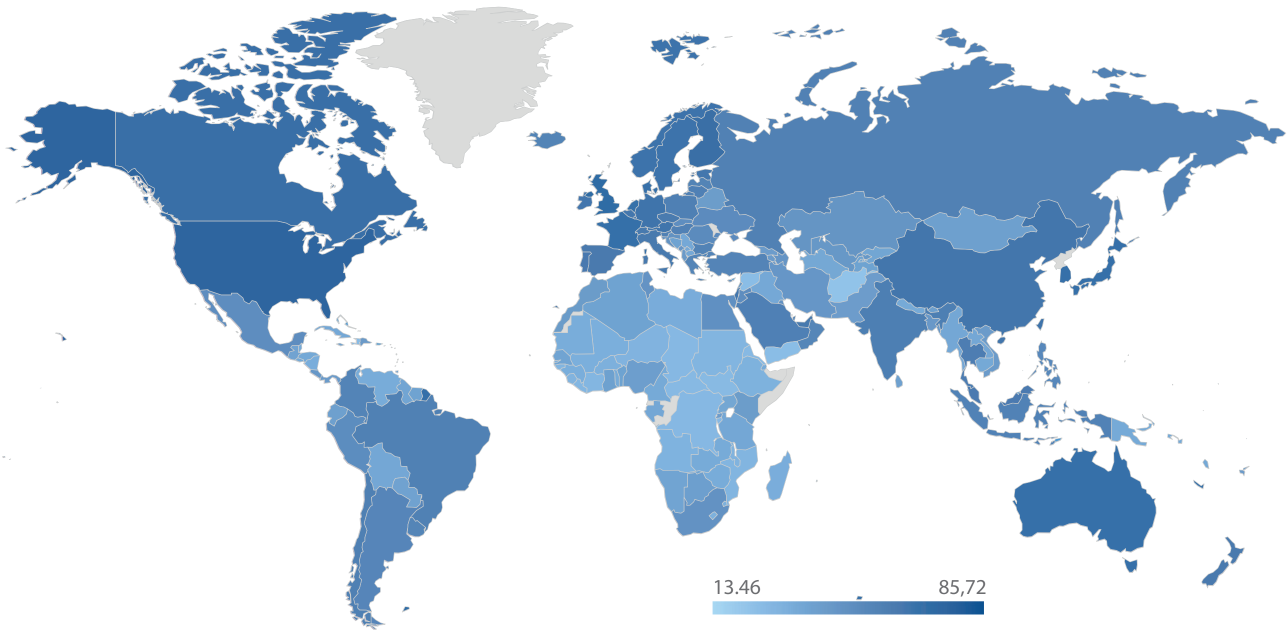


Figure: UNESCO IESALC on map created by the United Nations Maps & Geospatial services | Source: (Rogerson et al., 2022)

7 The Government AI Readiness Index aims to answer the question: how ready is a given government to implement AI in the delivery of public services to their citizens?

Moreover, it is vital to consider that for AI solutions to be useful and reliable it is essential to have ample local data for training and testing. This allows the solutions to be customized to the local context and more accurately mirror the unique social dynamics. However, in regions with resource constraints, data availability and compatibility pose significant challenges (Yu, Rosenfeld and Gupta, 2023). As an example, it is estimated that Africa needs at least 5,000 PhDs in AI or similar in the next five years to benefit from the digital economy (Ruwoko, 2022). The lack of datasets on Africa that are suitable for machine learning purposes contributes to the structural inequalities faced by that region (Ojenge, 2023), despite efforts by organizations such as the Lacuna Fund[8], which aims to provide data scientists and researchers in low- and middle-income contexts with resources to produce new labelled datasets or improve existing datasets, to be more representative.

The AI divide can also be illustrated by examining publications on AI and comparing this to national economic indicators. The number of articles on AI in scientific journals has increased steadily but highly unequally from 2000 to 2020 as a share of all publications (Figure 15) (Stanford University, 2021). Two regions – North America and Europe & Central Asia – started ahead of other regions in 2000, but since 2003, the East Asia and the Pacific region has dominated, taking a world leadership role in AI journal publications (Stanford University, 2021). Far behind are regions like South Asia, the Middle East and North Africa (MENA), Latin America and the Caribbean(LAC), and Sub-Saharan Africa. The proportion of publications from North America and Europe & Central Asia has remained relatively stable, and relatively large increases have been seen in the 2010s in South Asia and Middle East & North Africa. The LAC and sub-Saharan Africa regions have seen very little change over time, and together represent under 2% of the world total of AI journal publications.

The unequal global distribution of AI research and development is also evident by comparing GDP with the number of research publications. Figure 16 data shows that the higher the GDP per capita, the more AI research publications per capita there are. While most countries fall within this pattern, there are two groups of exceptions. These are: 1) countries whose level of publications exceeds most countries at the same level of GDP (for example, Iran's level of AI publications is very high, almost matching the level of AI research publication produced by countries whose GDP is twice as high); 2) countries where the number of AI publications is lower compared with countries with a similar level of GDP (for example, AI publications from Qatar and Japan are not as numerous as from other countries with similar GDPs).

From this perspective, global inequality in AI is evident with a significant gap between 1) South Asia, Middle East and North Africa, Latin America and the Caribbean, and Sub-Saharan Africa and 2) North America, Europe and Central Asia, with East Asia and the Pacific leading in different ways at various times over the past 20 years.

Figure 15 - AI Journal Publications (% of World Total) by Region, 2000-2020

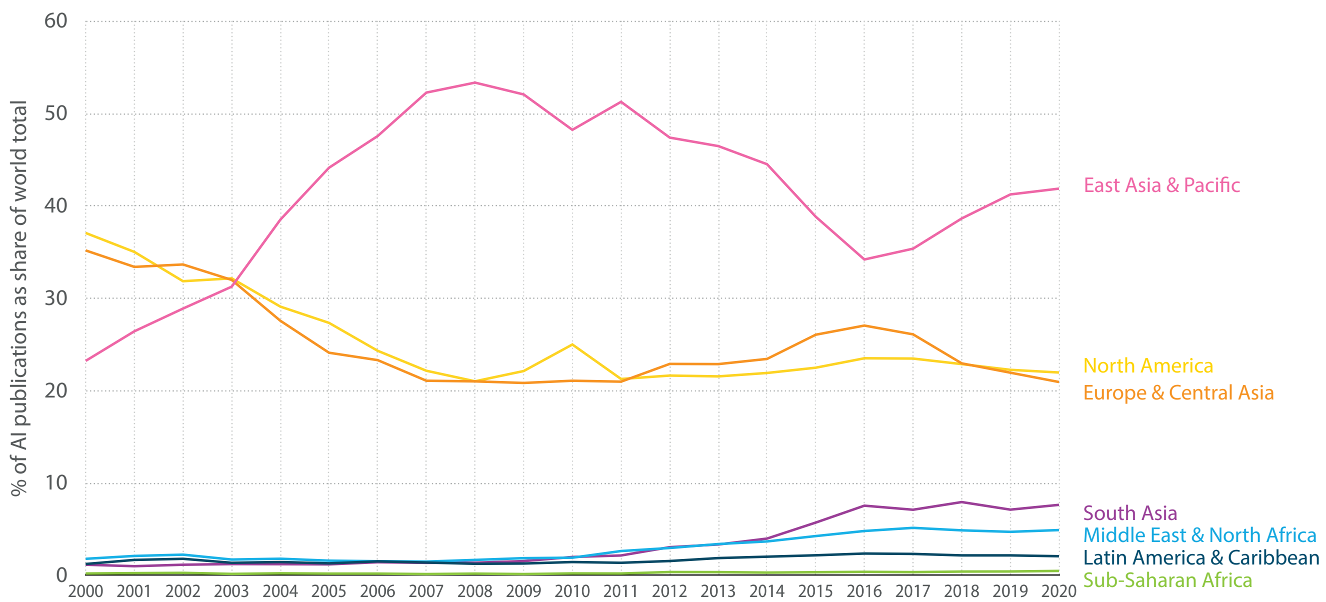
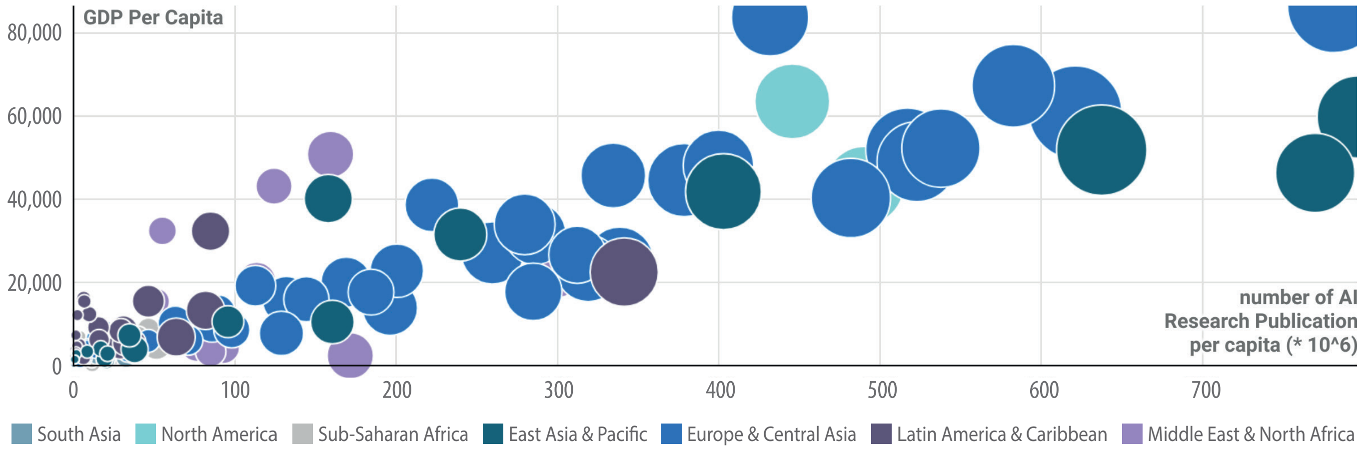


Figure: IESALC | Source: (Stanford University, 2021)

8 https://lacunafund.org/

Figure 16 – Number of AI research publications (per capita) vs GDP (per capita)



This chart plots countries by: number of AI publications per capita; GDP per capita; total number of all scientific publications per capita (bubble size); region (colour).

Figure: UNESCO IESALC | Source: Microsoft Academic Graph for bibliometrics; World Bank and OECD national accounts data for GDP and GDP per capita; World Bank and United Nations Population Division for population; and UNESCO for R&D expenditure. Created with Datawrapper.

7.2 AI, inclusion and diversity

AI can help reduce bias in decision-making by reducing human subjective interpretation of data, but AI also scales bias (Silberg and Manyika, 2019). As also discussed in chapter 8, AI is built on data, and if the data itself is skewed, it can have negative consequences for the AI system (Nouri, 2021). For instance, studies show that data fed into most AI models does not account for the gender-diverse experience and are rather set into a female / male dichotomy. This will evidently impact members of the LGTBQ+ community whose gender experiences are not replicated by AI since the data does not include them (Donnelly, Stapleton and O'Mahoney, 2022).

Research from the University of Maryland (USA) conducted with basketball players has shown that AI powered face recognition software interpret emotions in a different way considering race and show that black players have more negative emotions than white players (Rhue, 2018). In addition, facial recognition technology integrated into the majority of smartphones exhibits optimal performance for white male users (Leavy, 2018). Having said this, it is also important to highlight that it has been recognised that although machines are capable of observing facial expressions, these expressions are unreliable indicators of emotions, particularly when lacking broader contextual understanding (Starke and Hoey, 2021).

AI biases in higher education admission decisions often stem from historical inequities which, if left unaddressed, can perpetuate exclusion and lack of diversity. For example, the University of Texas Austin (USA) developed AI-powered algorithms for admissions decisions to its Computer Science PhD programme that was trained on past admissions decisions to calculate patterns and factors but was shut down after seven years due to the fact that historically marginalised students were more likely to be left out of the programme because of the way it was built (Burke, 2020).

However, the concern is not only biases in data but also biases by the people who develop the systems. In the absence of a broader range of engineers and researchers, AI products might result in the proliferation of bias on a large scale (Nouri, 2021). Hence, diversifying the population of AI professionals is crucial.

7.2.1 The gender gap in science, technology, engineering and maths (STEM) subjects

Despite having technically closed the gender gap in education, at least in terms of access, there are several other factors impacting the gender gap in STEM and they are found throughout the education pipeline as well as manifested in societal norms and expectations. On average across OECD countries, only 1% of girls among the 15-year-olds assessed by PISA expressed their interest in pursuing ICT-related occupations, in contrast to 8% of boys who reported the same desire (Schleicher, 2019). Gender inequality in mathematics and science education is reinforced by various actors such as peers, parents, teachers, and school counsellors who promote and uphold gender stereotypes in STEM fields. These stereotypes have a detrimental impact on girls' confidence in these subjects. Additionally, teaching and learning materials also contribute to the perpetuation of stereotypes in STEM.

In Chile, for instance, only 6% of the characters portrayed in a grade 6 science textbook were female, further exacerbating the underrepresentation of women in scientific contexts (GEM Report, 2023).

Thus, the gender gap in STEM is not exclusive to higher education, but the result of societal factors, hidden curricula and expectations and it can be seen as early as primary school. Yet girls who are exposed to technology early and regularly tend to develop a positive perception of their capabilities in ICT as they grow older. This enhances the chances of them opting for studies and careers that are technology-oriented (UNESCO and EQUALS Skills Coalition, 2019), denoting the importance of working across the education spectrum to address the gender gap that persists into higher education.

Worldwide and looking across subject fields, women have reached equal representation among graduates at both the bachelor's (53%) and master's (55%) levels (UNESCO, 2021d, p. 136). Nevertheless, the participation of women in STEM subjects remains low with only 1.7% graduates compared to male graduates in STEM who represent 8.2% - or 400% higher than women graduates (World Economic Forum, 2021).

Furthermore, STEM fields have been historically dominated by a relatively homogenous group, predominantly male and largely of certain ethnic backgrounds, the latter being especially true in multi-ethnic countries. This lack of diversity in gender and ethnic representation manifests itself as a significant concern, not just from an equity perspective, but more critically, due to its direct impact on the products and solutions these fields generate. The existence of this diversity gap in STEM disciplines, particularly within the realm of AI, can lead to the development of technologies that inadvertently incorporate and perpetuate biases.

7.2.2 Female participation in AI research

The participation of women in AI-related academic research is significantly lower than men (Stanford University, 2021) with those female researchers tending to be more concentrated in universities than private companies or research institutions (Stathoulopoulos and Mateos-Garcia, 2019). Put in other words, like other scientific disciplines, AI is mostly led by male researchers, of whom only a small group are considered eminent or 'elite' in the field (Hajibabaei, Schiffauerova and Ebadi, 2023).

As shown in figure 17, a survey of 4,000 published researchers from 27 countries found that on average, almost 90% of AI researchers were male (Mantha, 2019). In Taiwan, which had the best gender distribution, it was still the case that only 26% of researchers on AI were female (Mantha, 2019). A 2019 study found that less than 7% of single-authored AI publications were by women and that the proportion of papers in some AI-disciplines such as machine learning and robotics with at least one female author had been stagnant at about 25% between the mid-1990s and mid-2010s (Stathoulopoulos and Mateos-Garcia, 2019).

It is also instructive to examine the pipeline of future AI researchers. The 2021 Taulbee Survey[9] , focusing on students in North America, shows that the percentage of women earning PhDs in AI and computer science remains stagnant at 20% (World Economic Forum, 2021).

Only by fostering a truly diverse and inclusive STEM environment can the creation of AI systems that are fair, unbiased, and effectively serve all segments of society be ensured. In line with this, UNESCO has put gender equality at the heart of its Recommendation on the Ethics of Artificial Intelligence (see chapter 8). Among UNESCO's suggested strategies to guarantee women's inclusion and empowerment throughout every phase of the AI lifecycle are dedicated budget provisions and the facilitation of support for women in research, academia, and entrepreneurial roles (UNESCO, 2023a). Furthermore, in 2023, UNESCO has also launched a Women4Ethical AI expert platform to advance gender equality in the field (UNESCO, 2023a).

7.2.3 Racial and ethnic discrimination

Besides unequal gender representation, AI can also create and increase racism and discrimination (Buolamwini and Gebru, 2018; Gentelet and Mathieu, 2021). This is also discussed in the chapter on the ethics of AI in higher education. Moreover, AI-powered proctoring systems that many HEIs use, especially after the onset of the COVID-19 pandemic, have been demonstrated to be biased against people with darker skin tones as the system may not be able to recognize them (Asher-Schapiro, 2020; Stewart, 2020). Researchers at the University of Louisville (USA) tested the outputs of the automated proctoring software used at their university and discovered that women with the darkest skin tones were much more likely than other students to be flagged by the software, even though the study did not find evidence of differential rates of cheating (Yoder-Himes *et al.*, 2022). To overcome

9 The CRA Taulbee Survey is the principal source of information on the enrollment, production, and employment of PhDs in information, computer science and computer engineering (I, CS & CE) in North America

Figure 17 – The gender imbalance in AI research across 23 countries

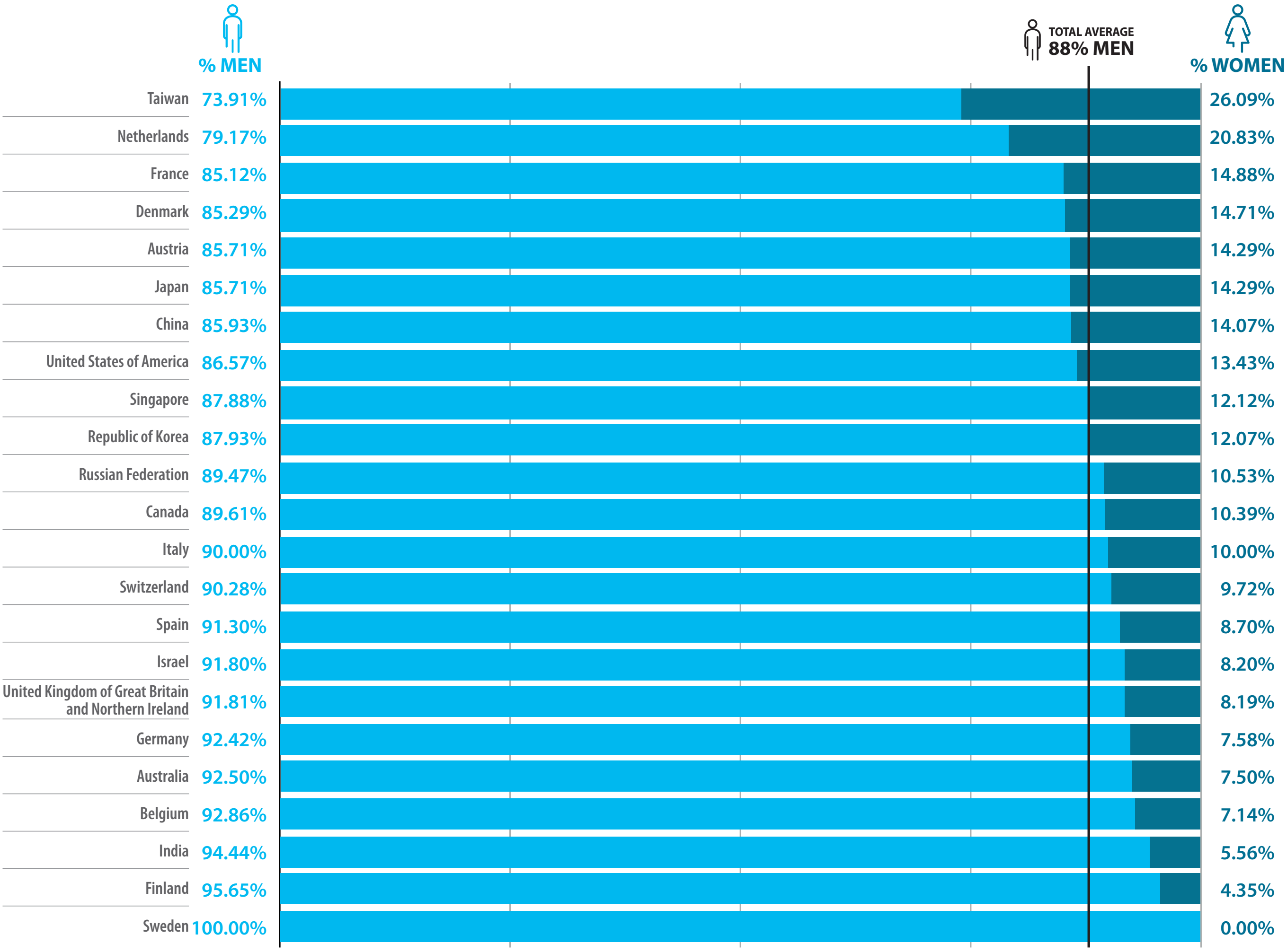


Figure: IESALC | Source: (Mantha, 2019) * Among 4000 reserchers who have been published at the leading conferences NIPS, ICML or ICLR in 2017

these inherent biases, it would be necessary to rethink how assessments are undertaken, which is discussed in chapter 4.

There is also a lack of racial diversity among students studying AI. Among all new AI PhD enrolments in the US, for example, 45.6% were white, 22.4% were Asian, 3.2% were Hispanic, 2.4% were Black or African American, and 1.6% multiracial (Stanford University, 2021). In Brazil, students who choose to pursue STEM subjects are typically of higher socioeconomic standing, which may be linked to the increased demand for STEM education and the advantageous position of wealthier, white students who have attended prestigious private high schools and do not rely as heavily on social support to pursue higher education (Machado *et al.*, 2021). And in India, although positive discrimination through reserved allocations in higher education is written into public policies, students from marginalized social groups (in local terminology: scheduled castes, scheduled tribes and other backward classes) are significantly under-represented in most Indian Institutes of Technology (*The Times of India*, 2019).

A study of diversity-focused STEM programmes in the USA found that institutional supports that combine supplemental learning, mentorship, skill building, financial aid, socializing, and bridging programmes are associated with positive outcomes for under-represented minorities, although the authors note that not all features and outcomes may be applicable for all groups, and that further research is needed to understand how to effectively support students with intersectional backgrounds (Palid *et al.*, 2023).

7.2.4 Knowledge diversity

The limited diversity in AI tools is further evidenced by their lower performance in languages other than English. Disparities have been highlighted in responding to queries in English compared to other languages, revealing that despite accurate data translation capabilities, the interpretation and understanding of culture-specific information often rely on U.S.-centred viewpoints (UNESCO, 2023c).

Box 13:

The philosophers' task

As part of a free online course on ChatGPT and Artificial Intelligence in Higher Education developed by UNESCO IESALC[10], participants are introduced through a practical exercise to some of the biases inherent in the data used by ChatGPT. This has been named the philosophers' task.

When ChatGPT is given the prompt "Give me a list of ten philosophers" the first reply offers a list of 10 male, European philosophers from Plato to Descartes and Nietzsche. Only one woman is mentioned, also European, Simone de Beauvoir. If then prompted again with the modified instruction: "Give me a list of ten philosophers who are not all men or European", the response typically includes a wider range of philosophers including Confucius, a Chinese philosopher who lived c.551-479 BCE, Kwame Nkrumah, a Ghanaian politician and political theorist, and Maria Lugones, an Argentinian feminist theorist focusing on intersectionality.

This task reinforces the importance of being aware of the bias that AI can present due to the data it is trained on. AI produces asymmetries between those who can generate information and those who cannot. It raises the question of which information is considered valid (and therefore included in ChatGPT's responses), which in turn can reinforce existing disparities.

7.3 AI and sustainability

Just as AI can be used to address sustainability issues by designing intelligent power grids, constructing infrastructure with low emissions, and creating models for climate change forecasts, AI systems also create issues of sustainability due to their consumption of natural resources. The production of AI computing hardware involves numerous stages, including mining, smelting, refining, component manufacturing and assembly, each with its own environmental repercussions such as soil pollution, deforestation, erosion, biodiversity degradation, toxic waste disposal, groundwater contamination, water usage, radioactive waste generation, and air pollution (Crawford and Vladan, 2018).

This value chain also encompasses the labour-intensive conditions of programmers who maintain systems and concludes with the collection of personal user data by the device (Dhar, 2020; OECD, 2021). An estimation of the carbon footprint attributed to the global production of data centres is approximately 20 megatons of CO2 equivalent, which accounted for roughly 15% of the total greenhouse gas emissions from data centres in 2015 (OECD, 2022). Researchers measuring the cost of training AI models stopped training their largest model at 13%, calculating that full training was equivalent to burning a railway carload of coal (Dodge *et al.*, 2022). That model had only six billion parameters, whereas by comparison, ChatGPT-3.5 has 175 billion parameters and therefore a substantially larger environmental impact. One conservative estimate is that ChatGPT training is equivalent to the monthly power supply of a small city (Groes Albin Ludvigsen, 2023).

7.4 The future of AI and higher education

It is also important to look ahead to the future and consider how continuing change in the world of AI might impact higher education. Beyond expecting newer iterations of the generative AI tools that have become popularized in the early 2020s, the biggest transformation that could be expected in AI would be the realization of Artificial General Intelligence, or human-level AI. Experts largely agree that achieving human-level AI is within the bounds of possibility, although there is no consensus on when this might occur: one aggregated estimate suggests that there is a 50% chance of this happening within the next 50 years, i.e., before the end of the 21st century (Roser, 2023a).

Even before this moment arrives, it can be expected that traditional approaches to higher education will be challenged. While higher education has a role to play in supporting societies to understand AI (see also the Practical Guide), HEI leaders have been encouraged to carefully consider the decisions made around integrating AI and neither to rush to invest based on the current hype nor to ignore developments, and to ensure any AI adopted is beneficial for the institution and has a lower impact on stakeholders (D'Agostino, 2023). Based on research with 25 Western academics considered AI thought leaders, the optimism that AI could help with routine administrative tasks (thereby opening up opportunities for new knowledge pathways and greater collaboration) was balanced by apprehensions that AI could promote bias and inequality, particularly if is used without an understanding of its underlying principles (Chubb, Cowling and Reed, 2022).

As such, one of the key issues for HEIs in the immediate future, regardless of location or resource level, is the need for

10 https://campus.iesalc.unesco.org/inicio/blocks/coursefilter/course.php?id=215

HEI leadership to be equipped to take forward responsible implementation of AI. This may require upskilling and capacity development; investment of time and resources in these processes is crucial – and not only for leadership – to harness AI such that it can be used for good in higher education. For AI to be effective, its reach should extend well beyond the current situation where a handful of faculty, staff or students understand how it works and how it can be used to improve higher education.

HEIs will create policies and guidelines on the use of AI in teaching, learning and assessment: the general shift will be towards adapting to AI rather than banning its use. Modes of assessment will be rethought, preferably in the direction of integrating AI into evaluations or identifying alternative assessments than using ever more AI tools to try and correct the problems with those that already exist. Resource-rich HEIs will be able to enhance the student experience through AI tools, for example by helping students to build their own programme while still meeting graduation requirements, or through the use of VR/AR to augment experiential possibilities. As one of the most obvious AI driven solutions that can be implemented with minimal technical expertise, the use of chatbots will proliferate in higher education, primarily to provide information about services and support. More generative AI tools will be trained to assist students in their learning, in the short-term continuing the tendency towards the question-answer format (students pose a question and the AI tool provides a response).

Integrating AI requires both technical and ethical expertise, suggesting that roles in HEIs will change alongside a shift in the expectation of leaders, staff, and faculty in relation to their knowledge and understanding of AI. Some lower-level job tasks (data entry, grading etc) may be replaced by AI tools and some job roles may be lost as others that require higher level skills are added. Data-informed decision-making will become more prominent in HEIs that have a robust data architecture and will inform strategies to enhance student retention, particularly in settings where dropouts are high. Most HEIs will need to buy in AI tools developed by private companies, raising issues around financial resource allocation as well as ensuring a full understanding of the tools' possibilities and limitations.

In an ideal future scenario, HEIs with research functions will make concerted efforts to bring together interdisciplinary teams of researchers to work on AI – both its technological development as well as a better understanding of its societal implications. Interdisciplinary AI labs will be created. Research in higher education will add to knowledge about aspects of AI that are currently under-examined. AI ethics training will be commonplace, or at the least become a part of broader ethics training for researchers. HEIs will identify ways to teach AI ethics and critical thinking to all students, whether through dedicated courses or as part of existing programmes.

Many more courses on AI will be available, not only those training AI specialists but others that provide more general education on AI, ethics, and other aspects. Educating the general public about AI will become part of HEIs' community engagement mission. As labour markets continue to change, HEIs will diversify their provision, potentially in partnership, to offer courses of different lengths and modalities. Such flexibility may prove challenging in contexts where curriculum change processes are lengthy and require advocacy by HEIs to the relevant regulatory agencies.

8

The ethics of AI in higher education

The ethics of AI in higher education

Previous chapters of this Primer have highlighted the ways that AI can be applied to different functions within higher education, in parts touching on some of the ethical issues that arise from the use of AI. Yet given the rapid development of AI technology and uptake in education and beyond, there is a need to delve more deeply into the ethics of AI (Escotet, 2023).

AI ethics refers to "a set of values, principles, and techniques that employ widely accepted standards of right and wrong to guide moral conduct in the development and use of AI technologies" (Leslie, 2019, p. 3). This chapter explores the significant work by UNESCO on the ethics of AI and applies the policy areas discussed in the UNESCO Recommendation on the Ethics of AI to higher education. The chapter also provides further information about ethics issues that are of particular concern for higher education: academic integrity, regulations and guidelines, data security and privacy, data bias and commercialisation.

8.1 UNESCO Recommendation on the Ethics of AI

In 2021, UNESCO adopted the Recommendation on the Ethics of Artificial Intelligence, which aims to "provide a basis to make AI systems work for the good of humanity, individuals, societies and the environment and ecosystems, and to prevent harm" (UNESCO, 2021c, p. 5). The Recommendation emphasises gender equality and environmental/ecosystem protection, and includes a series of values and principles to be respected by all actors.

Box 14:

Values and principles in the UNESCO Recommendation on the Ethics of AI

Values

- Respect, protection and promotion of human rights and fundamental freedoms, and human dignity
- Environment and ecosystem flourishing
- Ensuring diversity and inclusiveness
- Living in peaceful, just and interconnected societies

Principles

- Proportionality and Do No Harm
- Safety and security
- Fairness and non-discrimination
- Sustainability
- Right to privacy, and data protection
- Human oversight and determination
- Transparency and explainability
- Responsibility and accountability
- Awareness and literacy
- Multi-stakeholder and adaptive governance and collaboration

The Recommendation establishes that AI ethics involves efforts by a wide range of stakeholders, and benefits from having a common framework. It includes 11 areas of policy action to guide Member States on operationalizing the values and principles set out in the document. Although the recommendation emphasizes the role of Member States, the following table (Table 2) outlines how each could be understood and implemented through the lens of higher education. In addition, the table connects to specific actions that HEIs can take, which are discussed in detail in the Practical Guide.

Table 2 – Applying the UNESCO Recommendation on the Ethics of AI areas of policy action to higher education (I)

1 Ethical impact assessment

- Introduce an ethical impact assessment to identify and assess AI systems' benefits, concerns, and risks and introduce appropriate risk prevention, mitigation, and monitoring measures, among other assurance mechanisms.
- The assessment should include privacy and data security issues, a transversal gender perspective, the environmental impacts, and follow national, regional and international norms that regulate AI.

Take action: Develop a policy framework on AI

- Conduct research on the impacts of AI locally and/or globally, paying particular attention to risks to human rights and societal inequities.

Take action: Promote AI research and application

2 Ethical governance and stewardship

- HEI governance of AI and governance processes should be transparent, multidisciplinary, multi-stakeholder, multicultural, pluralistic and inclusive.
- Promote inclusive and equitable participation in discussions on AI governance.

Take action: Develop a policy framework on AI

- Advocate for and contribute expertise to the development/monitoring of national and/or regional AI norms, strategies and laws.

Take action: Mobilize knowledge and communities

- Researchers developing datasets for AI use or research using existing AI tools should take action to avoid or retrain AI where training data may reproduce bias or stereotypes.

Take action: Promote AI research and application

3 Data policy

- Put safeguards in place to protect the right to privacy of students, faculty and staff, ensuring individuals retain the right to their personal data.
- Establish or update policies that include the use of personal data to account for data that could be held by AI tools

Take action: Develop a policy framework on AI

4 Development and international cooperation

- Use existing membership of alliances, consortia and academic networks to exchange ideas on AI ethics; establish new networks with other HEIs, organizations, and civil society.
- Develop international research collaborations/centres/networks on the ethics of AI, centring the role of HEIs and HE actors from settings where the development of AI has been more limited or where resources are more constrained.

Take action: Mobilize knowledge and communities

5 Environment and ecosystems

- Following the principle of proportionality, investment in AI should favour methods that are data/energy/resource efficient, and which do not produce disproportionately negative environmental effects.

Take action: Develop a policy framework on AI

- In line with the UNESCO Recommendation, research on AI/using AI tools should seek rights-based and ethical solutions for disaster risk resilience, monitoring, protection and regeneration of the environment and ecosystems, the preservation of the planet, circular economy, more efficient and sustainable food ecosystems, among others.

Take action: Promote AI research and application

Table 2 – Applying the UNESCO Recommendation on the Ethics of AI areas of policy action to higher education (II)

6 Gender

- Within the context of prevailing national regulations, increase the number of female students in AI-related courses and increase incentives and support for female students for professional development
- Support efforts to fight gender stereotyping and harassment in AI research; take steps in research to ensure that gender biases are not replicated in AI systems
- Within the context of prevailing national regulations, hire more women as faculty/researchers and provide incentives for more women to participate in AI research and development

Take action: Improve gender equality for AI and higher education

7 Culture

- Develop or use AI tools that preserve and enrich cultural heritage and protect diversity. For HEIs, this is particularly relevant for teaching languages and arts/creative professions and for libraries/archives
- In research, examine ways to promote Indigenous and endangered languages which may be negatively impacted by automated translation and voice assistants

Take action: Promote AI research and application

8 Education and research

- Promote skills for AI education, both relating to use of technology (e.g. coding) as well as broader competencies (e.g. critical thinking, AI ethics)

Take action: Innovate in pedagogy and skills training

- Encourage research on and develop guidelines for the responsible and ethical use of AI e.g. in teacher training and online learning
- Train AI researchers on ethical concepts so that their AI designs, products, and publications reflect ethical considerations

Take action: Build internal capacity

- Promote the development and use of AI for inclusion in education, focusing on those not currently enjoying the full benefits of digital inclusion

Take action: Mobilize knowledge and communities

9 Communication and information

- Use AI to promote access to information and knowledge and enhance academic freedom

Take action: Mobilize knowledge and communities

- Promote information literacy skills, critical thinking and related competencies

Take action: Innovate in pedagogy and skills training

10 Economy and labour

- Introduce a wider range of core and interdisciplinary skills to support adaptation to rapidly changing labour markets
- Promote project-based teaching and learning for AI and facilitate partnerships with other HEIs, public and private companies

Take action: Innovate in pedagogy and skills training

- Conduct interdisciplinary research on the impact of AI systems on economic systems, labour markets and on human/robot interactions

Take action: Promote AI research and application

11 Health and social wellbeing

- In research, develop AI systems that can improve human health and protect the right to life, taking into account the psychological and cognitive impact of AI as well as global health issues in the context of HEIs' international outreach and collaboration.

Take action: Promote AI research and application

- Ensure that students or staff can clearly identify whether they are interacting with a human or an AI system (e.g. chatbot), and always have the option to request human intervention.
- Meaningfully engage with students in discussions, debate and decision-making on the use of AI systems in HE

Take action: Develop a policy framework on AI

8.2 Academic integrity

Academic integrity is an issue of global concern for higher education (Bretag, 2016), relating to values such as honesty, fairness and responsibility. The focus is typically placed on the impact of breaches of academic integrity, for example in relation to plagiarism, cheating or other violations by students or researchers. Being value-based, concerns around academic misconduct are affected by local socio-cultural contexts and educational traditions and, in the context of AI, are shaped by research that primarily derives from Western (Anglo-centric) systems (Prabhakaran *et al.*, 2022).

Even before the popularization of ChatGPT in 2023, the spread of the internet and rapid development of technology had created new challenges for maintaining academic integrity (Eaton, 2022; Sullivan, Kelly and McLaughlan, 2023). AI tools that can write human-like text or produce text or images in particular styles may cause some forms of assessment, especially those that rely on information recall, to become redundant, and may increase the risk of plagiarism and cheating by students. In response to these tools, new tools that can detect text written by AI are emerging and existing plagiarism checkers are being revised to account for AI-written text.

Calls for HEIs to update their guidance on the use of AI in teaching, learning and assessment have become significantly more pronounced with the popularization of GPT tools and the corresponding AI detection tools. To this end, it will be necessary for HEIs to discuss the ethics of using AI tools in the context where they are becoming more embedded in daily usage, for example with GPT integration into search engines and predictive text and grammar checking widely available in word processing products.

8.3 Regulation and guidelines

Recent developments and the greater take-up of generative AI tools in the 2020s have led to growing calls from educators, policymakers and private sector leaders alike to provide more in the way of regulation and guidelines (*Chat GPT: Considerations for education in Latin America and the Caribbean*, 2023). The extremely rapid development of ChatGPT, for example, has caused apprehension for many, including its founder who called for regulatory intervention by governments in May 2023 (Bhuiyan, 2023). The rise of ChatGPT has also led a group of over 1,000 academics and private sector leaders to publish an open letter calling for a pause on the development of training powerful AI systems (Future of Life Institute, 2023). This cessation would allow time for potential risks to be investigated and better understood and for shared protocols to be developed. As of April 2023, the letter had received over 30,000 signatories, an indication of the strength of the demand for greater regulation even in a fast-changing context.

The UNESCO Recommendation on the Ethics of AI, discussed above, recognizes the need to develop legal and regulatory frameworks and guidelines for all stages of the AI lifecycle (UNESCO, 2021c). This would include State level regulation of data (including data protection), ethical impact assessments and development of oversight mechanisms to assess algorithms, data and design processes, and AI systems. Although reforms are required at different levels to manage the ethical impacts of AI on higher education, these should be evaluated and monitored by states as part of their responsibility to guarantee human rights, peace and security (Roumate, 2023). Some countries such as China have already drafted regulations that would steer how AI tools are developed, including principles of non-discrimination in the data, and what content they may contain (Kharpal, 2023).

Other multilateral bodies have been developing or advocating for rules and legal frameworks relating to the ethical use of AI: the OECD recommendations on AI, for example, take a human-centric approach with trustworthiness as the first principle (Roumate, 2023). The European Union (EU) proposed a regulatory framework for AI in 2021 and hopes for the endorsement of the ensuing AI Act by the end of 2023 (Milmo, 2023). If enacted, the AI Act would bring in a risk-based classification of AI systems, with higher risk systems (such as systems to score exams) subject to greater regulation. Systems posing "unacceptable risk" such as those that seek to manipulate people would be banned (Milmo, 2023).

While calls for regulation are mainly focused at international and national level, guidelines on the development and use of AI are in various stages of creation with processes led by industry/non-profit AI organizations and researchers in higher education. For example, the US-based non-profit Partnership on AI has been advocating for multistakeholder efforts to develop guidelines on machine learning systems and set industry norms on transparency in AI through an initiative called ABOUT ML (Partnership on AI, 2021). Similarly, researchers have called for "datasheets for datasets", i.e., documentation for every dataset providing information about its contexts and contents (Gebru *et al.*, 2021). By following a series of prompts to populate the datasheet, the authors are of the view that this methodology would lead to greater accountability on the part of those who create datasets, and more transparency and potential to reduce bias by those who use datasets.

Guidelines on AI are also being created in HEIs although these are not yet the norm (UNESCO, 2023d). Most commonly, these have been applied to academic integrity policies in response to ChatGPT and include clauses explaining the circumstances in which ChatGPT can (and cannot) be used. Examples of such guidelines were discussed in chapter 4.

8.4 Data security and privacy

The large amount of data being collected and used to build and maintain AI systems used in HEIs can benefit students and institutions; nevertheless, it also proposes risks if such data is abused (Johnson, 2014), for example, if personal data was to be misappropriated or exploited during research processes (Roumate, 2023). The concentration of personal data can create risks to privacy and security; therefore, it is essential to install the necessary safeguards to prevent data theft and undue modification, and these safeguards must follow international and national standards. According to the UNESCO Recommendation on the Ethics of AI (UNESCO, 2021c), data privacy should be respected, protected and promoted throughout the life cycle of AI systems.

Thus, when using AI in their institutions, HEIs must have a data governance strategy (also discussed in the chapter on AI and higher education administration and management). It is important to note that students now are more protective about their data, and therefore, HEIs should reassure students that their data is being collected and processed in a secure, transparent, and ethical way (Rouhiainen, 2019). Higher education can also contribute to this area by strengthening research on data security. Issues relating to data ownership are also relevant to security and privacy: HEIs should be cognizant of how data was created, who created it, where it is located geographically and have strategies to ensure compliance with local laws as well as who can access the data.

In April 2023, Italy became the first country to block ChatGPT due to privacy-related concerns (McCallum, 2023). The country's data protection authority said that there was no legal basis for the collection and storage of personal data used to train ChatGPT. The authority also raised ethical concerns around the tool's inability to determine a user's age, meaning minors may be exposed to age-inappropriate responses. The tool was unblocked some weeks later only after the company behind ChatGPT agreed to provide a form for users in the European Union to opt out of personal data collection and offer a tool to check the age of people signing up from Italy (Mukherjee and Vagnoni, 2023). Other countries and regional groupings such as the European Union and the Ibero-American Data Protection Network are also, at the time of writing, investigating ways to coordinate on the regulation of AI (El Colombiano, 2023; Khatsenkova, 2023).

8.5 Data bias

AI relies on data: collecting it, reasoning about it, and processing it. Machine learning in particular requires large quantities of raw data to train the algorithms that create models to process the data. From an ethical perspective, there are three main areas where the dependence on data can create and perpetuate bias: in the process of labelling data, in the choice of dataset, and in the replication of cognitive bias. HEIs are already taking steps to address bias in datasets, for example with Aequitas, an open-source bias audit toolkit that can measure bias and discrimination in datasets and has been designed by researchers Center for Data Science and Public Policy at Carnegie Mellon (USA) for use by AI developers, analysts and policymakers (Carnegie Mellon University, no date).

8.5.1 Data labelling

Supervised learning in machine learning (see chapter 2) relies on human intervention. This means that decisions about what data gets labelled (for inclusion in datasets) and classified and the value systems that underpin these decisions rest on choices made by people who may, consciously or otherwise, replicate or deepen existing biases (Hanna, Baker and Miceli, no date). These biases then become part of the data used in AI models which replicate them.

A related issue is the working conditions of data labellers. Reports have found that companies based in the Global North outsource data labelling to places where salaries are low and working conditions insecure (A. Williams, 2022), and where the nature of the work may be highly traumatizing or harmful (e.g. in the case of labelling explicit images or text) (Perrigo, 2023).

8.5.2 Choice of dataset

Data bias also stems from the limited use of datasets for training and evaluation purposes, with one study finding that only 12 datasets were used in over half of the papers on machine learning (Hanna, Baker and Miceli, no date). Furthermore, 10 of the 12 datasets were developed in the US, one in Germany and the other in Hong Kong. Beyond the bias apparently inherent in most data being used to develop AI tools, these findings also point to bias in the unofficial gatekeeping function being played by a small number of datasets primarily located in the Global North.

8.5.3 Replication of cognitive bias

AI tools based on language models (including ChatGPT) are not governed by ethical principles and cannot distinguish between right and wrong, true and false. These tools only collect information from the databases and texts they process on the internet, so they also learn any cognitive bias found in that information. For example, research on GPT-3 has found that it has been trained on datasets that have biases against people with disabilities (Amin and Kabir, 2022), mirroring other studies that have detected ableist bias in another influential natural language processing model, BERT (Hassan, Huenerfauth and Alm, 2021). In addition, models such as BERT have been found to reproduce biases that are intersectional, for example, against Black women (Lepori, 2020). The ways in which bias can be replicated have been set out in an accessible and interactive webpage by software engineers, encouraging users to find out more about how datasets can have 'worldviews' and how to question these baked-in assumptions (Baker, 2022).

8.5.4 Gender bias

Algorithms are being trained on highly biased male datasets, which yield discriminatory outcomes (Criado Perez, 2019). Gender biases in data can profoundly disadvantage women across various sectors that employ AI models for example, in perpetuating gender stereotypes. It has been demonstrated that several voice assistants identified as female and utilized by hundreds of millions globally, provide passive or submissive responses when subjected to gender-based harassment (GEM Report, 2023). For instance, research carried out at the University of Washington (USA) indicates that Google's speech recognition software has a 70% higher likelihood of accurately identifying male speech compared to female speech (UNESCO, 2021d), making the application of technology easier for males than females. This bias is also translated into virtual worlds which capture the same biased settings as our reality since they are built with the same datasets. Gender-based violence, for example, is also transported into virtual worlds where it can take different forms from stalking to online impersonation, image-based abuse and sextortion (UNFPA, no date).

Even though it is acknowledged that a wealth of balanced data can help bridge gender disparities, there are prevailing concerns. Specifically, if data collection processes do not ask the correct questions, including those pertinent to women's experiences, the algorithms might reinforce and even exacerbate gender inequalities. These misinformed algorithms not only negatively affect women, but also have deleterious effects on businesses and economies as a whole (Niethammer, 2022). As AI technologies become increasingly prevalent, shaping every aspect of our lives from healthcare to finance, these biases can have far-reaching consequences (Buolamwini and Gebru, 2018).

Intersectionality serves as a framework for broadening our perception of various aspects of inequality, including in education. It fosters a more complete methodology towards conceptualizing inclusivity in education systems. Students' identities are intersectional and the same student could be facing exclusionary practices because of race, gender and socioeconomic background at the same time. AI should serve inclusivity yet it has been found that intersectionality is often oversimplified into a dual analysis of race and gender, rather than being understood as a structure-based analysis or a critical political assessment. AI also fails to address the complexities of interlocking systems of oppression. Little research addresses the systemic reasons for certain groups being underrepresented in datasets or establishes links between groups and societal structures and inequality (Ovalle *et al.*, 2023). To mitigate biased interactions with individuals they impact, it is essential that AI systems are imbued with a comprehensive understanding of social and historical contexts from their inception to their operational phase.

8.6 Commercialization

The involvement of private entities in higher education is not new and in the realm of AI there has been a shift over time, with industry now dominating academia when it comes both to developing AI and to AI outcomes such as publishing (Ahmed, Wahed and Thompson, 2023). On the one hand, the concentration on AI development by industry could bring benefits relating to how the ever-increasing cost of technological advances and computing power are covered, and potentially induce process and product efficiencies that reduce costs and effort (Ahmed, Wahed and Thompson, 2023).

On the other hand, the commercialization of AI may lead to its further development only in areas that are likely to generate profit for industry. Furthermore, the concentration of AI in industry rather than academia may have implications for future research, for example reducing the likelihood of academia leading 'blue skies' (basic) research that is so important to develop knowledge creation, innovation and collaboration and long-term societal benefits. Only 28% of PhD graduates choose to stay in academia while fewer than 1% continue their careers working in the public sector (Stanford University, 2023). Industry-academia partnerships and international academic partnerships may be diluted, undermining the critical role of cooperation across and within sectors.

The COVID-19 pandemic opened a unique window for the expansion of privatization and commercialization in higher education. This is especially evident in the endorsement of educational technology as temporary solutions for campus closures and the portrayal of private sector entities as catalysts and architects of post-pandemic reforms and transformations in higher education. In this context, AI has experienced significant advancements through the use of extensive data monitoring tools integrated into online learning management software, surveillance technologies like remote examination proctoring systems, and campus safety systems such as student tracking and monitoring of locations and contact tracing applications (Williamson and Hogan, 2021). At the same time, HEIs have become users and consumers of AI based technologies for education and administration purposes.

The education sector must take responsibility for promoting the development of age appropriate, pedagogically consonant and culturally and socially appropriate content materials. In many regions, educational resources undergo further evaluation by groups of teachers, school leaders, and civil society organizations before receiving institutional approval. Similarly, AI models and applications claiming educational value should undergo thorough examination based on comparable criteria and others, considering their complexity and wide-ranging impact, before being implemented on a large scale (Giannini, 2023).

There is also a risk that AI may not be the open source for the datasets used in industry, and that data may be extracted for commercial purposes. As such, concerns around the ethics of AI as it relates to commercialization also extend to equitable access to advances in AI technologies. Many AI tools are offered free of charge, but not all are available in all locations. Some tools ostensibly designed for widespread use may only provide some features free of charge, with other functionalities (e.g. greater reliability and faster access to new versions) only available for a cost. Considering these characteristics, it is always important to consider inequality when talking about access to AI applications and the consequences it might have in learning outcomes or opportunities.

9

Practical Guide to Responsibly Integrating AI into Higher Education

Practical Guide to Responsibly Integrating AI into Higher Education

AI is expected to bring about profound changes for the higher education sector, presenting numerous opportunities as well as serious and urgent challenges that must be addressed in the transition towards AI-driven systems. This chapter provides a Practical Guide for higher education leaders. It sets out actionable recommendations and steps that can be taken at the institutional level, to adapt to AI in a responsible and ethical manner.

The Practical Guide has been designed with HEIs in resource-constrained contexts in mind; however, it is also intended to be flexible and responsive to a range of local/global institutional and regulatory situations. The Practical Guide identifies actions that affect internal capacity building, institutional governance, teaching, research, and community engagement. These actions also include specific recommendations on gender equality that can lead to transformation by addressing the root causes of gender inequalities.

9.1 Build internal capacity

The first step towards integrating AI into any HEI is to generate and build internal capacity. This is particularly relevant for professional staff and faculty whose jobs are most likely to be affected by AI. Addressing internal capacity building needs as a first priority, is important for several reasons:

- **Building confidence and knowledge**, overcoming fears or cynicism around AI that may stem from a lack of understanding of AI applications in higher education;
- **Improving the quality and relevance of teaching**, assessment and student support by effectively and responsibly applying AI;
- **Developing or enhancing a culture of innovation** and empowerment at the HEI.

Internal capacity building can be actioned in multiple ways but in all cases should be informed by two cross-cutting principles. First, the importance of bringing together staff and faculty with different disciplinary and professional expertise so that an array of perspectives and ideas can be fruitfully shared. Second, developing flexible and adaptive strategies that account for people's different starting points in relation to AI as well as the importance of enabling faculty and staff, also in consultation with students, to express their needs and areas of interest.

With these two principles in mind, HEIs could:

- **Provide or develop resources, starting at the introductory 'what is AI' level, and including tips or advice on using AI according to the regulations and technological availability at the HEI**. Such resources can combine materials developed externally by trusted sources, such as UNESCO IESALC's free online short course on ChatGPT and higher education[11] or other MOOCs, with materials that are specific to the needs of the HEI.
- **Create opportunities for faculty, staff, together with students and other stakeholders, to discuss the impact of AI** on the HEI and co-construct strategies to adapt and adopt to AI.
- **Organize workshops, forums, and other types of training events to learn about AI tools**, how to use them, their limitations, the HEI's policy for use. These could cover the use of different AI tools or focus on a specific tool.
- **Actively encourage and consider incentivizing** (e.g. reallocating staff or faculty time to 'buy' them out from other activities) staff and faculty to invest in their ongoing professional development in relation to AI. This might be done through peer support and informal mentoring to increase skill level and share good practices for teaching and ways of using AI tools. Professional development can be undertaken at multiple levels: within faculties, at institutional level, or among supra-institutional communities of knowledge.

Additionally, it is crucial to provide training to all internal colleagues on AI ethics. This should encompass not only the technical aspects of AI applications (suitably adjusted depending on level of technical expertise) but also address biases related to gender, race, and cultural factors.

Such capacity-building endeavours should become integrated into the HEI's culture: while there may seem to be a particularly urgent need to respond to the latest developments in AI now, a longer-term and more sustained set of activities will support positive and pro-active adaptation that could even lead to transformation.

11 https://campus.iesalc.unesco.org/inicio/blocks/coursefilter/course.php?id=215

9.2 Develop a policy framework for AI

Having taken steps to start building internal capacity, HEIs should work on developing a policy framework for AI. This is an important set of actions that will help assess the current situation in relation to use of AI and will support institutional planning. This also aligns with the recommendation of the Beijing Consensus to promote the equitable use of AI in education (UNESCO, 2019a) and the UNESCO Recommendation on the Ethics of AI that proposes introducing frameworks to assess the (ethical) impact of AI (UNESCO, 2021c).

The development of a policy framework starts with extensive consultation with all academic, administrative and IT departments as well as with students. HEIs may consider additionally consulting with their key stakeholders such as members of the local community, research partners, and students' families. This is also an opportunity to identify AI Champions, i.e., people who could support the institution with AI in the longer-term: these might be students working on AI, researchers who are using or developing AI, IT technicians with expertise in AI, or others. Working on the framework could be undertaken together with other HEIs through institutional communities of practices, alliances/networks, etc. This would support the development of good practices and knowledge sharing within the higher education system.

A toolkit for developing a policy framework is organized as a series of prompts under three main stages: **Define** (understand the current situation), **Implement** (decide which AI tools to use and how to use them), and **Monitor** (evaluate performance and impact on equity). Although the framework sets these out in a linear way, they are intended to be used in a cyclical and continuous manner. After the first review, which would require significant consultation and effort, HEIs may consider creating a standing committee or working group with AI Champions and/or a representative range of institutional stakeholders to continue the review process on a regular basis.

The toolkit sets out the main prompt questions under each of the three stages and (where applicable) additional questions/ considerations that help to answer the prompt questions. Based on the responses to each prompt, HEIs should design appropriate next steps and impact indicator(s) that will demonstrate how the prompts will be answered, what will be the next steps and how the HEI will know whether positive change is taking place. For example, if the HEI has a policy on academic integrity but it does not mention AI, the next step would be to have the committee responsible for academic integrity work with the AI Champions to devise appropriate updates to the policy, which could be reviewed after one year to assess its impact.

Table 3 – Toolkit for developing a policy framework for AI (I)

DEFINE (Understand the current situation)		
Prompt question	**Additional questions / considerations**	**Next steps and Impact indicator(s)**
1. What is the institution's position on the use of technology?	▪ What is the institution's understanding of data-driven AI? ▪ How does the institution currently use (AI or non-AI) technology to support its functions? ▪ Who benefits from AI? ▪ Who could be the institution's AI Champions / AI steering group? How would gender equality in this group be assured?	To be completed by the HEI
2. At the institutional level, what policies or regulations currently exist that are relevant to the use of AI?	▪ Including but not limited to policies/regulations on privacy and data protection, academic integrity, safeguarding, research ethics ▪ To what extent is gender equality addressed in these policies or regulations? ▪ Which policies would need to be adapted and which would need to be created? How could these policies be developed to be responsive to the fast-changing nature of AI? ▪ In addition to policies or regulations, do guidelines for faculty, staff or students need to be created? How will these guidelines be developed / communicated? ▪ What internal capacity building would be needed to support the roll-out of revised/new policies and regulations?	
3. What external policies or regulations does the HEI need to account for?	▪ Including but not limited to government, research funders ▪ Such policies or regulations may be national, regional, and/or international	
4. Which types of AI are currently being used in this HEI?	▪ What data is being collected and processed? ▪ Where is the data stored? ▪ What is known about the origins of and possible biases in the datasets being used? ▪ For which functions or units are AI technologies being used? ▪ Which stakeholders (faculty, staff, students) have access to them? ▪ What kind of training and support is provided? ▪ Are there differences in access to AI technology based on gender?	

Table 3 – Toolkit for developing a policy framework for AI (II)

IMPLEMENT (Decide which AI tools to use and how to use them)		
Prompt question	**Additional questions / considerations**	**Next steps and Impact indicator(s)**
5. Which areas could benefit from using AI?	▪ Including but not limited to student wellbeing/services, assessment, research ▪ What types of data would it be useful to collect that could be managed using AI? ▪ In which areas could AI improve gender equality? For example: student admission/retention, staff/faculty recruitment. ▪ What minimum AI standards would be expected of faculty, staff and students? For example, basic AI literacy for professors in order to be able to evaluate student deliverables which use AI tools. ▪ How will training or capacity development be provided so that everyone can reach these standards?	To be completed by the HEI
6. Which AI technology could be chosen?	▪ What would be the criteria for selecting AI technology? For example, desired balance between open source and commercial AI tools; efficiency in terms of data/resources/energy. ▪ What value does the technology add? For whom? ▪ How will accessibility factors be considered? ▪ Who should have the authorization to choose new tools? How will gender balance among decision makers be ensured?	
7. How would risks be managed?	▪ What are the ethical risks and concerns? ▪ How will personal data be protected? ▪ How will stakeholders be trained and in which areas? For example: data security; AI ethics? ▪ What steps will be taken to mitigate the negative environmental impact of introducing AI?	
8. What changes would need to be made to the HEI's IT infrastructure to support AI?	▪ Including but not limited to the digitalization of databases, interoperability of systems, cloud computing capacity, security, privacy protocols. ▪ What training and support would be needed to prepare personnel to develop / procure / maintain AI systems? ▪ What resources are available to support these changes? What funding or partnership opportunities exist at local / national / international level to support resource needs?	

MONITOR (Evaluate performance and impact on equity)		
Prompt question	**Additional questions / considerations**	**Next steps and Impact indicator(s)**
9. How effective is the AI technology in meeting the need that was identified?	▪ What criteria will be used to measure effectiveness? Who will decide on these criteria? ▪ What has been the take up (adoption) rate of the AI technology? What feedback do users have, for example, about usability? ▪ How well does AI technology integrate with other systems and tools used at the HEI? ▪ How flexible (adaptive) is the technology?	To be completed by the HEI
10. What data is collected about the AI technology?	▪ How often is data collected? ▪ How and by whom will the data be used? ▪ Have safeguards been put in place to protect the right to privacy of students, faculty and staff, ensuring individuals retain the right to their personal data?	
11. To what extent is the AI technology overcoming or addressing equity concerns?	▪ How does the AI technology improve gender equality? ▪ How are changes in other equity concerns being measured? ▪ How can the technology be adapted to better overcome/address equity concerns?	

9.3 Innovate in pedagogy and skills training

The need to innovate in pedagogy and skills training affects students at all levels and across disciplines. Given that the impact of AI is transversal, it will be important to train all students in AI-related competencies and skills, even those not intending to work in AI or related fields. This can be differentiated by considering AI skills on the one hand and the skills needed for living with AI on the other hand. This chapter also outlines how generative AI tools (such as ChatGPT) can be used to enhance teaching and learning, with specific examples of the various applications of generative AI to these processes.

9.3.1 Teach AI skills and skills for AI

Within the remit of the local regulatory context, one option for HEIs is to develop new courses and programmes that focus on AI or incorporate AI competencies and skills. In doing so, HEIs will contribute to training the AI developers of the future, that are in high demand in the labour market – with these numbers expected to be even higher in the coming years. However, this is a high-intensity and resource-consuming option, particularly in the case of HEIs that have limited expertise in computer science or mathematics/statistics, which form the backbone of most AI courses. Consideration should also be given to whether new programmes would be offered at the undergraduate and/or postgraduate level (and if postgraduate, whether there is a suitable 'feeder' undergraduate course at the HEI), whether they would be offered in-person, online or hybrid, and whether the teaching/supervisory/administration capacity already exists at the HEI to venture in this direction.

For some HEIs, it may be more logical to add modules or courses on AI to existing programmes. These could focus on the technical aspects of AI (AI skills) and therefore be more suited for integration into computer science or mathematics/statistics programmes. They could also introduce cross-cutting themes such as ethics or running an AI company, in which case new courses could be added to a wide range of existing programmes, such as business/management, engineering, law, medicine, and philosophy. Given that most HEIs continue to organize programmes along disciplinary orientations, this presents an opportunity to reimagine how teaching is organized to respond both to the current moment of change, and also to incorporate interdisciplinarity and transversal skills and competencies that are not subject-specific.

In both cases, changes can be made within the 'traditional' structured format of a degree or programme of study, but given that AI is such a fast-paced phenomenon, it may also be appropriate for HEIs and learning content providers to consider tailoring their materials for the award of credits and shorter professional certification. This would be particularly relevant in the context of lifelong learning.

As AI becomes more present in different professional and academic fields, it is crucial for students who are not necessarily thinking of a career in AI to at least be familiar with its basics, which could be covered in a course or module on AI literacy. It is also important to train all students in AI ethics, in light of the many challenges and unknowns presented by technological developments.

Box 15:

Enhancing AI ethics training in higher education

HEIs can adopt the following three approaches to enhance training in AI ethics.

First, technology teaching can be approached from the ethical design of AI algorithms.

Second, incorporating real-life scenarios of the foundational elements used in AI – such as data that involves ethical concerns – can help students gain hands-on experience and address such concerns from the beginning of their practices.

Third, offering ethics-related lessons or lectures with diverse presentations to help kindle students' awareness in this topic and allow them to shape a new future of ethical practice in AI (Borenstein and Howard, 2020).

Where a full course on AI ethics is not possible, an alternative modular approach would include certain topics relating to ethics in regular-length HEI courses. Though short, students are introduced to the practice of connecting specific AI ideas to their relevant ethical implications (Furey and Martin, 2019).

Furthermore, all students should have a solid and holistic understanding of the data involved in AI – from learning about how datasets are created, by whom and with which variables to how data can be used ethically and responsibly. Finally, as discussed in chapter 6, AI is making other skills more relevant. Skills such as analytical/critical thinking, communication and other complementary skills need to be included in the curricula.

9.3.2 Use generative AI to enhance teaching and learning

Due to their ability to generate and assess information, generative AI tools (such as ChatGPT) can play a range of roles in teaching and learning processes. Together with other forms of AI, they can improve the process and experience of learning for students. To do this, they can be used as a standalone tool, or can be integrated into other systems and platforms used by HEIs.

Generative AI tools can perform many simple or technical tasks (e.g. basic research, calculations, proofing) and the examples outlined in the table[12] show how one such tool, ChatGPT, could be incorporated and used to augment teaching and learning.

9.4 Promote AI research and application

The development and application of AI involves, on the one hand, doing research and development relative to AI at the HEI. Here, the suggested emphasis would be divided between AI research and development, research using AI tools, and research on the implications of AI for inclusion, access, human rights and societal inequities. On the other hand, developing and applying AI hinges on the careful integration of AI tools into one or more areas of the HEI and to that end, this chapter proposes a hackathon to build a chatbot. This is a specific but concrete and relatively low resource initiative that can also provide hands-on learning for students and opportunities for the HEI to engage both within and beyond its campus.

Table 4 – How to incorporate ChatGPT into teaching and learning

Role	Description	Example of implementation
Possibility engine	AI generates alternative ways of expressing an idea	Students write queries in ChatGPT and use the Regenerate response function to examine alternative responses.
Socratic opponent	AI acts as an opponent to develop an argument	Students enter prompts into ChatGPT following the structure of a conversation or debate. Teachers can ask students to use ChatGPT to prepare for discussions.
Collaboration coach	AI helps groups to research and solve problems together	Working in groups, students use ChatGPT to find out information to complete tasks and assignments.
Guide on the side	AI acts as a guide to navigate physical and conceptual spaces	Teachers use ChatGPT to generate content for classes/courses (e.g. discussion questions) and advice on how to support students in learning specific concepts.
Personal tutor	AI tutors each student and gives immediate feedback on progress	ChatGPT provides personalized feedback to students based on information provided by students or teachers (e.g. test scores).
Co-designer	AI assists throughout the design process	Teachers ask ChatGPT for ideas about designing or updating a curriculum (e.g. rubrics for assessment), and/or focus on specific goals (e.g. how to make the curriculum more accessible).
Exploratorium	AI provides tools to play with, explore and interpret data	Teachers provide basic information to students who write different queries in ChatGPT to find out more. ChatGPT can be used to support language learning.
Study buddy	AI helps the student reflect on learning materials	Students explain their current level of understanding to ChatGPT and ask for ways to help them study the material. ChatGPT could also be used to help students prepare for other tasks (e.g. job interviews).
Motivator	AI offers games and challenges to extend learning	Teachers or students ask ChatGPT for ideas about how to extend students' learning after providing a summary of the current level of knowledge (e.g. quizzes, exercises).
Dynamic assessor	AI provides educators with a profile of each student's current knowledge	Students interact with ChatGPT in a tutorial-type dialogue and then ask ChatGPT to produce a summary of their current level of knowledge to share with their teacher/for assessment.

12 This table was first published in UNESCO IESALC's *ChatGPT and Artificial Intelligence in higher education: Quick start guide* (2023a). The roles and descriptions were created by Mike Sharples (Professor Emeritus of Educational Technology, Open University, UK) and are reproduced with permission. The examples of implementation were devised by UNESCO IESALC and also draw from suggestions by Ronald Knust Graichen (Education Consultant, the Netherlands) published at https://eduteka.icesi.edu.co/articulos/KNUST-como-usar-chatGPT-en-el-aula. It is based on ChatGPT-3.5.

9.4.1 Support AI-informed research

Expanding AI-informed research at the HEI can be done in three main ways:

1. Research and development relative to AI
2. Research using AI tools
3. Research on the implications of AI

The relative mix of these directions will depend on the mission of the HEI, the resources available for research and development, and the expertise and interest of researchers and units. Overall, the development and application of AI at the HEI should be guided by ethical considerations, rights-based approaches, and a commitment to societal wellbeing. Examples of research and development on/using AI and research on the implications of AI are listed in table 5.

Elevating the position of AI-informed research on the agenda is also an opportunity to cultivate interdisciplinarity across departments or between the HEI and other education/research actors. Previous studies have already pointed out the benefits of interdisciplinary work on AI in fields as varied as aerospace, agriculture, economics and healthcare (Kusters *et al.*, 2020; Zhuang *et al.*, 2020; Ryan, Isakhanyan and Tekinerdogan, 2023). Also, as AI becomes ever more present in societies, research examining it from multiple perspectives, is needed to help with understanding the impacts and harness the potential of AI for the good of humanity and the environment. This also enhances HEIs' contributions to the Sustainable Development Goals.

9.4.2 Organize a hackathon to build a chatbot

A hackathon is a fast-paced and time-limited problem-solving event that is designed to foster innovation and creativity by creating an environment that encourages participants to collaborate, think critically, and come up with solutions to specific challenges. It fosters a culture of continuous development and can bring together students, faculty, staff and community members/businesses. Hackathons aim to facilitate the generation of new ideas, encourage problem-solving skills, and promote teamwork and creativity among participants (Lake, n.d). They can be organized with a relatively low budget, offering a pathway to start developing AI in HEIs in resource-constrained (and other) settings.

In this case, the hackathon would be organized around developing a chatbot[13] for the HEI. As the Primer has demonstrated, chatbots are among the most commonly used AI-powered tools in HE and can be used to solve different

Table 5 – Examples of areas for research and development on/using AI and on the implications of AI

Research and development on/using AI	Research on the implications of AI
■ AI for disaster risk resilience; the monitoring, protection and regeneration of the environment and ecosystems; the preservation of the planet; circular economy; more efficient and sustainable food ecosystems	■ Promote the development and use of AI for inclusion in education, focusing on those not currently enjoying the full benefits of digital inclusion
■ Use of AI in improving human health and protecting the right to life, including mitigating disease outbreaks; addressing global health challenges	■ AI for gender equality, gender/racial/ethnic biases; addressing bias and stereotypes in AI training data and tools; AI ethics
■ AI for cultural heritage protection; AI for artists; AI research at the intersection of intellectual property (IP); and AI for museums, libraries and galleries	■ AI to promote access to information and knowledge and freedom of speech; to provide people with relevant literacy skills to realize such usages
■ How to structure data to account for intersectionality and overcome other existing limitations (e.g. a binary view of gender)	■ Impact of AI on labour markets and implications for education requirements
	■ Impact of privatization and commercialization of AI; relationship to the common/public good
	■ Intersection of human intervention (working conditions, cognitive biases) and development of AI

13 It is essential to prioritize transparency and user awareness when deploying AI systems within HEIs. Users should be able to clearly identify whether they are interacting with a human or an AI system (e.g. chatbot), and always have the option to request human intervention. By clearly distinguishing between human and AI interactions, such as providing clear indications when users are engaging with a chatbot, students and staff can make informed decisions and have the agency request human intervention if needed. This approach fosters trust, empowers individuals to navigate the AI systems effectively, and ensures that human support is readily available when desired, enhancing the overall user experience.

kinds of problems or improve a range of services. Creating some chatbots might need advanced computer skills, while others need no coding at all. It is possible to develop a chatbot with a zero-coding technique (Essel *et al.*, 2022), adding to the accessibility of this proposition and expanding the range of stakeholders that could be involved as they do not all need subject expertise.

The specific objective of developing a chatbot will change depending on the needs of the HEI and can be designed to address specific challenges faced by the institution, such as student support, information dissemination, or administrative tasks. AI-based chatbots that solve queries on the university website for prospective and current students are perhaps the most widely spread. It is worth noting that the hackathon can also be oriented towards the integration of an open source chatbot. It does not necessarily have to focus on developing a chatbot from scratch.

The hackathon can be organized by one or more departments at the HEI, for example, the office responsible for student events, the IT department, or the Innovation office. The first thing to formulate is the terms of reference that the students will receive with the invitation. The terms of reference should include the aim of the hackathon (build a chatbot for the HEI) and the functions of the chatbot, including UX/UI design and maintenance. It is recommended that meetings be held with the relevant stakeholders, including students, to define these functions beforehand. The terms of reference should also include the composition of the teams ensuring equal representation of male and female students as well as the participation of students from equity-deserving groups. The hackathon should be open to all faculties, and interdisciplinarity taken into account.

Once the terms of reference are approved, confirmation of the date, time and availability of a suitable space within the premises is required. The next step would be to prepare the invitation to be sent to all students of computer science and other faculties to develop the new chatbot for the HEI.

9.4.3 Considerations

The terms of reference may also include the budget allocated for the implementation of the chatbot. This budget should come from the respective HEI. In the absence of a budget allocation for the purpose, crowdfunding or external funding options may be considered. Consideration should also be given to the inclusion – in the terms of reference – of the copyright of the technology developed, for example, whether it remains with the HEI, the developers, or both. It may be interesting to consider inviting an expert in chatbots to evaluate the solution or to be a mentor of the teams during the development of the Hackathon. Once the solution is implemented, the HEI research team could conduct research to assess what impact the chatbot has had on student attention. The final implementation of the chatbot and integration with the web services of the HEI should be the responsibility of the IT Office of the HEI.

Figure 18 – Hackathon process

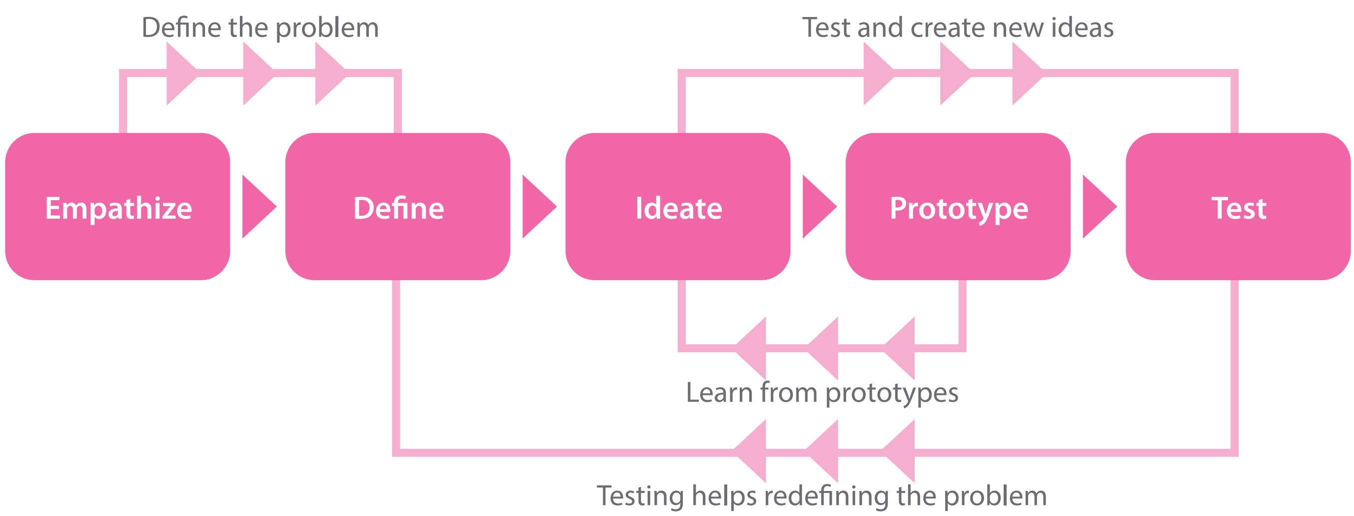


Figure: IESALC | Source: UNESCO IESALC

9.5 Mobilize knowledge and communities around AI

AI offers significant potential for HEIs to mobilize knowledge and communities. In the section on building internal capacity, where the mission of HEIs is discussed, this can be done both internally and externally, targeting the local community, government, and other HEIs, among others. Strategies include the dissemination of information, comprehensive training, and partnerships to improve outcomes related to the AI agenda of the HEI and the country/region. The table below (Table 6) offers a summary of the different initiatives the HEI could organise per stakeholder. It is important to highlight that gender parity should be ensured throughout the organisation and mobilisation of these communities.

Table 6 – Initiatives HEIs can organise to mobilise knowledge and communities, by stakeholder group

Stakeholder	Activities
Community	Boost interest and encourage questions from the community in advance with the assistance of IT-related faculty, student services and associations,. Sectorial sessions can be organized in different faculties: for example, the Law Faculty organizes AI legal issues; the Humanities department talks about ethical issues; the Social Sciences and Economics Department speaks about labour market issues; the Health Sciences Department discusses AI in health etc. The goal is to engage everyone by giving each faculty/department ownership over one or a few activities –decentralizing the events management. If available, invite representatives from companies, using AI in the HEI city / region, to share their experience with students and discuss the future of AI-intensive jobs. Leverage in-house knowledge developed by the internal activities of the HEI to organise public, free of charge forums open to the community to inform in general terms of AI and how it can impact their lives. Include information about privacy, bias and ethics regarding AI.
Government	HEIs should actively engage in advocating for the development and monitoring of national and/or regional AI norms, strategies, and laws. HEIs with more capacity in AI can develop locally adaptable training programmes on AI and higher education for policymakers and for other HEIs. By leveraging their expertise and research capabilities, HEIs can contribute valuable insights and recommendations to shape AI policies that prioritize ethical considerations, safeguard individual rights, and promote responsible AI deployment, thereby ensuring that AI technologies align with societal values and serve the best interests of the community at large.
Transversal (for everyone)	Implement comprehensive training programmes for everyone at the HEI to educate students and staff on the intersection of AI and bias, with a specific focus on prevalent gender biases in AI design and development. These training initiatives should incorporate practical exercises to enhance participants' ability to recognize instances of bias in AI systems and equip them with strategies to address and mitigate such biases. If possible, invite experts on the matter to give master classes not only open to the educational community but to everyone, including secondary school students from local schools. If the HEI has its own radio or TV channel devote some time to developing videos and radio programmes and podcasts on AI for the public. This could be integrated as an interdisciplinary project on project-based learning between faculties (e.g. communication and journalism). The programmes can focus on interviewing experts on the matter, identifying local concerns, and creating debates on the impact of AI on the community.
Other HEIs and academic / research organizations	Partnerships with the private sector as well as other HEI or research centres focusing on AI can have a positive impact on developing and applying AI and should always follow the ethical guidelines of the HEI. Partnerships could be established to provide internships for students in the AI related fields, to provide experts for hackathons, webinars, masterclasses and to get in depth knowledge on the AI requirements at the business level in real time. HEIs should leverage their existing memberships in alliances, consortia, and academic networks to actively engage in collaborative discussions and knowledge-sharing platforms focused on AI ethics. By exchanging ideas, best practices, and experiences with other HEIs, organizations, and civil society, institutions can collectively foster a deeper understanding of AI ethics and explore innovative approaches to address ethical challenges associated with AI technologies. Furthermore, HEIs should also consider establishing new networks and partnerships to broaden their reach, facilitate interdisciplinary collaborations, and promote cross-sectoral engagement in shaping ethical AI practices and policies. In order to foster global dialogue and comprehensively address the ethics of AI, it is essential to establish international research collaborations, centres, and networks that specifically prioritize the involvement of HEIs and stakeholders from regions where AI development has been relatively limited or resource-constrained. By including diverse perspectives and voices in these initiatives, HEIs can contribute unique insights, experiences, and ethical considerations, ensuring a more inclusive and contextually sensitive approach to AI ethics that reflects the global landscape of AI development.

9.6 Improve gender equality for AI and higher education

The lack of gender equality in AI, which primarily affects females, was comprehensively discussed in chapter 7, with its implications for the labour market and data bias noted in subsequent chapters. It is the duty of all actors in the higher education system to take action to address the underlying causes of gender inequality. There are many possible opportunities for HEIs, some of which may benefit from partnerships to increase access to financial resources (e.g. scholarships) and/or to pool expertise to use it more efficiently (e.g. networks). Wherever applicable, decision-makers should also account for prevailing national and international regulations.

The table below (Table 7) outlines a number of options that aim to improve gender equality in the context of AI, higher education, and other levels of education. It provides space for HEIs to map the current status for each action and set out targets, methods of implementation, and the ways that actions will be monitored and evaluated once implemented. Further practical tools are available in UNESCO's 'From access to empowerment: Operational tools to advance gender equality in and through education' (UNESCO, 2021b).

Table 7 – Tool for improving gender equality in the context of AI and higher education

Action	Current status	Target	Implementation	Monitoring and evaluation
	To be completed by the HEI			
Increase the number of female students in AI courses				
Build links with local schools to raise awareness about AI courses among female students				
Provide mentorship possibilities to female students in secondary school by female HEI students in STEM to reinforce positive feedback related to STEM careers.				
Provide funding or non-monetary inducements (e.g. discounted or free housing) to incentivize female students to study AI				
Provide all faculty with gender- related training to reduce gender stereotyping in classes				
Provide female faculty with lifelong learning opportunities with a special focus on upskilling and reskilling in the STEM sector				
Ensure that all students have equal access to courses or training in skills for AI				
Educate all students to detect and know how to address bias in AI tools / datasets				
Use AI to develop tools to increase student retention / reduce dropout				
Develop mentorship schemes to combat gender (and other) stereotyping regarding AI and improve female student/faculty retention				
Develop an exclusive internship pathway for female students in STEM; design partnerships accordingly				
Recruit more female faculty members to teach/research AI				
Provide incentives for more women to participate in AI research and development				
Create networks dedicated to women in AI and/or incentivize female students and researchers to actively participate in existing networks				
Ensure gender equality in institutional decision-making groups relating to AI				
Address gender in all AI regulations and policies				
Assess all datasets used in AI tools at the HEI for gender and other forms of bias				
Ensure equal access for all to AI tools used at the HEI				

Harnessing the Era of Artificial Intelligence in Higher Education: A Primer for Higher Education Stakeholders

10

Recommendations

Recommendations

This chapter concludes the Primer by presenting recommendations for policymakers and HEIs based on material that has been presented.

AI is a fast-moving concept and reality, to the extent that most non-AI specialists are struggling to keep up with today's developments. The current pace of change, even in an era of digitalization, has been disruptive and disorienting (Giannini, 2023). As innovative technologies emerge, societies face inevitable changes that can be positive, but that can also have negative and unforeseen consequences when challenges and concerns are not adequately addressed.

It is for this reason that a major objective of this AI and higher education Primer has been to provide a comprehensive overview of the current situation and set out a Practical Guide that HEIs can use to take their first or next steps in relation to AI. This Primer has highlighted the core issues relating to AI and higher education, with the aim of striking a balance between providing relevant information, evidence and examples while also emphasizing the importance of taking critical, ethical, responsible, and gender-transformative approaches to AI.

In this Primer, the emphasis has mainly been on how AI is shaping higher education. Now equipped with further knowledge and understanding, the next step is to ask how higher education could or should shape future AI (Giannini, 2023), and the role that higher education could play, together with other stakeholders, in shaping a future that systematically addresses the digital and connectivity divides, as well as the challenges of data bias and availability of data.

As previously noted, one of the key issues for **higher education institutions** in the immediate future, regardless of location or resource level, is the need for HEI leadership to be equipped to advance the responsible implementation of AI. This may require upskilling and capacity development. Investment of time and resources in these processes is crucial – and not only for leadership – to harness AI such that it can be used for good in higher education. For AI to be effective, its reach should extend well beyond the current situation where a handful of faculty, staff or students understand how it works and how it can be used to improve higher education.

The Practical Guide in the previous section sets out detailed actions for HEIs in responsibly integrating AI. To recap, these recommendations are:

- **Build internal capacity** to create the right environment for informed and sustained engagement with AI across the HEI;
- **Develop a policy framework for AI** to make decisions based on evidence, understand the current situation, decide which AI tools to use and how to use them, and evaluate their performance and impact on equity;
- **Innovate in pedagogy and skills training**: through curriculum dynamism, HEIs support the training of the next generation of AI specialists and AI-aware graduates;
- **Promote research and application of AI**, which can be adapted to suit the resources available at the HEI;
- **Mobilize knowledge and communities around AI** to increase general understanding of AI and contribute to HEIs' community engagement or extension mission;
- **Improve gender equality for AI** and higher education by improving conditions for female students (even before they reach higher education) and addressing gender bias and stereotypes in and beyond data.

While wide-ranging, the Practical Guide should be seen as a flexible set of tools that should be contextualized in the local reality and adjusted as AI technology develops.

For **governments and policymakers**, the recommendations are to be applied on a wider scale:

- **Build capacity within policymaking structures to better understand AI**, its possibilities, limitations and risks;
- **Foster interdisciplinary and cross-sectoral spaces for discussion on AI issues**, and actively engage with a wide range of stakeholders;
- **Regulate AI, with emphasis on the ethical and safety implications** of AI, and provide guidance to HEIs about the use of AI;
- **Fund training and development for AI courses and AI ethics courses** in higher education;
- **Fund interdisciplinary research on AI** and incentivize research collaboration across borders;
- **Ensure that HEIs have the required connectivity and infrastructure to deploy AI tools**;
- **Ensure that higher education quality assurance processes are updated** and that they include AI ethics;
- In cases where governments regulate curriculum/guidance to HEIs, **include critical thinking as a meta-skill to be taught across all courses**;
- **Introduce policies and programmes to overcome marginalization of people in AI** based on their gender, race/ethnicity or other factor.

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4 QUALITY EDUCATION

Sustainable Development Goals