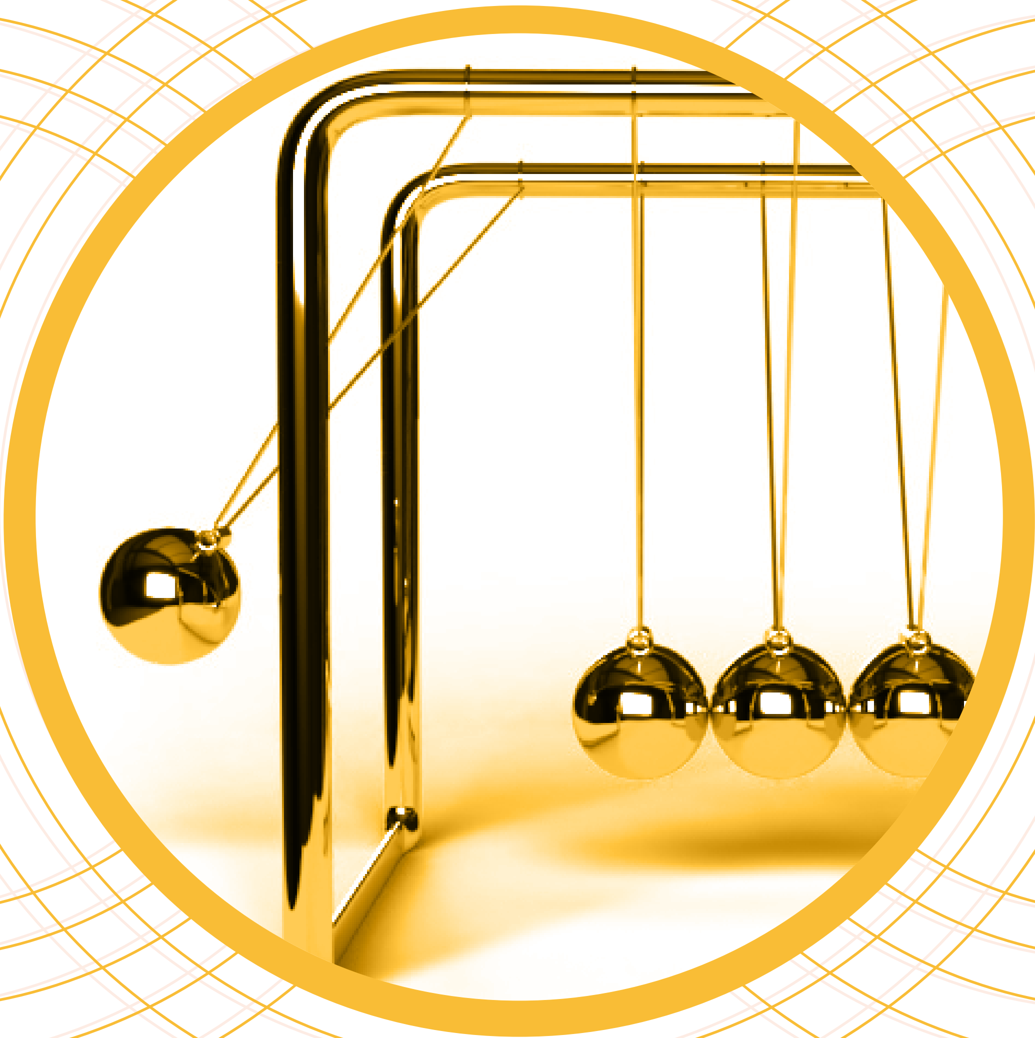
05 ASEF HIGHER EDUCATION innoLab



Universities' Role in Artificial Intelligence Innovation Ecosystems by 2060 in Asia and Europe

A collection of position papers produced by the 5th ASEF Higher Education Innovation Laboratory online cohort

ASIA-EUROPE FOUNDATION

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A Word from the Editors

In line with the Asia-Europe Foundation's (ASEF) mission, we create platforms where higher education stakeholders from Asia and Europe can come together, learn from one another, and collectively address shared global challenges.

The ASEF Higher Education Innovation Laboratory (ASEFInnoLab) was created in 2021 to facilitate dialogue, collaborative capacity-building and professional networking for academics and higher education managers. The 5th edition of this initiative focused on *"Universities' Role in AI Innovation Ecosystems"*, offering a space to reflect on how institutions can adapt and lead in an AI-driven world.

This publication is the key outcome of ASEFInnoLab5, representing the collective effort of 61 scholars from 29 countries across Asia and Europe. Featuring 16 position papers, this volume provides multidisciplinary perspectives on the evolving role of universities in AI innovation ecosystems, with a forward-looking lens toward 2060.

The position papers are grouped under ASEFInnoLab5's thematic areas:

- Universities' Role in AI Governance: 2 papers
- Universities' Role in AI in Education: 12 papers
- Universities' Role in AI for Sustainable Development: 2 papers

This publication is the result of a rigorous Asian-European brainstorming process. Over a series of facilitated sessions, authors analysed diverse national and institutional landscapes, assessed how AI impacts universities, and examined how universities contribute to AI development. They explored future scenarios and identified key drivers of change, such as human- vs tech-centred AI development and equity in technology access, to shape strategies for navigating AI's transformative influence.

A key feature of this work is the identification of "no-regret moves"—proactive, strategic actions that universities and policymakers can take now to prepare for the era of AI. These steps are designed to help institutions embrace innovation while remaining adaptive to the significant changes AI will bring to their mission and operation.

This publication reflects a truly collaborative and interdisciplinary effort, blending insights from diverse disciplines and regions. While it does not aim to be exhaustive, it raises essential questions, defines key concepts, and offers strategic options to guide university administrators, scholars, and policymakers in their forward-looking discussions.

We encourage all readers—whether educators, administrators, or policymakers—to explore this publication. Its pages offer not just a roadmap for navigating the AI era but also inspiration for proactive, impactful leadership in higher education.

Reka Tozsa **Cleo Cachapero**

Acknowledgements

This publication was made possible through the collective efforts, expertise, and unwavering support of numerous individuals and institutions. ASEF extends its heartfelt gratitude to all those who contributed to this endeavor.

First and foremost, our deepest thanks go to the 16 teams of position paper authors, whose insightful papers form the core of this volume. These talented academics and experts, despite the demands of their professional lives, committed their time and energy to participate in the ASEFInnoLab5 programme and produced a collaborative body of work that exemplifies innovation and intercultural teamwork. Their dedication has been instrumental in bringing this publication to life.

We would like to acknowledge the exceptional contributions of our Facilitators from RTU Riga Business School in Latvia: Dr Claudio Andres RIVERA and Ms Paula ELKSNE-REVELIŅA. Their adept facilitation of virtual sessions and strategic guidance in shaping the position papers through stimulating approaches were invaluable. Dr RIVERA also provided crucial support throughout the entire development process of the publication, for which we are profoundly grateful.

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Introduction

Universities in the Age of AI—Navigating Transformation and Shaping the Future

Artificial Intelligence (AI) has emerged as a transformative force, reshaping industries, economies, and societies across the globe. Among the sectors most profoundly affected by this technological revolution is education. Universities, as the custodians of knowledge and the incubators of future leaders, face an imperative to adapt to the sweeping changes AI brings to the educational landscape.

As we move deeper into the 21st century, universities find themselves at a crossroads. On one hand, AI offers unprecedented opportunities to enhance learning, personalise education, and drive innovation across academic disciplines. On the other hand, it introduces complex challenges related to equity, governance, and the ethical use of technology.

This publication assembles a collection of position papers crafted by a group of 61 scholars from 29 European and Asian countries, exploring the complex relationship between AI and higher education. It examines how institutions can, not only adapt to, but also flourish in an AI-driven future.

The position papers focus on three critical themes: 1) the role universities can play in contributing to the governance of AI, 2) how they can transform their educational activities in response to AI, and 3) their role in advancing the sustainability agenda through AI application. Each position paper in this compendium offers insights into specific areas where AI intersects with higher education, presenting both the challenges and the opportunities that lie ahead.

Universities and the Governance of AI

As AI becomes more deeply integrated into educational systems, universities will play a critical role in shaping the governance structures that regulate its use. Some of the papers address the governance challenges associated with AI, including its implications for data privacy, bias, and accountability. Universities are uniquely positioned to influence these discussions, given their expertise in research, ethics, and policy development.

These papers argue that universities must not only adapt to the changes AI brings but also actively shape the rules governing its deployment. Whether through interdisciplinary research, public engagement, or collaboration with policymakers, universities have the potential to lead in the creation of fair, transparent, and inclusive AI systems.

The Transformational Impact of AI on University Teaching and Learning

The second set of position papers delve into the transformation of the educational landscape through AI. Universities are no longer static repositories of knowledge. Instead, they are dynamic ecosystems, where learning can be increasingly tailored to the individual needs of students through AI-powered adaptive technologies. This transformation is not just a technological shift but requires a paradigm change that affects pedagogy, student engagement, and the overall structure of academic programs.

AI has the potential to personalise education in ways that were previously unimaginable. From AI-driven learning assistants, such as the hypothetical AI-Buddy discussed in one of the papers, to advanced systems for student feedback and assessment, these papers explore the ways in which AI can make education more accessible, efficient, and effective. However, with these advancements come significant risks. As pointed out in several chapters, including those on *AI in Student Feedback and Assessment* and *AI for Collaborative Learning*, the integration of AI must be handled with care to avoid exacerbating existing inequalities in education and ensure that AI-driven tools remain aligned with the core values of academia—equity, inclusivity, and critical thinking.

Universities must also consider the ethical implications of AI in education. Papers such as *Shaping Tomorrow's Curriculum by AI: A Vision for 2060 in Higher Education* and *Personalised Bot Education Agents* highlight the dual nature of AI—as both an enabler of enhanced learning and a potential threat to the integrity of education. Universities must lead the way in ensuring that AI technologies are implemented ethically and responsibly, balancing innovation with a commitment to human-centred values.

Universities Harnessing the Power of AI to Drive the Sustainability Agenda

The intersection of AI and sustainability is a major focus of the last two papers, which explore how universities can leverage AI to drive the sustainability agenda. As centres of innovation and research, universities are well-positioned to develop AI solutions that address some of the world's most pressing challenges. From AI-driven climate modelling to smart energy systems, the possibilities are vast. However, the adoption of AI in this domain requires careful consideration of equity and access, ensuring that the benefits of AI are distributed fairly across different populations and regions.

In papers like *Positioning for Success: How Universities in Developing Countries Can Thrive in the AI Era by Focusing on Sustainable Development* and *Universities as Catalysts for Responsible AI: Reconciling Conflicting SDGs within AI Innovation Ecosystems in 2060*, the authors emphasise the need for a holistic approach that integrates AI into the broader goals of sustainable development. Universities must not only teach AI but also demonstrate how it can be used to create a more equitable and sustainable future.

Scenarios and No-Regret Moves for Universities

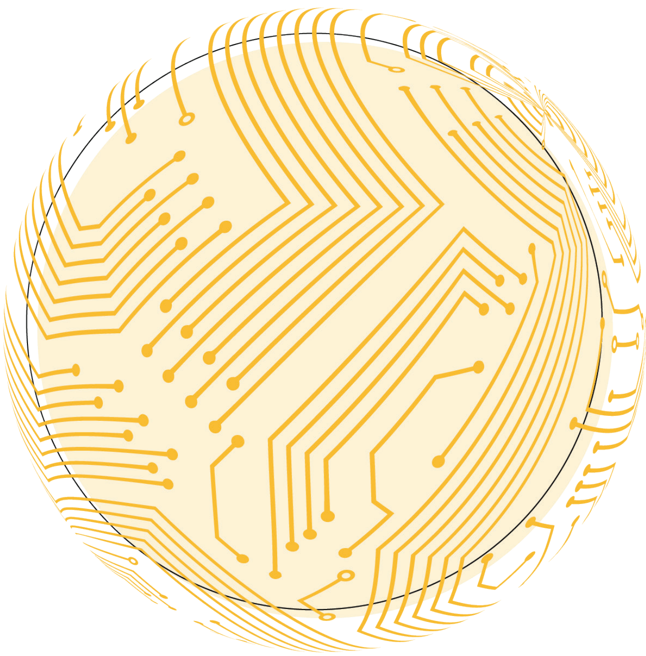
There are two recurring themes in this publication:

- Authors employed the scenario planning method to broaden their perspectives, envisioning possible futures and exploring proactive actions universities can take today to succeed in any of these scenarios. Each group developed detailed descriptions of how their specific topics—AI Governance, AI in Education, or AI for Sustainable Development—might unfold within these imagined futures by 2060. This process allowed participants to identify key issues and areas of concern, offering actionable insights and strategic directions for universities to navigate uncertainties and thrive in an AI-driven world.

- The concept of "no-regret moves" for universities is another recurring element in the papers. They are actions that institutions can take now to prepare for an AI-driven future, and considered to be safe choices under any circumstances irrespective of which scenarios are to be realised in the next couple of decades. Among the many moves included in this volume are investing in AI literacy, fostering interdisciplinary collaborations, and building AI ecosystems that integrate industry partnerships with academic research. As AI continues to evolve, universities must be agile, able to adapt their curricula, teaching methods, and governance structures to keep pace with technological advancements.

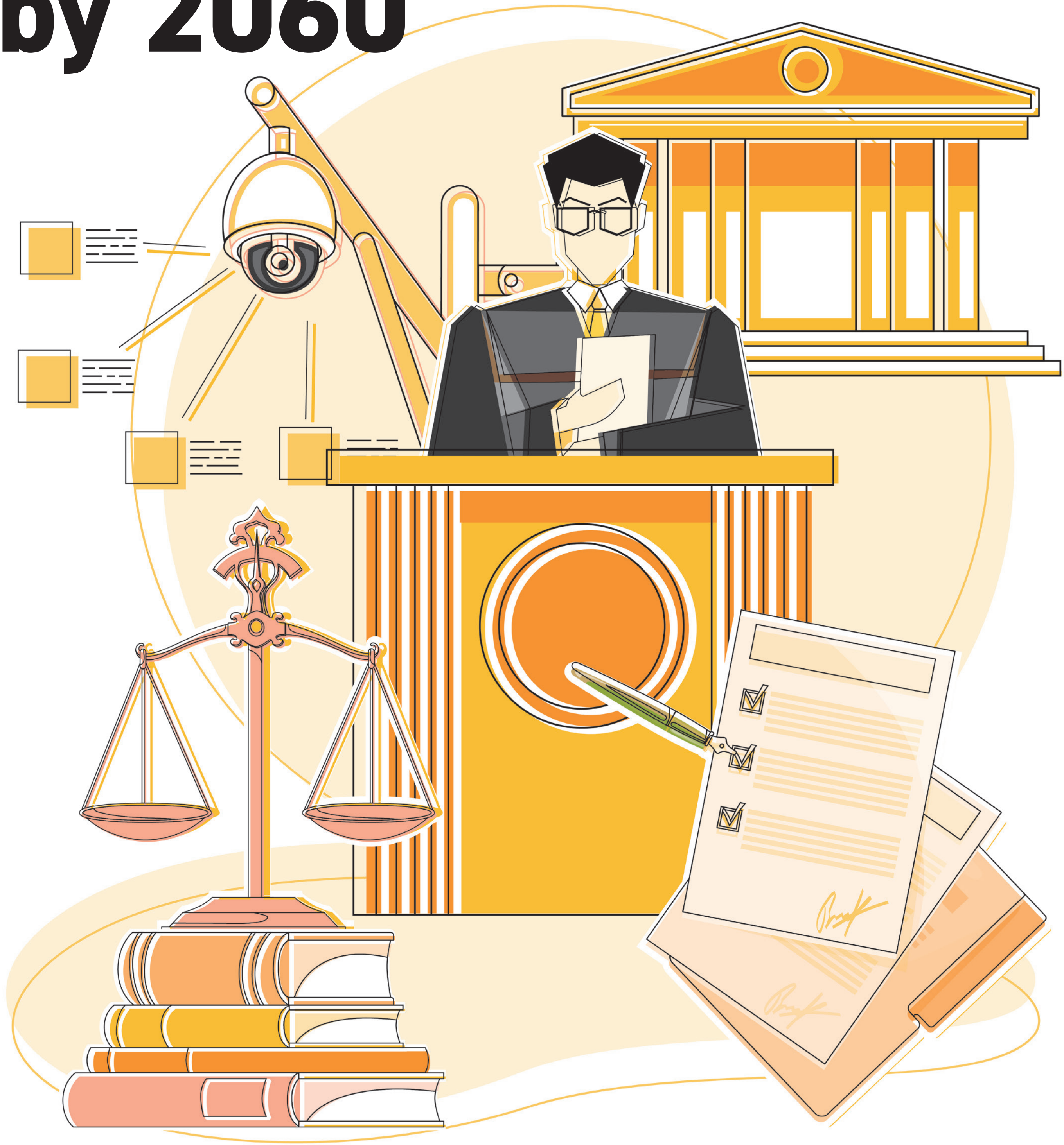
Conclusion: The Future of Universities in an AI-Driven World

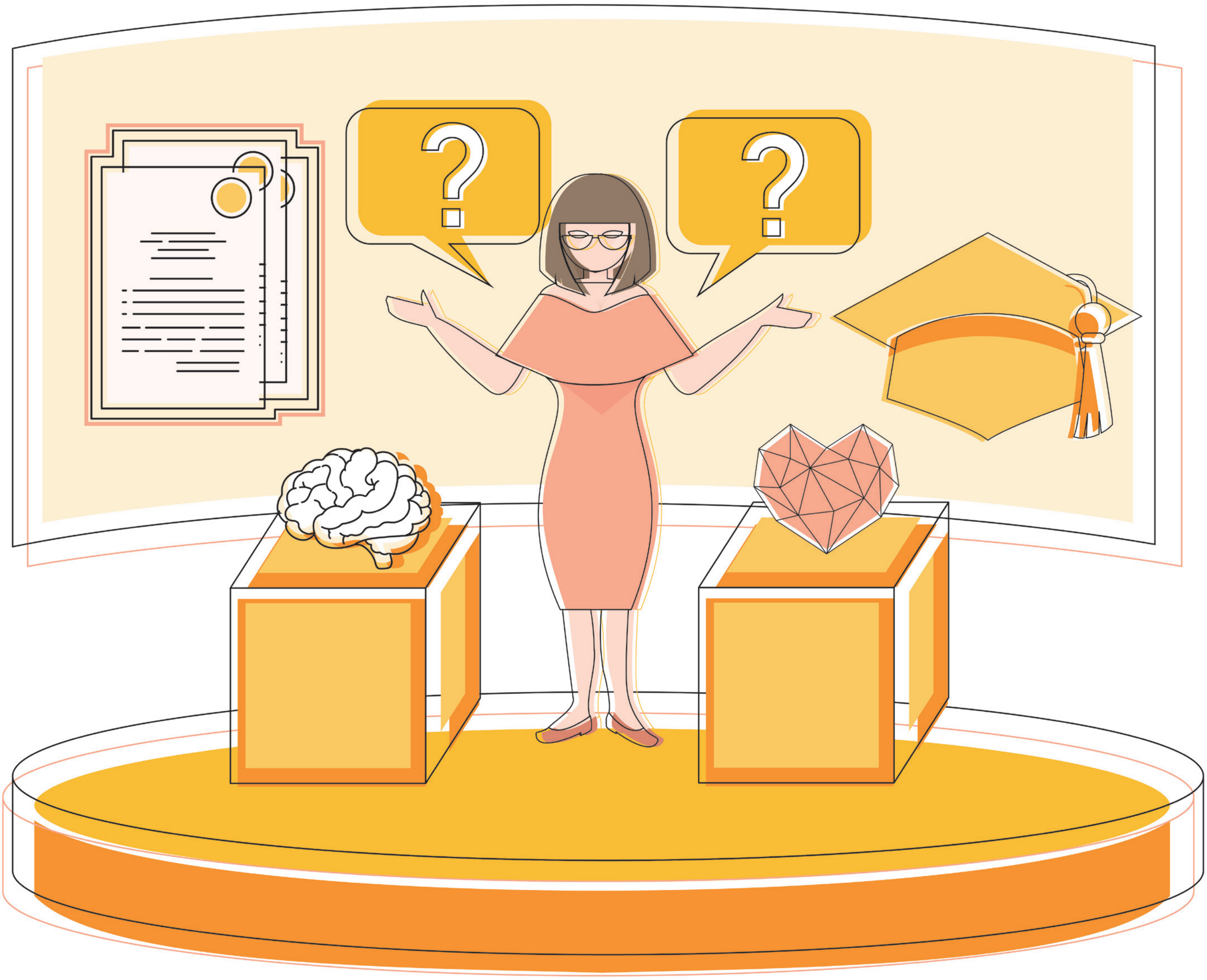
As AI continues to reshape the world, universities must embrace their role as both leaders and learners in this new era. The position papers in this publication offer a roadmap for how universities can navigate the challenges and opportunities that AI presents. By focusing on transforming educational activities and contributing to the governance of AI, universities can ensure that they remain relevant and impactful in the years to come.
This publication serves as both a call to action and a guide for universities seeking to adapt to the AI revolution. The no-regret moves outlined in these chapters provide actionable steps that institutions can take to stay ahead of the curve, while the discussions on governance and sustainability highlight the broader societal role that universities must play in shaping the future of AI. As the custodians of knowledge and the incubators of future leaders, universities have a unique responsibility to ensure that AI is used for the greater good, fostering a world that is more just, equitable, and sustainable for all.



PART 1

Universities' Role in AI Governance by 2060





Softening the Landing: Universities' Role in AI Governance

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Introduction

The following position paper will offer recommendations for European and Asian universities regarding their involvement in Artificial Intelligence (AI) governance. It will proceed in line with the parameters of the exercise proposed by the facilitators of 5th ASEF Higher Education Innovation Laboratory. To start with, it will make several observations about the current AI deployment context and perspectives of different stakeholders, relevant to the subsequent discussion. Afterwards, it will consider two drivers of change that, in the long term, have the potential to shape contexts in which AI governance could be embedded. The paper will then offer four hypothetical scenarios of AI development ecosystem in the year 2060, which derive from different configurations of drivers of change, outlining different opportunities and risks presented by each scenario. Lastly, it will discuss three "no-regret moves", i.e., actions Asian and European higher education institutions might take to positively contribute to AI governance in 2060, irrespective of which among the four scenarios would be the most likely to occur.

The Current AI Deployment Context

The beginnings of AI trace back at least to the first half of the 20th century (Haenlein & Kaplan, 2019). Ever since, AI occasionally captured popular imagination and underwent several "seasons" metaphorically representing expectations about its potential (Norvig & Russell, 2021). Few would dispute that for the past several years, "AI summer" returned, possibly to endure for years, or even decades to come. The preceding springtime provided solid foundations for all three key elements of AI development: (1) available mathematical models – with the appearance and development of "attentive" transformers (Vaswani et al., 2017), (2) computing power – Stanford researchers' idea to use GPUs to train AI models (Raina et al., 2009) combined with awe-inspiring precision of devices used in extreme ultraviolet lithography (ASML, n.d.), and (3) regular increase in data production volumes from c. 2 zettabytes in 2010 to the estimated 120 zettabytes in 2023 (Petroc, 2023). The result of these developments was as spectacular as it was unexpected by a public hitherto unfamiliar with AI systems. Not even two years have passed since Open AI made its ChatGPT available to the public and it already seems to be an important milestone in the history of AI development. ChatGPT was the application that attracted new users faster than any other (Hu, 2023). NVIDIA, holding c. 80% of the GPU production market share, has recently become the most valuable private company in the world (Leswing, 2024) increasing its market capitalisation over 300 times since the publication of the paper on using GPUs to train AI models.

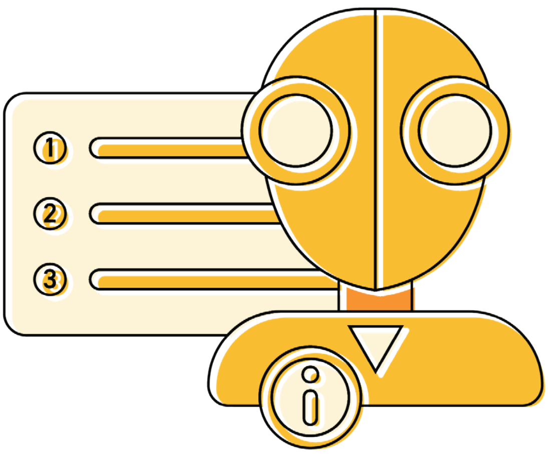
The rise of NVIDIA illustrates a widespread recognition of the fact that the usefulness of innovative AI models and systems is likely to greatly increase demand for them. Depending on the source and methodology used, the estimates of the size of the global AI market vary greatly, but there is a virtual consensus that it would swiftly grow in the next several years (Thormundsson, 2024), (Catsaros, 2023), (PwC, 2017). Accordingly, tech companies with adequate resources engaged in fierce competition are exploring the new frontiers of technological affordances of AI systems. For example, since the release of ChatGPT to the public, the struggle for hearts and prompts ensued, particularly between OpenAI and Google. The latter released its own chatbot, Bard, probably earlier than initially planned. The unfortunate consequence was that a single factual error made in the public demonstration apparently cost Alphabet as much as 100 billion dollars in its market value (Mihalcik, 2023). AI chatbots were no longer in the business of answering mere million-dollar-questions. Two years since, the race remains in place as the recent coinciding dates of release of OpenAI's ChatGPT-4o and Google's I/O developer conference imply. Market-related incentives to deploy innovative AI systems quickly in a relatively unregulated environment resonate with what Shoshana Zuboff (2019) described, based on Google's past actions, as "dispossession cycle". The cycle comprises four stages beginning with 1) an incursion into a new private sphere to collect data, 2) habituating users to the transgression, 3) adapting business practice as late and as little as possible, and 4) redirecting users' attention elsewhere, while minimising changes to own actions. One may doubt if knowing that such strategy proved profitable recently and while being engaged in a fierce competition, the largest tech companies would, on their own accord, go to great lengths to minimise negative consequences of their AI innovations. This is not to say that they would not invest their time, talent, and resources into attempting to ensure that their state-of-the-art products are reasonably safe, but rather that the time pressure felt from business competitors would lead to leaving certain risks incompletely explored.

In the recent years, there was no shortage of efforts to regulate AI development ecosystems, among them UNESCO's Recommendation on the Ethics of Artificial Intelligence (UNESCO, 2022), the European Union's so-called "AI Act" (Regulation 2024/1689, 2024), Canadian "Directive on Automated Decision-Making" (Directive on Automated Decision-Making, 2019), Singapore's "Model Artificial Intelligence Governance Framework" (Government of Singapore, 2020) and a number of alike documents. They stem from a clear need to address risks related to the unencumbered development of AI systems, such as algorithmic bias, violation of copyrights or privacy laws, lack of transparency, or deepening socio-economic inequalities. The role of the regulators is crucial as they coordinate the process of aligning innovative technological affordances with legislative frameworks of given jurisdictions and ethical considerations, and foster business-friendly ecosystems, combining them with the political authority necessary to implement new legislation. More comprehensive regulatory endeavours, with sanctions for non-compliance, are inherently complex and require time, which is why larger-scale legislative efforts (such as the EU's AI Act) enter into force years after their drafting has begun. At the same time, general regulations are vital to ensuring level-playing fields for AI innovators and, doubtlessly, more targeted regulatory acts or guidelines would follow over time. As (Mökander, 2023) pointed out, there already exists a "confluence of top-down [i.e. coming from regulatory bodies] and bottom-up [i.e., coming from the private sector] pressures" to develop viable AI auditing mechanisms. In a similar vein, (Wernick, 2024) draws attention to ex ante mechanisms of assessing the impact of an AI system deployment. Both those mechanisms ought to permit balancing of social and ethical challenges to AI systems' deployment pose whilst allowing AI developers to remain competitive.

At the same time, anecdotal evidence (Soh, 2022) suggests that even those AI systems' users who have solid reasons for adopting AI systems in their business have little patience for brief explanations of technical concepts behind them. One may thus reasonably doubt whether an average person using AI applications for daily use is likely to study basic mathematics describing stochastic gradient descent, compare consequences of applying different activation functions, understand the mechanism of backpropagation in neural networks, or understand the importance of attention in transformer models. Without developing an intuition about the mathematical aspects of AI models (e.g., that they are gargantuan polynomial functions arriving at an output by assessing probability based on training dataset, training method, and a given prompt), such users are vulnerable to misconceiving AI systems through analogies with popular culture works and, as a result, anthropomorphising AI. The risk is substantial as conceptualising AI with the use of analogies, as (Soh, 2023) argues, permeates computer science terminology (e.g., neural networks, attention, memory) itself. Misconceived anthropomorphising AI systems may lead to end users' impression that AI systems are "autonomous", which, depending on whether one thinks of "autonomy" in an "engineering" or "legal" sense, may contribute to construing very different perceptions on who is responsible for an AI system's harmful output (Soh, 2023).

While discussing tech companies, regulatory bodies and general public's perspectives on recent innovations in AI development in such format is already a very precarious exercise, any attempt at summarising universities' viewpoints is virtually bound to be, at least partially, incomplete, inaccurate, and unfair. The word "university" is meaning-heavy as it encompasses inter alia education-oriented, research-oriented institutions, each of which has an array of disciplinary backgrounds with its specific sets of attitudes and presuppositions about AI, each of which is deeply embedded in a particular historical, cultural, and political context. The same heterogeneity, which makes conflating all the above types of institutions into a single term and using it for analytical purposes a futile exercise, positions universities as potentially key stakeholders capable of developing unique relations with the other three stakeholders – tech companies, regulators, and the public. Universities with vision, means, strategy, and determination might even create their own ecosystems, which become reputable in the AI development circles. Fudan University is one example of a university going through a fundamental transformation of its curriculum and research objectives, nurturing its own computing power capabilities and making efforts to turn research projects into products (Fan, 2022). Nonetheless, for the time being, such a comprehensive approach appears to be more of an exception than a rule among higher education institutions.

Overall, the current AI deployment context features fierce competition of tech companies still exploring the limits afforded by abundance of data, relatively new training methods and ever-increasing computing power. All of this takes place at a time when AI deployment is not yet well-regulated, whilst the public, impressed by generative AI systems' capabilities, still struggles with grasping its basic conceptual underpinnings. This combination illustrates why developing solid methodologies for AI deployment's impact assessment and auditing AI systems is much needed. Attempts at devising auditing AI methodologies have already been made in practice by auditors (ISACA, 2018), (Chartered Institute of Internal Auditors, 2024). At the same time, just as AI systems' deployment is a result of interdisciplinary endeavours, it is likewise necessary to engage independent interdisciplinary teams to assess potential impacts of an AI system's deployment and audit it in due course. Such evaluations are particularly needed in the context of AI systems' potential to replace human employees in their workplaces.



The Drivers of Change

The paper will now turn to discussing two drivers of change that might strongly affect the future context of AI governance. The first concerns the scale of AI-induced job displacement, while the second regulatory bodies' ability to address the challenge effectively.

The first driver of change is the ability of tech companies to integrate already generative AI systems into high-precision robotics, which would determine the scale of the AI job displacement. To most contemporary people, it seems obvious that the discourse used to describe a physical object shapes the perception of the object. It is true both in terms of historical evolution – the understanding of a single concept producing multiple meanings and their consequences (Foucault, 2002) (West, 2018) – but also in terms of determining the scope of interactions with the same physical object. Insofar as the meaning of the word "hospital" evolved through the ages to produce different types of institutions for people as analysed by Foucault, a car as a physical object would offer completely different opportunities for a person, an animal, and a large language model. An animal would lack a conceptual understanding of the role of a vehicle, but its ability to navigate the physical world would permit to use it as, for instance, temporary shelter. A large language model could have a profound understanding of cars at a discursive level but would not be able to move itself using it due to absence of mechanical actuators. A person having both discursive understanding of the car's purpose and physical ability to use it can put the vehicle to the best use of the three. The above example illustrates that it is when deep conceptual understanding of physical surroundings is combined with ability to navigate the physical world freely that the array of potential actions of an agent is the broadest. In the context of the present discussion, the broader the array of potential actions, the more tasks AI systems could perform, and thus the greater the number of jobs of human employees at risk of being lost to AI systems.

The first driver of change – ability to integrate AI multi-modal models with robotics – would thus determine if AI systems would move to the same quadrant as people in the above matrix. If this happens, the impact on the possibility of replacing human employees with AI-powered mechanisms would be profound indeed.

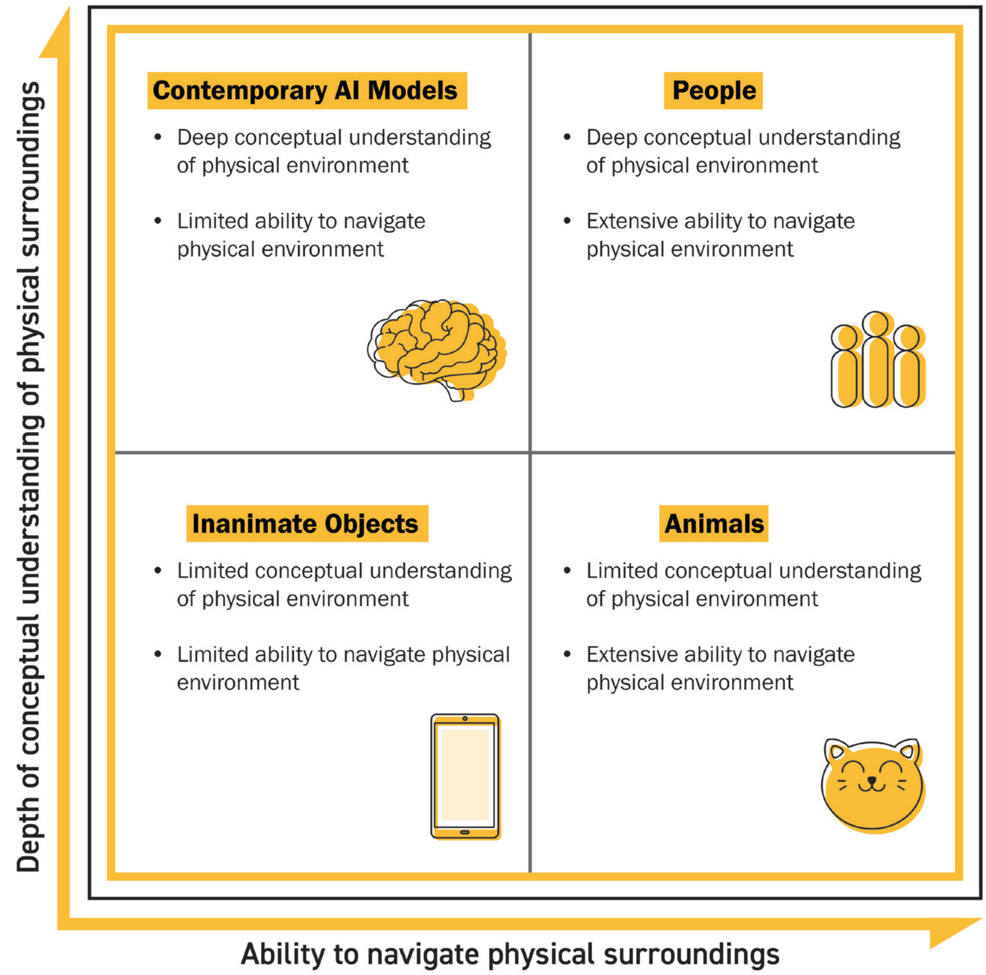


Figure 1. The impact of the two drivers of change

The second driver of change is the ability of regulatory bodies, be it at the level of international organisations or states, to proactively recognise potential challenges emerging from AI innovations and regulate them at the earliest possible stage. In principle, the longer time elapses between deploying an innovation into an un(der)regulated area, the longer "dispossession cycles" the users would need to endure without legal means to argue against the transgression, which could be of exploitative nature. This could lead to intense, though not always perceptible, social tensions since, regardless of the scale of the phenomenon, AI systems would not replace human employees everywhere simultaneously and would not render all of them unemployable (for they could have other desirable skills). Consequently, governments might need more proactive mechanisms to minimise the impact of innovative AI systems rendering human employees jobless. In the algorithmically accelerated future societies, the ability of regulators to ensure reasonable degree of safety and limiting tech-induced economic inequalities would be of cardinal importance. Whether such capability materialises is an open question.

The Four Scenarios of AI Development Ecosystem in 2060

The following section will explore four scenarios of potential AI development ecosystem in 2060 depending on the juxtaposition of binary states of the drivers of change in line with the below matrix.

Scenario 1: Domestication of intelligent robots

By 2060, tech companies successfully integrated AI-powered applications with high-precision robotics. Over time, this allowed for a development of a wide array of types of robots – those carrying out simpler tasks (e.g., industrial processes), and those capable of more diversified operations (e.g., housekeeping, gardening). Replacing human employees with tireless intelligent robots rendered most human employees jobless, yet regulatory bodies, at regional/state level, with jurisdiction over territories hosting most successful tech companies, developed

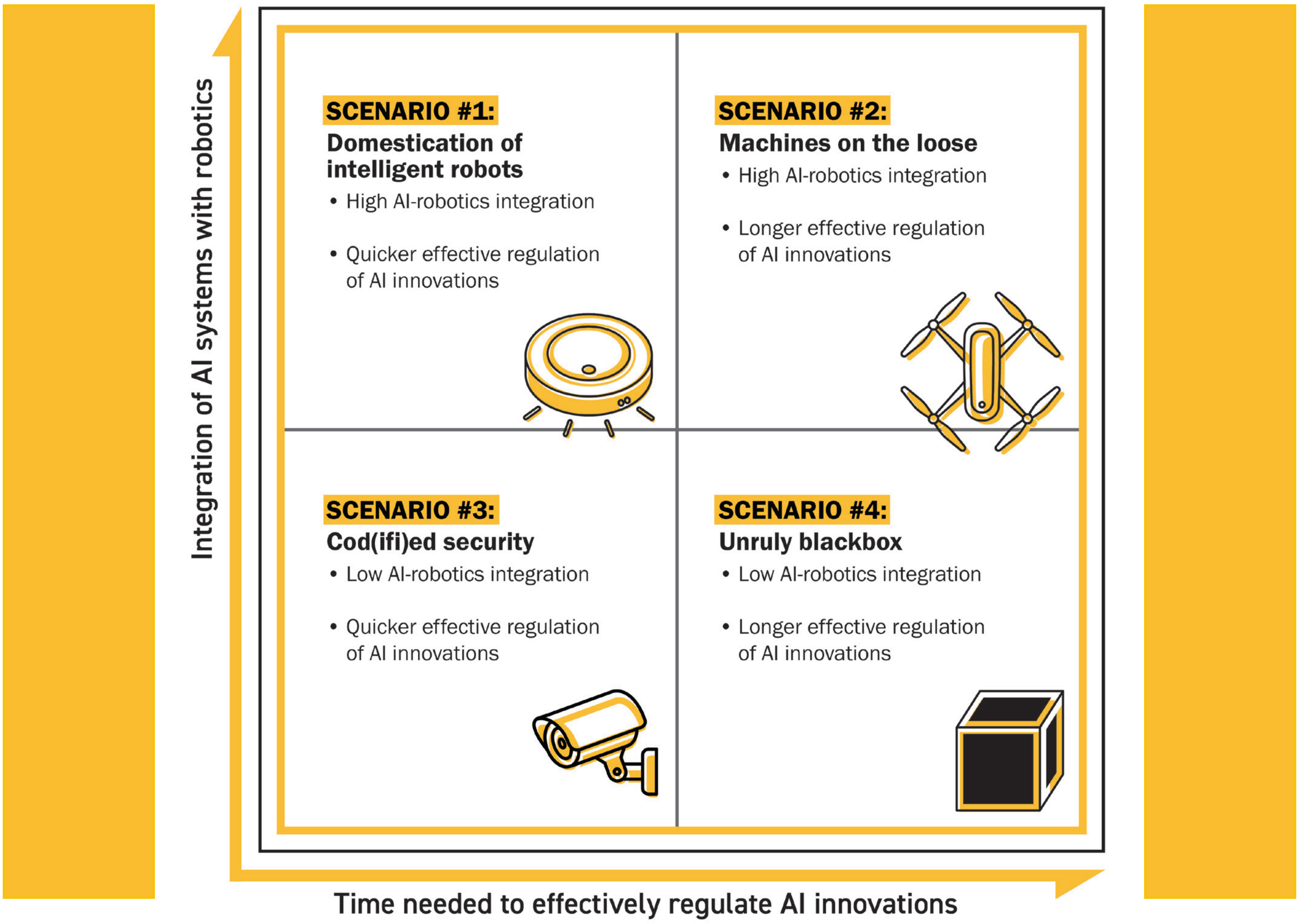


Figure 2. The four scenarios of AI development ecosystems

mechanisms allowing quick regulatory responses to the newest AI innovations. The regulations resulting from the process, were in line with the pre-existing legislation, consistent with the actor's political decision-making processes, as well as legally binding. Accordingly, even in case of more imaginative AI innovations, it was not possible to exploit regulatory gaps for long, which minimised negative socio-economic impact of their deployment. Fair redistributive practices resulted in limiting social tensions resulting from AI-induced job displacement, despite its extensive scope. The relative orderliness of the deployment of new AI systems (including robots with multimodal generative AI systems) greatly benefits from an extensive involvement of universities. Interdisciplinary teams of researchers from universities and practitioners continuously develop effective and practical impact assessment tools and audits methodologies to ensure the safety of new AI systems. University-led teams of researchers cooperate with tech companies to observe innovative AI projects and to formulate regulatory suggestions in parallel to technological developments, thereby drastically reducing time needed to fill regulatory gaps. People generally trust that deployed AI systems are safe, even if black swan situations occur on occasion. AI systems' impact assessments and their audits contribute to determining the proportion of automation profits that ought to be redistributed in the form of universal basic income and re-skilling allowance for AI-displaced employees.

Scenario 2: Machines on the loose

By 2060, tech companies successfully integrated AI-powered applications with high-precision robotics, creating business opportunities to replace human employees with intelligent robots. Over time, this pushed large numbers of human employees out of their work, with few employment opportunities left. When it came to rapidly developing AI innovations, states/international organisations' processes of collecting data, consulting relevant stakeholders, drafting legislation and making it part of legal orders remained slow (in political cultures considered democratic), imperfectly informed (in political cultures considered more authoritarian), or not legally binding (in cases of large international organisations). As a result, the negative socio-economic impact of the innovative AI systems' deployment was both strong and enduring, which led to profound social tensions wherever AI systems replaced human employees. Ever since robots were equipped with multi-modal AI systems, the pace of their innovative application increased dramatically, overwhelming both slow decision-making processes as well as AI impact assessors and auditors. While universities attempted to offer regulatory suggestions based on research surrounding potential innovations of AI systems, they were not organised well enough to engage regulatory bodies within a framework of coherent consultative mechanisms. The general public's suspiciousness of new technologies persisted but did little to impede the pace of deploying AI-aided robots. Political tensions emerged as neo-luddite movements attempted to secure living standards for swathes of employees replaced by AI-aided robots.

Scenario 3: Cod(ifi)ed security

By 2060, tech companies were able to greatly enhance AI-powered applications but faced insurmountable obstacles when it came to integrating them with robots. A dearth of sufficiently developed training datasets that could develop device's ability to interact with physical objects (Gibney, 2024) resulted in robots' high production costs, incommensurate to generated profits. Other AI systems can carry out tasks that do not require (much) navigation of the physical environment (with autonomous vehicles being a notable example). Deployment of AI systems did produce a large-scale job displacement but left human employees a large niche in sectors where complex manual operations remain necessary. At the same time, regulatory bodies developed mechanisms allowing quick legal responses to the newest innovations, shortening the time where negative socio-economic impact was most perceptible. University-led innovation observatories closely cooperate with tech companies and regulatory bodies. Their function is twofold. Firstly, they engage in developing effective impact assessment frameworks for new AI systems as well as auditory frameworks for the already deployed AI systems. Secondly, they develop regulatory and practice-oriented suggestions ensuring safety of the future AI systems. Whilst the complexity of AI systems' training methods is steeply increasing, the absence of robots with integrated multi-modal AI systems makes the regulatory tasks manageable in the foreseeable time horizon. Impact assessments and audits contribute to determining the proportion of profits stemming from work automation that would be redistributed as gradually increasing universal basic income and re-skilling allowance for AI-displaced human employees. To complement their universal basic income, large groups of displaced workers engage in re-skilling towards job positions requiring the manual dexterity of a human employee.

Scenario 4: Unruly black box

By 2060, the interest in AI systems and their impact on labour market subsided. After initial hype in the earlier decades of the 21st century, tech companies proved unable to integrate multi-modal AI models with precise robotics (cost-)effectively. While AI systems continue to flourish, they have limited ability to navigate and affect their physical surroundings (except autonomous vehicles), thereby pressuring some groups of human employees to re-skill towards jobs requiring manual dexterity. At the same time, regulatory bodies did little to shorten the periods of legal gaps exploited by tech companies deploying AI innovations. Consequently, the negative socio-economic impact of AI-induced job displacement is narrower in scope, but strongly perceptible for human employees affected by it. New mathematical models underpinning AI systems emerged and their unexpected applications were quickly adopted by large segments of world's population. However, regulatory bodies failed to fill regulatory gaps quickly and efficiently. AI systems' level of complexity and potential consequences of their deployment were understandable merely to relatively scattered and incoherent groups of university researchers who were in no position to offer regulatory suggestions to regulatory bodies. This contributed to an increase in inequalities in favour of those with stakes in innovative algorithmic enterprises. General distrust of further algorithmic innovations has become the prevalent sentiment of the other groups. As equipping robots with multi-modal AI systems proved economically impractical, the phenomenon of AI-induced joblessness affected predominantly the employees replaced by AI systems. This marked a new social rift that rendered maintaining a degree of social stability difficult.

No-Regret Moves

Irrespective of which scenario of the world in 2060 turns out to be the most likely, already in the second decade of the 21st century universities can engage in several actions that could enhance AI development ecosystem.

No-Regret Move 1: AI taxonomies

Already today, Asian and European universities could further intensify their efforts and collaborate on improving the depth of public understanding of AI systems in their home countries. Increasing public awareness about AI beyond a rather superficial understanding, from ("What AI can do?") towards ("How does AI execute its tasks?", "What could AI possibly do in the future?"), would permit increasing human employees' resilience towards potential AI-induced changes to the labour market. As a feasible first step, universities could engage in collaborative efforts to develop a more precise terminology by creating two standardised taxonomies – of AI training methods and, as its derivative, of AI systems. Both taxonomies should be open-ended enough to include future training methods and systems. As AI training methods relate to mathematical models, the completion of the first taxonomy could be an axiologically neutral exercise and could pave the way for more ambitious cooperation on the second, AI model taxonomy. Once in place, such taxonomies would require regular revisions or updates, which would constitute an opportunity for merit-based discussions on innovations in mathematical methods used in AI system trainings. The expected results could benefit many stakeholders. Engaging in developing such two interrelated taxonomic systems would facilitate concise labelling and greatly enhance the quality of discourse about AI by non-experts. Non-expert discourse would gradually steer away from using the term "AI" as an umbrella term for, e.g., expert systems, convolutional neural networks, recurrent neural networks, transformers and others, which would nudge the users towards gaining basic understanding of the differences between these terms. A standardised taxonomy would also facilitate efforts to illustrate mathematical underpinnings of each AI system to the public – enhancing non-experts' understanding of AI's advantages, disadvantages, risks, and trends. It would also motivate voters to factor AI competence of candidates for public offices in their [voting] considerations. Moreover, academic researchers involved in developing the taxonomies would find it easier to focus their attention on specific subsets of AI training methods and AI systems. This could foster an in-depth academic reflection on epistemic limits of AI systems and subsequently translate into clarified practical guidelines for AI developers, both in terms of good practice codes as well as formal protocols for impact assessment of AI systems and auditing AI systems. Clearer formal and informal guidelines for AI developers could lessen compliance-related burdens, especially for smaller AI developers without resources to maintain sizeable legal teams.

No-Regret Move 2: Developing methods of AI innovations' impact assessment and audit

Asian and European universities could also act as (co-) developers of robust methodologies facilitating the processes of AI's impact assessment and auditing AI systems. The development of robust ex ante and ex post evaluation practices of AI systems deployment will play an increasingly important social role providing answers to questions about both technical robustness and normative appropriateness (Russell et al., 2015, after Mökander, 2023). Moreover, academic AI experts could advocate for impact assessment methods that include analyses of country-/region-specific impact of permitting the deployment of an AI innovation on a given labour market. Such analyses could be vital in determining how regulatory bodies should proceed with regulating AI innovations in the coming decades and configure policies redistributing profits stemming from replacing human employees with AI systems. This would apply to all above scenarios, albeit to a different extent depending on the scale of AI-induced job displacement (i.e., on the ability to integrate multi-modal AI models with robotics). Academic staff could also be important in developing standardised procedures for AI impact analysis and auditing AI systems through collaborative research on discerning legal design patterns (Wernick, 2024), process-oriented audits, and methods of updating evaluation practices in line with the new AI development methods' emergence. Moreover, audits of AI systems could include estimation of profits generated by them at the expense of displaced human employees, which could serve to further finetune and update policies regulating the redistribution of automation profits and, consequently, moderate the impact of AI-induced job displacement regardless of its scope, scale, and pace.

No-Regret Move 3: Research policies smoothening AI innovations' socio-economic impact

Lastly, university researchers could serve an important role in informing regulatory responses to AI-induced job displacement. Depending on the scenarios, the scale of the challenge could be radically different, but its existence already appears conspicuous. The predictions about the pace and AI-induced job displacement rates differ rather widely (Lee, 2018), although a relatively recent prediction about c. 50% of jobs being potentially replaceable by AI systems by 2027 appears accurate following the release of generative AI models (Ma, 2024). Naturally, the technical feasibility of replacing human employees with AI systems or AI-powered robots is one thing, the actuality of implementing such measures on a large scale is another. However, the potential social upheavals that could be triggered if sleepwalked into, deserve a prior in-depth reflection, including planning of countermeasures. Universities could contribute to alleviating some of the impact on AI-induced joblessness by setting up interdisciplinary teams comprising for e.g. economists, lawyers, political scientists, sociologists, and psychologists. Such teams could cooperate to offer viable policy recommendations to facilitate displaced employees' transitions to new jobs in the short- to mid-term and consider bolder scenarios of social transformation in case most current jobs would, in principle, be replaceable in the longer term. Policy recommendations for lessening social tensions caused by AI-induced joblessness could involve for e.g. case studies experimenting with incrementally rising universal basic income and additional automation allowances in case of sudden AI-related job loss. In view of the country-specific idiosyncrasies of AI-displaced groups of employees, the continuous exchanges between Asian and European universities could prove very fruitful, as they represent collectivist and individualistic cultures respectively. While certain caveats (Talhelm, 2019) apply, such diversity would undoubtedly be an advantage.

Summary

This position paper began by considering persisting ripple effects of the disruptive release of generative AI models in late 2022 from the perspectives of tech companies, regulatory efforts, end users, and universities. It then offered two drivers of change related to 1) the tech companies' ability to integrate AI multi-modal systems with physical actuators, and 2) the regulators' ability to shorten the gap between the release of AI innovations and their effective regulation. It then reflected on four potential scenarios of the year 2060 emerging from different configurations of binary states of each driver of change. Subsequently, it recommended three no-regret moves for the present-day universities: 1) to engage in enhancing the quality of public debates with AI non-experts, to begin with, by developing two taxonomies – one for AI mathematical models and the other for AI systems, 2) to research and develop best practices for interdisciplinary teams evaluating various aspects of AI systems both prior to and after their deployment, and 3) to prepare and offer well-substantiated, context-specific policy recommendations for smoothening the socio-economic impact of AI-induced job displacement.

All in all, it underscores that universities are uniquely positioned to facilitate the process of AI governance and that the cooperation between Asian and European universities could be particularly fruitful as they implicitly emphasise different cultural perspectives.

References

ASML. (n.d.). *EUV lithography systems*. https://www.asml.com/en/products/euv-lithography-systems

Catsaros, O. (2023). *Generative AI to Become a $1.3 Trillion Market by 2032, Research Finds*. Bloomberg Intelligence. https://www.bloomberg.com/company/press/generative-ai-to-become-a-1-3-trillion-market-by-2032-research-finds/

Chartered Institute of Internal Auditors. (2024, February 20). *Auditing artificial intelligence*. https://www.iia.org.uk/resources/it-auditing-and-cyber-security/auditing-artificial-intelligence/

Fan, W. (2022). *The Role of Universities in Building an Artificial Intelligence Ecosystem - Insights from Professor Shen Yi, leading expert on Cyberspace International Governance Research and International Relations*. Medium.Com. https://medium.com/asefedu/the-role-of-universities-in-building-an-artificial-intelligence-ecosystem-insights-from-professor-c2141138866a

Foucault, M. (2002). *The Order of Things: An Archaeology of the Human Sciences*. Routledge.

Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review*, *61*(4), 5–14. https://doi.org/10.1177/0008125619864925

Hu, K. (2023). *ChatGPT sets record for fastest-growing user base - analyst note | Reuters*. Reuters. https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/

ISACA. (2018). *Auditing Artificial Intelligence*. https://ec.europa.eu/futurium/en/system/files/ged/auditing-artificial-intelligence.pdf

Leswing, K. (2024). *Nvidia passes Microsoft in market cap, is most valuable public company*. CNBC. https://www.cnbc.com/2024/06/18/nvidia-passes-microsoft-in-market-cap-is-most-valuable-public-company.html

Mökander, J. (2023). Auditing of AI: Legal, Ethical and Technical Approaches. *Digital Society*, *2*(3). https://doi.org/10.1007/s44206-023-00074-y

Norvig, P., & Russell, S. (2021). *Artificial Intelligence: A Modern Approach, Global Edition* (4th ed.). Pearson.

Petroc, T. (2023). *Amount of data created, consumed, and stored 2010-2020, with forecasts to 2025*. Statista.Com. https://www.statista.com/statistics/871513/worldwide-data-created/

PwC. (2017). *Sizing the price*. https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

Raina, R., Madhavan, A., & Ng, A. Y. (2009). Large-scale deep unsupervised learning using graphics processors. *ACM International Conference Proceeding Series*, *382*. https://doi.org/10.1145/1553374.1553486

Soh, J. (2022). The executive's guide to getting AI wrong. *Asian Management Insights*, 9(1), 74–80. https://ink.library.smu.edu.sg/ami

Soh, J. (2023). Legal dispositionism and artificially-intelligent attributions. *Legal Studies*, *43*(4), 583–602. https://doi.org/10.1017/lst.2022.52

Thormundsson, B. (2024). *Artificial intelligence (AI) market size worldwide from 2020 to 2030*. Statista.Com. https://www.statista.com/forecasts/1474143/global-ai-market-size

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, Ł., & Polosukhin, I. (2017). Attention is all you need. *Advances in Neural Information Processing Systems*, *2017-Decem*(Nips), 5999–6009.

Wernick, A. (2024). Impact Assessment as a Legal Design Pattern—A "Timeless Way" of Managing Future Risks? *Digital Society*, *3*(2), 29. https://doi.org/10.1007/s44206-024-00111-4

West, S. (2018). *Episode #122 - Michel Foucault Pt. 2 - The Order of Things*. https://www.philosophizethis.org/transcript/episode-122-transcript

Zuboff, S. (2019). *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. Profile Books Ltd.

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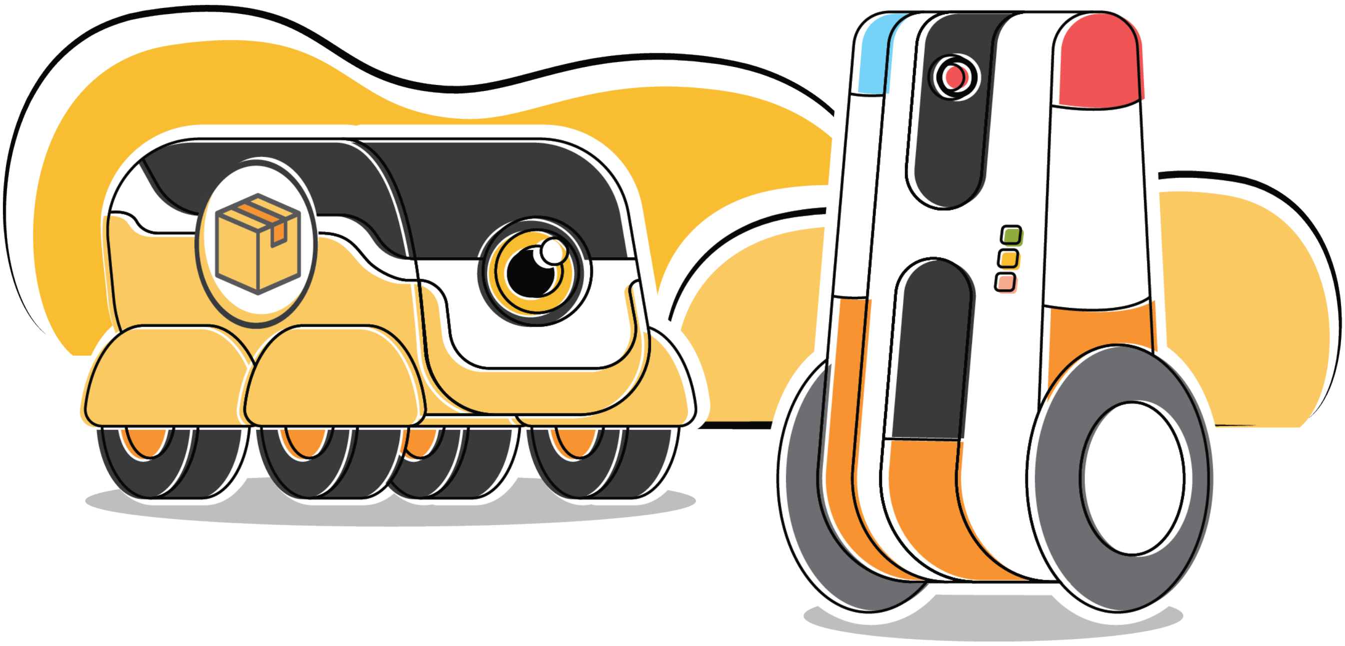

Universities as Catalysts: Advancing Ethical and Inclusive AI Governance




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Introduction

The rapid recent advancements in Artificial Intelligence (AI) offer opportunities across various domains, including medicine, engineering, education, and agriculture, but also introduce risks such as ethical dilemmas and security concerns. These risks must be managed to fully harness AI's benefits.

Risks can arise from the algorithms themselves or from improper use. Indeed, machine learning (ML) algorithms allow for learning AI models from data, but if the data are biased, those biases are reflected in the models. Additionally, if the data do not cover all possible scenarios, AI systems may struggle with unexpected inputs. Examples of improper use of AI include social scoring, biometric surveillance, and manipulative systems. AI development must therefore address not only technical aspects, like accuracy, robustness, transparency, and performance, but also ethical, legal, and social concerns to manage these risks comprehensively.

Regulations worldwide aim to balance innovation with the protection of fundamental rights, addressing the ethical, legal, and social implications of AI. While they acknowledge AI's benefits across sectors, they also work to mitigate its risks. International organisations like the OECD and UNESCO are advocating for global standards that promote transparency, accountability, and human-centred AI (OECD, 2022; UNESCO, 2019).

However, challenges remain. There are no universally accepted standards for evaluating AI quality and performance. AI performance is often assessed using developer-specific datasets, which can introduce bias. Standardised testing procedures and open access to datasets are essential for fair comparisons and ensuring that AI methods perform well in diverse contexts (Huang et al., 2021; Akter et al., 2021; Leavy & Siapera, 2020). Further, a general method to measure performance and quality would enable insights into standardised performance metrics allowing for generalised comparison across domains (Chidiogo et al., 2024; Hicks et al., 2022). Additionally, data representation and metrics must account for ethical, legal, and social considerations. Global agreements involving experts from various disciplines and cultures are essential to establish guiding principles for AI development (Hureye, 2023; de Almeida et al., 2021).

Bridging the gap between research and real-world application requires enhanced learning strategies to address AI's limited generalisability and potential biases (Pereira et al., 2023; Borges et al., 2021), and to increase transparency of AI systems (Taboada et al., 2023). International collaboration can help establish best practices for data sharing, testing procedures, and ethical considerations (Xiaoteng et al., 2021), ensuring that AI development prioritises technical excellence, human rights, and social well-being. Academia plays a crucial role in this effort by training informed developers and generating innovative solutions through high-level research.

This paper explores the critical role of universities in promoting ethical and inclusive AI governance. By taking action now, universities can prepare a new generation of AI developers and researchers who are technically proficient, ethically aware, and legally informed. This comprehensive education strategy is essential to effectively navigating the complex interplay between AI advancement and its social impacts, ensuring AI technologies are developed and deployed beneficially, fairly, and safely for all. Furthermore, universities play a critical role in advancing AI technologies and ensuring they are trustworthy, robust, and beneficial to society. Also, the scientific community can promote the establishment of international committees to create universal AI principles and application-specific standards with the aim of defining transparent and open performance measurements to ensure fairness and comparability in AI innovations.

In the remainder of the paper, we describe the status quo in Section 2. In Section 3, we introduce the drivers of change. Section 4 describes four envisioned scenarios and Section 5 proposes four no-regret moves. Finally, Section 6 draws some conclusions.

The Status Quo

AI, as a transformative technology, offers great potential but also presents significant risks. AI models can perpetuate and amplify biases present in training data, such as gender or racial discrimination. Furthermore, their reduced robustness can result in errors and potential hazards in real-world applications, such as incorrect medical diagnoses (Ünver, 2024). Finally, the misuse of AI can infringe upon human rights, highlighting the urgent need for strong regulatory frameworks (UNESCO, 2022).

Many researchers are working on mitigating the first two issues. Regarding the third issue, countries worldwide have proposed AI regulations, striving to balance fostering innovation with addressing technology's ethical, legal, and social implications. The European Union has taken a new approach with its proposed AI Act, which classifies AI systems into different risk categories: prohibited, high-risk, and limited-risk applications (European Parliament, 2024).

China has adopted a centralised and stringent regulatory approach (State Council of China, 2017). China's AI strategy emphasises state control over AI technologies, with regulations targeting algorithmic transparency and data security (Sacks, 2021). In 2020, non-mandatory industry standards were introduced, followed by mandatory regulations in 2023, such as the Generative AI Measures emphasising content management, transparency, and legal compliance (Bird & Bird, 2024).

In contrast, the United States has yet to establish a unified federal regulatory framework for AI. While various states have introduced AI-related laws, federal regulation remains fragmented. However, the U.S. President's October 2023 Executive Order on AI marks a step toward addressing AI risks (The White House, 2023). It outlines a roadmap for AI regulation and promotes collaboration between the government, private sector, and civil society to ensure responsible AI deployment. It also emphasises the importance of transparency, fairness, and accountability in AI systems (The White House, 2023).

Other countries, including Australia, Canada, Japan, South Korea, and UK, have also been proactive in AI regulation. Their initiatives focus on addressing the impact of AI systems by prioritising transparency, fairness, and ethical considerations to promote responsible development and deployment of AI technologies.

Despite these efforts, achieving universal ethical principles for AI remains elusive. The divergence in regulatory approaches between regions - such as the EU's risk-based framework, China's top-down regulatory model, and the U.S.'s decentralised strategy - reflects differing cultural, political, and economic priorities (Franke, 2021). The complexity of AI technologies and national interests makes establishing globally recognised ethical standards difficult. Issues such as transparency, fairness, and accountability in AI systems lack universally agreed-upon definitions and measurable metrics, complicating the pursuit of a common ethical framework (Hacker, 2023).

Moreover, the role of academic institutions in shaping and standardising AI regulations has been notably minimal, suggesting that there is substantial room for enhancement in this domain. Meyer (2022) argues that the root cause for the elusive nature of a universal principle for AI ethics can be traced back to the deeply ingrained differences in governance philosophies, economic priorities, and political ideologies among world's leading AI powers. Despite widespread recognition of the importance of ethical considerations in AI, the vastly different approaches to realising these principles significantly hamper the possibility of reaching a global consensus. This situation encapsulates the intricate interplay of global dynamics in the pursuit of ethical AI, marking it as a complex and evolving challenge that requires thoughtful navigation through the differing visions of these key players. Academia with its neutrality can play a key role in finding global consensus.

The Drivers of Change

Understanding the drivers of change is essential for shaping the future, particularly in the landscape of technological development. These drivers reveal how various factors interact, enabling us to anticipate future developments and prepare for challenges and opportunities. This analysis focuses on two dimensions: **human versus technology centrality** and **equity in technology**. These dimensions help explore whether technology will prioritise human values or emphasise efficiency. We will discuss four possible scenarios illustrating different combinations of centrality and equity in the next section. Universities are pivotal in this process, advancing technology through research and contributing to economic growth and sustainable development (Salmi, 2021). By engaging with communities, they address complex social, economic, and environmental issues and influence technology's societal impact by providing evidence for policymakers.

Incorporating equity is crucial to addressing disparities in access and benefits, ensuring inclusive and fair outcomes from technological advancements (Schot & Steinmueller, 2018). Understanding these drivers enables organisations to make informed decisions about resource allocation and strategic priorities. By considering these drivers, we aim to foster technological advancements that prioritise human well-being and social justice, ensuring technology serves the greater good (OECD, 2001).

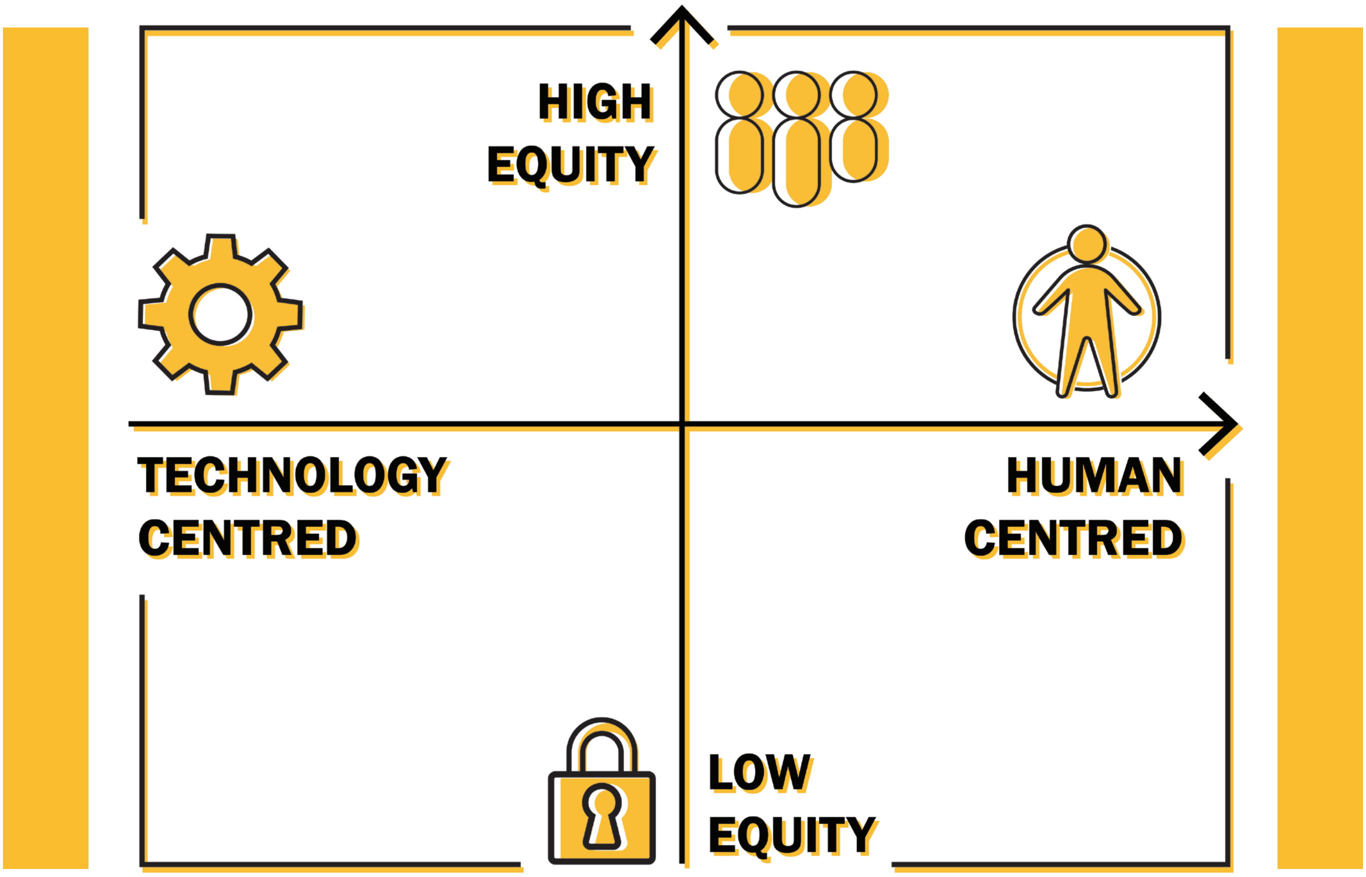


Figure 1: The Socio-Technical Equity Plane

The Four Scenarios

We develop four scenarios illustrating different combinations on the socio-technical equity plane illustrated in Figure 1, projecting their potential impacts by 2060. These scenarios help stakeholders envision possible futures and prepare for arising challenges and opportunities.

Scenario 1:
Open, free, worldwide approved standards tackling ethical issues (high equity, human-centred)

In a world of high equity and human-centric AI development, open and globally approved standards address ethical challenges. Efficient, dynamic, and adaptive governance frameworks prioritise human well-being and accessibility while balancing innovation with societal impact (Taeihagh, 2021). These frameworks bridge the digital divide, empower underserved communities, and ensure AI technologies benefit everyone. Adaptive governance allows for continuous evaluation and adjustment of regulations as AI evolves, fostering responsible innovation aligned with societal values (Marchant & Wallach, 2015).

A multidisciplinary international committee comprising members from academia, industry and international organisations elaborates globally approved and open standards that strike a balance between fostering innovation and protecting human well-being. The role of academia in the work of this committee is crucial since science has always built bridges between nations by vocation and has been pointing out the possible risks of AI. This initiative aims to develop open models and interoperable AI systems, reflecting a collective move towards more robust and cohesive AI standards. All AI products undergo certification to guarantee quality and compliance with these standards, resulting in compatible, interoperable, and trustworthy AI products.

Despite the widespread adoption of AI tools, standards can become outdated rapidly. Efforts are underway to streamline and expedite the approval process to keep pace with rapid advancements in the field. Significant progress is evident in the increased emphasis on AI ethics and the growing collaboration among the tech industry, academia, and international organisations.

Scenario 2: Pure technology-driven, open, free, worldwide approved standards (high equity, tech-centred)

The main issue in this scenario is the tension between prioritising technological advancements in AI and ensuring equitable access and human well-being. While policies aim to reduce the digital divide and make AI accessible across socio-economic backgrounds, there is a concern that the focus on maximising AI's technological potential may overshadow broader considerations of human welfare (Floridi et al., 2018). Balancing innovation with inclusivity and ethical considerations remains a critical challenge in AI development and deployment (Vinuesa et al., 2020). In this scenario, all AI products undergo certification to ensure technical quality and compliance with standards; however, human well-being and ethical considerations are either excluded or not prioritised.

The policies and initiatives have been implemented to ensure that rapidly evolved cutting-edge AI technologies benefit all segments of society. These efforts aim to reduce the digital divide, which refers to the gap between those with access to digital technologies and those without, by making advanced AI tools and resources accessible to everyone, regardless of their socio-economic background. Investments in infrastructure, such as expanding internet access and improving digital networks, are prioritised to support the widespread adoption of AI.

Additionally, education and training programmes are being developed to equip individuals with the necessary skills to use and benefit from AI technologies. By promoting digital literacy and providing resources for continuous learning, these initiatives empower people to participate fully in the AI-driven economy.

However, the primary goal of maximising the technological potential of AI sometimes overshadows broader considerations of human well-being. While the focus on innovation and performance drives impressive advancements, it can occasionally neglect AI's ethical, social, and psychological impacts on individuals and communities. AI development also poses potential risks, such as job displacement, privacy concerns, and algorithmic bias, which are not fully addressed in this scenario.

Scenario 3: Commercial, company-maintained standards with ethical, social issues (low equity, human-centred)

AI development prioritises human-centred goals but benefits primarily affluent groups, exacerbating socioeconomic disparities (Eubanks, 2018). While ethical considerations are emphasised, access to AI technologies remains limited for underserved communities (West et al., 2019).

Standards for technology or AI are in place, yet accessibility largely favours those in academia and industry that are already equipped with advanced technology and possess the financial means to implement these AI solutions. There are no open standards, or they are constrained; the quality checking, reliability checking techniques, etc., are companies' intellectual property, mostly secret. The cooperation between tools is limited to products from the same company. The premium AI tools have certificates, but the majority do not. This creates a disparity in access to these critical resources, where only a select few can genuinely benefit from these standards; the majority are left behind in the technological advancement race. Moreover, a majority of people use unpredictable, not standardised, AI tools that are dangerous and do not protect users' privacy and others' rights.

The main challenge in this scenario is ensuring equitable AI governance to democratise both AI use and innovation, addressing the needs of all populations rather than just those who can afford advanced solutions (Whittaker et al., 2018). If access to AI is limited to well-funded institutions, leaving underserved communities without the necessary resources to benefit from these advancements, the risk of widening the digital divide, perpetuating inequality, and restricting the overall benefits grows.

Scenario 4: Commercially maintained technical standards disregarding ethical, social issues (low equity, tech-centred)

AI development prioritises technological advancement over equitable access, exacerbating social and economic inequalities. The benefits of AI are concentrated among those with resources and skills, marginalising large segments of the population. This focus on technology benefiting only a select few leads to societal tensions.

International standards for AI and technology currently emphasise technological advancement with limited emphasis on equitable access and not considering ethical issues. This approach predominantly benefits those with the necessary resources and skills to leverage advanced technologies, as in the previous scenario, sidelining large population segments. Moreover, AI tools often fail to protect users' privacy and rights, particularly those of premium users. This could lead to social pressure for regulations that either ban AI technology or severely limit its applications.

Currently we observe this scenario, as major advancements in AI are driven by well-funded tech giants and well-funded academic institutions. This concentration of resources and expertise results in a lack of interoperability of AI tools. Proprietary technologies and intellectual property protections in the AI industry also mean that critical quality checking and reliability assessment techniques are often kept private. This lack of interoperability and secrecy around techniques restricts broader access, exacerbating social and economic disparities. For instance, it widens the gap between those who can afford advanced AI-driven healthcare and those who cannot, resulting in disparities in health outcomes.

The No-Regret Moves

In the evolving field of AI, balancing innovation with the protection of human values requires strategic and forward-thinking actions. We call these strategic actions "no-regret moves". They proactively address the potential risks outlined in the above scenarios. Simultaneously, they are designed to maximise AI's full potential. In each of the following subsections, each no-regret move will be described (in italics) followed by a rationale.

No-Regret Move 1: Agree on universal principles for AI

An international multidisciplinary committee, comprising members from academia, industry, and organisations, should establish general rules for all AI systems to balance innovation and the protection of human beings. Swift decision-making processes should be ensured by a structured approach. The committee should begin by establishing principles for sound scientific conduct in the use of AI tools. Incremental progress through regional agreements and sector-specific guidelines should facilitate the way for broader consensus.

AI's potential, though promising, raises concerns about catastrophic risks, highlighting the need for regulation. The EU's AI Act exemplifies a proactive effort. Other nations like the US, UK, and China also recognise this need. A multidisciplinary committee from academia, industry, and companies should standardise AI use, balancing innovation with human protection. Initially, the committee should focus on establishing principles for responsible AI use and enabling swift decision-making.

Initiatives like the Council of Europe's Convention on AI and General Data Protection Regulation (GDPR) showcase effective regional regulation that could serve as a foundation for global standards. The OECD and UNDP also emphasise the feasibility of establishing a global body to adapt to AI's rapid evolution. While achieving global consensus on AI principles is undoubtedly challenging, not pursuing it would be a missed opportunity. The effective success of universal ethics in banning human cloning demonstrates that consensus is possible even on sensitive issues. The process must acknowledge that not all ethical values underpinning guidelines are universally shared. Rigid positions on ethical AI use might hinder progress, given the varying moral standards across cultures. Economic powers and national governments may exert influence to protect their interests, potentially skewing decisions. Cultural differences further complicate the matter, as different groups have distinct views on ethical AI use, privacy, and the balance between innovation and human protection. This diversity may lead to extended discussions, but it also presents a chance to find common ground. As Cowls et al. (2019) note, designing AI for social good requires engaging with diverse ethical perspectives, a challenge recognised by UNESCO (2021) and the European Commission (2019). Nevertheless, the strong global demand for existing universal methods of technical validation suggests that especially universities can help to achieve consensus.

Swift decision-making within culturally diverse committees is both a challenge and a necessity. Reaching consensus may take time and negotiations and is only feasible with a structured approach. While prolonged discussions might hinder the committee's ability to respond promptly to AI's rapid evolution, a lack of structured dialogue will lead to stagnation. Additionally, excessive rigidity risks alienating minorities and stifling innovation. Another concern is partial-interest capture, where dominant groups may overshadow others, leading to biased guidelines. Ethical guidelines on sensitive issues, like human life, may spark conflict due to cultural differences. However, research in universities can create awareness of these challenges and help structure the committee's work to ensure progress.

In conclusion, creating a global, multidisciplinary committee to establish universal AI principles offers the potential to balance innovation and human protection. Ensuring swift decision-making, the success of universal ethical agreements - like the UN's non-binding ban on human cloning - should inspire optimism for the future of AI ethics.

No-Regret Move 2: Invest in networking for efficient implementation of AI under the universal principles

In the various application domains where AI will be implemented, principles must be translated into standards and guidelines to support AI system development. Universities should lead subject-specific international working groups, involving experts from industry and public administration. These groups, composed of AI experts and domain specialists, are responsible for drafting standards. While global implementation is complex, these groups should prioritise developing standards for specific high-priority domains or regions (Eitel & Buxmann, 2020; Wendler, 2019). This focused approach makes the task more feasible and manageable.

Through networking and collaboration in subject-specific working groups, experts should translate the universal principles (see section 5.1) into standards. These groups, with their critical insights, play a key role in ensuring comprehensive coverage across different application domains.

Implementing rules within frameworks like ISO and IEC, where experts regularly convene, will ensure new technologies are developed safely and ethically. Regular meetings of domain-specific working groups should address new technological challenges, monitor risks, and resolve inconsistencies in proposed standards, ensuring adaptive and coherent AI governance.

This approach must balance innovation with safety. Too rigid guidelines might stifle innovation, while too broad ones might fail to provide adequate protection. The rapid evolution of AI and diverse perspectives within working groups may lead to delays in decision-making. Additionally, cultural differences in values related to technology and privacy further complicate the establishment of universally accepted standards (Eitel & Buxmann, 2020; Wendler, 2019).

Addressing partial-interest capture is crucial for the successful implementation of AI, ensuring broad representation and mitigating the influence of specific interests. While challenges such as bureaucratic delays and the complexities of reaching global consensus exist, they can be managed through strategic networking and diligent oversight. Practical AI application depends on strategic planning, swift decision-making, and embracing cultural diversity. By striking a balance between specificity and generality in guidelines, we can achieve a globally equitable AI standard.

No-Regret Move 3: Make AI quality and performance transparent and comparable

Universities and industry should develop open, accessible tools for assessing AI quality. Globally accessible repositories of ML models should be created. These repositories, built on AI standards, should include metadata to support advanced techniques like transfer learning and federated learning (Kairouz et al., 2021). This approach is feasible and will ensure AI systems are transparent and comparable worldwide.

Through networking and collaboration in subject-specific working groups, experts should translate the universal principles (see section 5.1) into standards. These groups, with their critical insights, play a key role in ensuring comprehensive coverage across different application domains.

Transparent and comparable measures of AI quality and performance are essential for AI's widespread adoption across various sectors. Universities and industries should provide open, accessible tools and benchmarks to build trust and ensure equitable use. Existing frameworks like CRISP-DM (Chapman, 2009) partially address this need, but more comprehensive, universal standards are necessary. A phased approach, starting with basic metrics and expanding to more complex measures, is feasible. Standards like ISO/IEC TS 25058 will reinforce the importance of universal measurements. Consistent and reliable quality assessments should ensure that AI systems meet expected performance and safety standards. In healthcare, for instance, the established AI Quality Standards (Kuziemsky 2024) demonstrate the effectiveness of such universal methods. These approaches underscore the need for standardised measures across different sectors, ensuring transparency and comparability in AI performance.

Tackling the challenges in AI evaluation is crucial. Bias in metrics can unfairly advantage certain AI systems, while open performance metrics may expose them to malicious exploitation, and standardised measures could stifle creativity. To navigate these concerns, it is vital to integrate robust bias mitigation, ensure security, and maintain flexibility within standards. Striking a balance between transparency, equity, and innovation is key to fostering responsible and inclusive AI development.

No-Regret Move 4: Reduce administrative barriers for AI usage under the universal principles

Enforcing rules will involve some administrative burden, but using AI to automate tasks can minimise it. Simplifying rules and keeping the burden low will make compliance more appealing. Universities should focus on knowledge transfer and promoting lifelong learning to support this process, making the approach both feasible and effective.

Reducing administrative barriers for AI usage under universal principles should be crucial for the effective and ethical deployment of AI technologies. Implementing AI-based training programmes and equipping individuals with essential AI skills should lead to more productive administrative workforces (Noy & Zhang, 2023). This should increase job opportunities and stimulate economic growth (Saini et al., 2023).

While this perspective is optimistic, realising productivity gains may take longer, and the gains might be smaller than widely expected (Acemoglu, 2024; Kalyani & Hogan, 2024). Additionally, the impact of AI on increasing inequality should be managed to prevent prevailing reservations against AI usage (Acemoglu, 2024). Training can be a crucial step in mitigating this downside risk. Promoting responsible usage and understanding of AI ethics can reduce potential negative impacts (Uygun, 2024). Workers should be empowered to use AI responsibly rather than being forced to avoid it. Given the virtually endless amount of undone labour and unfulfilled needs, enabling everyone to use AI to contribute to a wealthier future is again essential for mitigating inequality risks.

By investing in AI infrastructure and simplifying compliance processes, universities and the scientific community should facilitate the seamless integration of AI technologies, making adherence to ethical guidelines easier. This approach should ensure that the benefits of AI are widely accessible while maintaining high ethical standards. However, there are drawbacks, such as the significant costs and investments required to develop and maintain AI infrastructure and training programmes. While full automation may be a long-term goal, initial efforts should focus on streamlining key administrative processes to demonstrate the benefits of AI-assisted governance. Despite these challenges, the long-term benefits of a well-implemented, ethical AI framework should outweigh the initial financial outlay, fostering a more inclusive and prosperous society (Zawacki-Richter et al., 2019).

Conclusion

Standardising AI quality and performance is crucial for advancing AI methods in a controlled manner that addresses ethical and social issues. Implementing open standards for AI tools provides transparency regarding their expected quality, reducing the risk of improper usage. When based on representative benchmarks, these standards simplify the development and integration of AI tools while addressing potential biases and preventing the creation of unethical AI applications. Open standards play a pivotal role in ensuring that AI development aligns with societal values and ethical norms. Universal principles, standardisation, and appropriate education are essential for developing AI that truly benefits society.

In this paper, we envision a universal multidisciplinary committee that could define shared principles to guide the development of AI systems, ensuring they protect human rights and social values. Additionally, the committee would establish workgroups for each domain to ensure proper development across various application areas, defining specific guidelines and standards. Finally, bridging the gap between AI research and real-world application requires improved training and digitisation strategies that address AI's limited generalisability and potential biases.

Universities play a crucial role in this ecosystem, preparing the next generation of AI developers and researchers, and doing innovative research to technically improve AI models, making them more robust and trustable. By integrating technical proficiency with ethical and legal awareness, universities ensure AI technologies are developed and deployed in beneficial, ethical, fair, and safe ways. This integration is achieved through comprehensive education strategies that include insights into standardised performance metrics for AI methods. These strategies not only equip students with the technical skills to develop AI systems but also instil in them a deep understanding of the ethical and legal aspects that should guide their work. This approach fosters innovation and ensures that AI development is grounded in ethical, legal, and social considerations, promoting the creation of 'good AI.'

References

Acemoglu, D. (2024). *The simple macroeconomics of AI (NBER Working Paper No. 32487)*. National Bureau of Economic Research.
Akter, S., McCarthy, G., Sajib, S., Michael, K., Dwivedi, Y. K., D'Ambra, J., & Shen, K. (2021). Algorithmic bias in data-driven innovation in the age of AI. *International Journal of Information Management, 60*, 102387.

Borges, A. F., Laurindo, F. J., Spínola, M. M., Gonçalves, R. F., & Mattos, C. A. (2021). The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions. *International Journal of Information Management, 57*, 102-225.
Chapman, P. et al. (2009). *CRISP-DM 1.0 step-by-step data mining guide*.

Akpuokwe, C.U., Adeniyi, A.O., & Bakare, S.S. (2024). Legal challenges of artificial intelligence and robotics: A comprehensive review. *Computer Science & IT Research Journal, 5*(3), 544-561.

Cowls, J., King, T., Taddeo, M., & Floridi, L. (2019, May 15). *Designing AI for Social Good: Seven Essential Factors*. http://dx.doi.org/10.2139/ssrn.3388669

de Almeida, P.G.R., dos Santos, C.D. & Farias, J.S. Artificial Intelligence Regulation: a framework for governance. *Ethics and Information Technology 23*, 505–525 (2021).

Eitel, A., & Buxmann, P. (2020). Artificial intelligence in business: State of the art and future research agenda. *Business Research, 13*(3), 1-25.

Eubanks, V. (2018). *Automating inequality: How high-tech tools profile, police, and punish the poor.* St. Martin's Press.

European Commission. (2019, April 8). *Ethics guidelines for trustworthy AI. Shaping Europe's digital future.* European Commission. https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

European Parliament. (2024). *EU AI Act: first regulation on artificial intelligence*. European Parliament. https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., ... & Vayena, E. (2018). AI4People—An ethical framework for a good AI society: Opportunities, risks, principles, and recommendations. *Minds and Machines, 28*(4), 689-707.

Franke, U. E. (2021). *Artificial divide: how Europe and America could clash over AI.* https://www.jstor.org/stable/resrep29123

Government of the Republic of Korea. (2019). *National strategy for artificial intelligence*.

Hacker, P. (2023). The European AI liability directives – Critique of a half-hearted approach and lessons for the future. *Computer Law & Security Review*, *51*(51), 105871–105871. https://doi.org/10.1016/j.clsr.2023.105871

Hicks, S.A., Strümke, I., Thambawita, V. et al. On evaluation metrics for medical applications of artificial intelligence. *Sci Rep 12*, 5979 (2022).

Huang, D. Z., Baber, J. C., & Bahmanyar, S. S. (2021). The challenges of generalizability in artificial intelligence for ADME/Tox endpoint and activity prediction. *Expert Opinion on Drug Discovery, 16*(9), 1045–1056.

International Organization for Standardization. (2022). *ISO/IEC TS 25058: Systems and software engineering—Systems and software quality requirements and evaluation (SQuaRE)—AI system quality model.*

Kairouz, P., McMahan, H. B., Avent, B., Bellet, A., Bennis, M., Bhagoji, A. N., ... & Zhao, S. (2021). Advances and open problems in federated learning. *Foundations and Trends in Machine Learning, 14*(1–2), 1-210.

Kalyani, A., & Hogan, M. (2024, April 4). *AI and productivity growth: Evidence from historical developments in other technologies.* Federal Reserve Bank of St. Louis.

Kuziemsky C., Chrimes D, Minshall S., Mannerow M., & Lau F. (2024). AI quality standards in health care: Rapid umbrella review. *Journal of Medical Internet Research, 26*.

Leavy, S., O'Sullivan, B., & Siapera, E. (2020). Data, power and bias in artificial intelligence. arXiv. https://arxiv.org/abs/2008.07341

Marchant, G. E., & Wallach, W. (2015). Coordinating technology governance. *Issues in Science and Technology, 31*(4), 43-50.

Noy, S., & Zhang, W. (2023). Experimental evidence on the productivity effects of generative artificial intelligence. *Science, 381*(6654), 187-192.

Organisation for Economic Co-operation and Development (OECD) (2001). *Drivers of Growth: Information Technology, Innovation and Entrepreneurship.*

Organisation for Economic Co-operation and Development (OECD) (2022). *OECD framework for the classification of AI systems.*

Pereira, V., Hadjielias, E., Christofi, M., & Vrontis, D. (2023). A systematic literature review on the impact of artificial intelligence on workplace outcomes: A multi-process perspective. *Human Resource Management Review, 33*(1), 100857.

Saini, R., Habil, M., & Srivastav, S. K. (2023). Role of artificial intelligence in the creation of employment opportunities. *International Journal of Innovations & Research Analysis (IJIRA), 3*(1), 12-18. Retrieved from ResearchGate.

Salmi, J. (2021). *Universities and the knowledge economy*. University World News.

Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy, 47*(9), 1554-1567.

State Council of China. (2017, July). *New generation artificial intelligence development plan.*

Taeihagh, A. (2021). Governance of artificial intelligence. *Policy and Society, 40*(2), 137-157.

The White House. (2023, October 30). *Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence*.

The White House. https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/
UNESCO - United Nations Educational, Scientific and Cultural Organization. (2019). *Preliminary study on the ethics of artificial intelligence.*

UNESCO - United Nations Educational, Scientific and Cultural Organization (2021). *Recommendation on the Ethics of Artificial Intelligence*. https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence

UNESCO - United Nations Educational, Scientific and Cultural Organization. (2022). *Ethics of Artificial Intelligence*. UNESCO. https://www.unesco.org/en/artificial-intelligence/recommendation-ethics

Ünver, H. A. (2024). *Artificial intelligence (AI) and human rights: Using AI as a weapon of repression and its impact on human rights*.

Uygun İlikhan, S., Özer, M., Tanberkan, H., & Bozkurt, V. (2024). How to mitigate the risks of deployment of artificial intelligence in medicine? *Turkish Journal of Medical Sciences, 54*(3), 483-492.

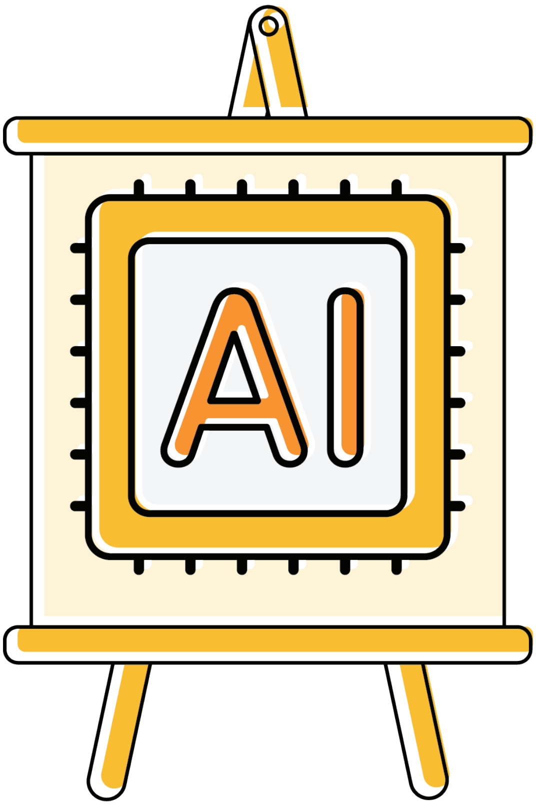
Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S.D., Tegmark, M., & Nerini, F. F. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications, 11*(1), 233.

Wendler, R. (2019). Ethical AI: Challenges and opportunities for business and society. *Journal of Business Ethics, 160*(4), 1015-1028.

West, S. M., Whittaker, M., & Crawford, K. (2019). *Discriminating systems: Gender, race and power in AI*. AI Now Institute.

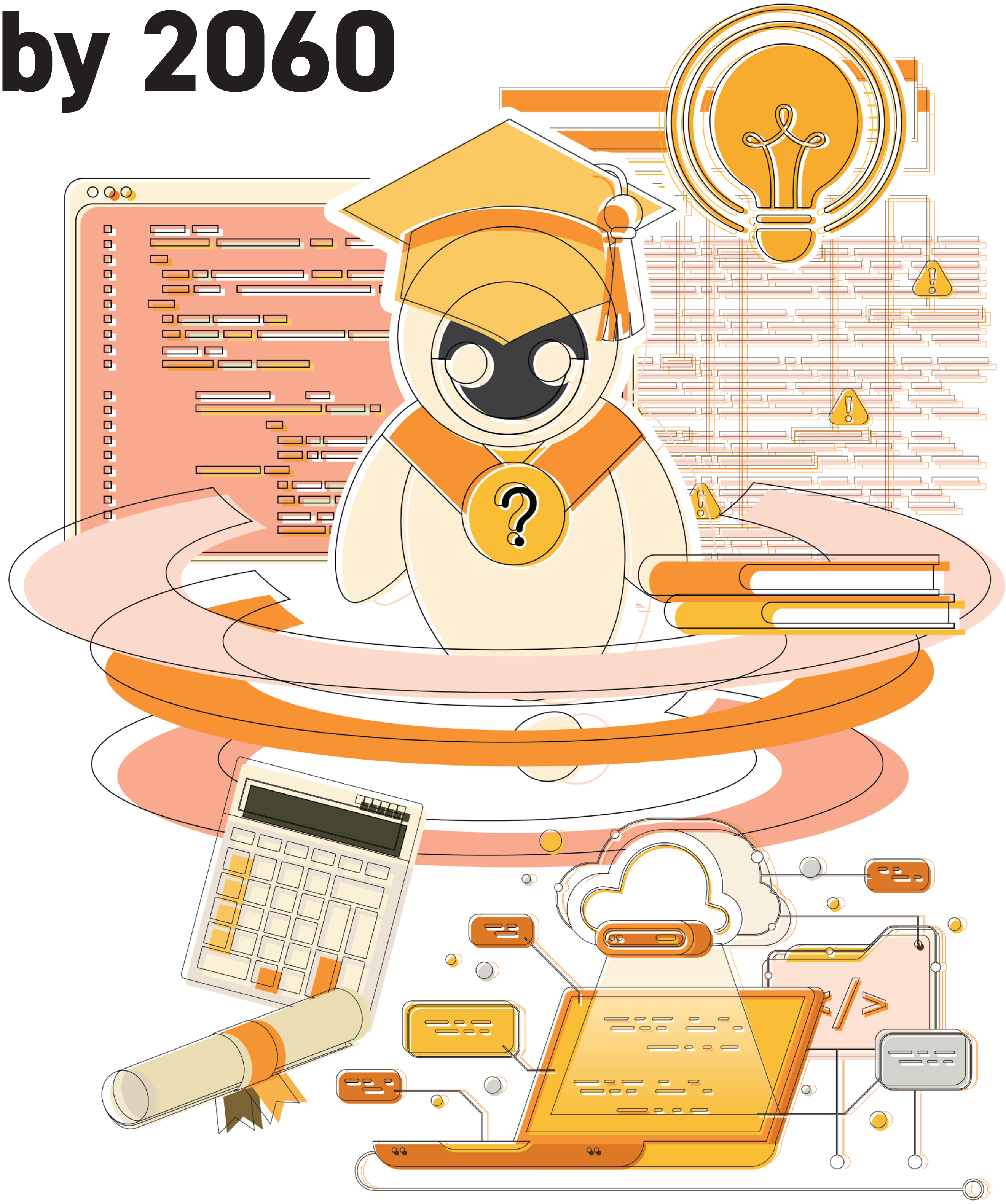
Whittaker, M., Crawford, K., Dobbe, R., Fried, G., Kaziunas, E., Mathur, V., ... & Schwartz, O. (2018). *AI now report 2018*. AI Now Institute.

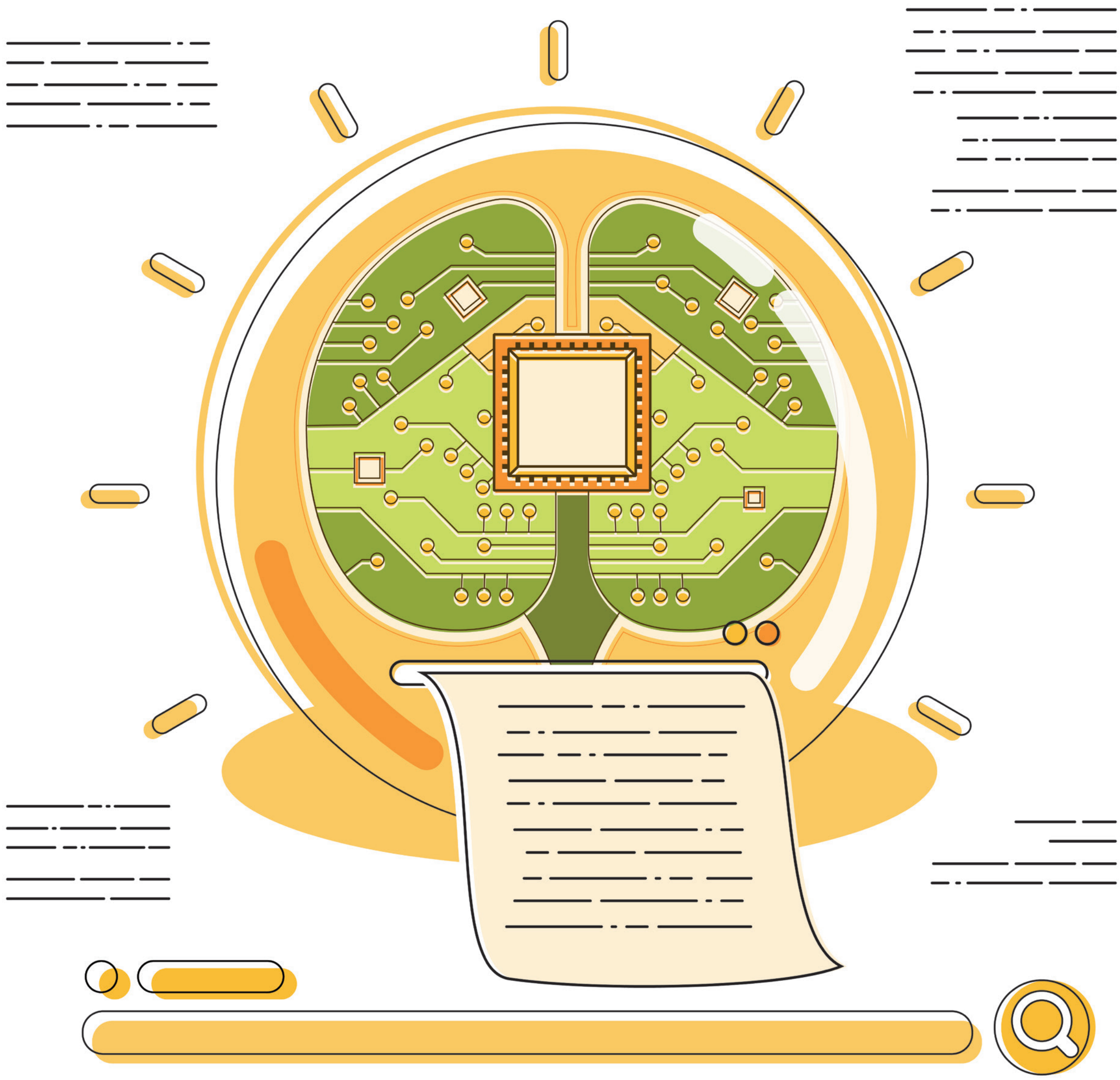
Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education, 16*(1), 39.



PART 2

Universities' Role in AI in Education by 2060





No-Regret Moves for Universities in the Era of AI-Based Student Feedback and Assessment

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Introduction

Advancements in artificial intelligence (AI), both in the form of predictive AI (PredAI), which is powered by machine learning algorithms, and generative AI (GenAI), which leverages large language models (LLMs), have made AI more accessible and versatile across a wide range of applications. These include student feedback and assessment in learning environments. More specifically, GenAI-driven services that can stochastically deliver human-like coherent text based on user prompts (UNESCO, 2023; Atlas, 2023), have captured the attention of the educational community. Numerous studies have begun to explore the educational potential of GenAI tools and the impact these tools might have on student learning (Kasneci et al., 2023; Hwang & Chen, 2023; Lo, 2023; Bond et al. 2024; Essel et al., 2024).

At the same time, it is clearly recorded that the use of AI in education comes with several risks that need to be carefully considered (Atlas, 2023; Bender et al., 2021; Paschke et al., 2024). Both Chinese regulation and the EU AI Act (Kelly et al., 2024) classify the educational use of AI, particularly for admission and assessment, as high risk because they have vast impacts on the potential future of students. These regulations underscore the critical importance of safeguarding against unintended consequences that could arise from the misuse of or over-reliance on AI systems.

This position paper takes the view that the rapid evolution of AI technologies, coupled with their increasing sophistication, will have a transformational impact on traditional educational methods and systems. This shift is not merely a matter of integrating new tools. It involves a fundamental rethinking of what we mean by education, how education is delivered, assessed, and experienced by students and educators alike. Our objective is to propose a no-regret move scheme, meant to provide a basis for current formative actions of universities, based on an analysis of four potential scenarios concerning the evolution of educational environments and closely related to the provision of feedback and assessment to students. We anchor our future scenarios in 2060 to allow sufficient time for re-thinking and taking action, in anticipation of the inevitable technological and societal changes emerging from new technologies. To thoroughly explore and model through these possible futures, we undertake the following steps:

First, we identify as key drivers of the AI-driven change two important socio-technological processes that strongly affect the integration of AI technology in education, namely:

1. Human-centred vs technology-centred development of AI, and
2. Equity in technology access (high vs low).

Second, we focus on "student feedback and assessment" as prominent educational functions highly relevant to AI repercussions. It is not only the immediacy of the change that motivated our choice but also the profound and long-lasting ripple effects that will be engendered from it. In our analysis, we discuss possible transformations that student feedback and assessment may undergo in each of the four possible future worlds and suggest no-regret moves appropriate for safeguarding the quality of education in an AI-led future.

The Status Quo and the Drivers of Change

In higher education, the integration of AI is already reshaping traditional paradigms and prompting a re-evaluation of responsibilities and workflows within universities. Several studies review the potential of GenAI tools in various educational tasks (for example, content generation, assessment, etc.), and conclude mostly by commenting on opportunities offered and risks generated by these tools (Atlas, 2023; Kasneci et al. 2023). Other publications report concrete evidence from research on the use of GenAI tools in educational settings. For example, Dai et al. (2023) explore the efficacy of LLMs in providing feedback to students.

Given increased demand worldwide for quality educational services, one of the most pressing needs in education is the availability of qualified educators who can deliver timely and accurate feedback across various domains, considering not only the cognitive dimension of learning but also the metacognitive and affective dimensions (for a detailed analysis of the "global teacher gap" see the World Economic Forum, 2024 report).

Skilful teachers' feedback is crucial for formative assessments, which play a significant role in guiding students' learning processes and fostering their academic growth (Hattie, 2012). For summative assessments, which often involve evaluating complex and demanding tasks, the necessity for trained personnel is equally critical. Teaching assistants and other academic staff must be equipped with the skills to carry out high-quality assessments that accurately reflect students' skill development and competencies. The challenge lies not only in managing the volume of assessments but also in ensuring the consistency and fairness of the evaluations.

To address these challenges, the development and implementation of smart AI-based tools are becoming increasingly vital. These tools are expected to augment the capabilities of teaching personnel, enabling them to handle the demands of modern education more effectively (Mollick & Mollick, 2023). AI can enhance both the quantity and quality of feedback and assessments, offering personalised, on-time responses that can significantly improve the learning experience for students. However, the introduction of AI into education necessitates a broader reconsideration of what learning and knowledge entail. As we look towards the future, it is essential to reassess what skills will be needed in an AI-driven world and how universities can adapt to remain relevant. Such deliberation also involves a deeper examination of the nature of intelligence itself, exploring the distinctions and potential synergies between human intelligence and AI. Questions about whether these forms of intelligence are mutually exclusive or whether they will eventually converge, or even create a singularity, are central to this discourse.

To model the forces that might shape the AI-enhanced future of education, we identify as key drivers of change the two following socio-cognitive processes:

1. *Human-centred vs technology-centred AI, modelling the two distinct directions that AI development may follow*: "Human-centred" refers to the perspective of identifying and prioritising the needs of human communities and human agents as active members of these communities, a policy marked by humanistic values and devotion to human welfare. In contrast, "technology-centred" refers to prioritising the advancement of technology and related artefacts as a value per se, implementing a policy that focuses largely on advancing the capabilities of the technology and not necessarily on the specific needs of human users.
2. *Equity in technology access (high vs low)*: High equity in technology refers to the fair and inclusive access for, participation of, and sharing of the benefits of technological advancements to all individuals, regardless of their socioeconomic status, race, gender, or other potentially discriminatory factors. Low equity, on the other hand, denotes significant disparities in access to, use of, and benefits from technology. This situation often results in marginalised groups facing systemic barriers such as high costs, limited infrastructure, inadequate digital literacy, and biassed algorithms.

The graph in Figure 1 depicts the four possible future worlds (henceforth: "four scenarios") that may emerge depending on the specific way that these drivers of change have a combined impact on the near future.

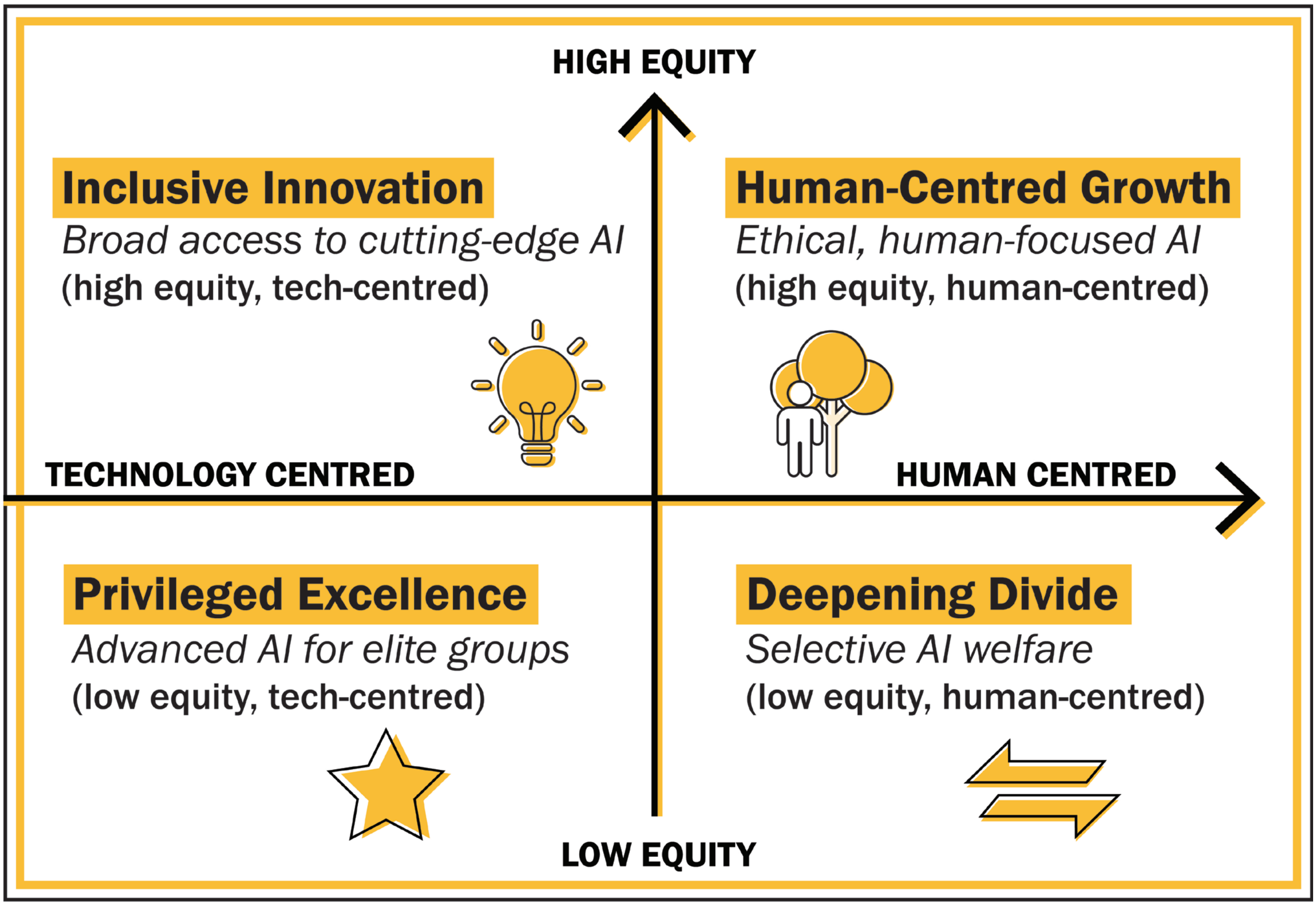


Figure 1. The four possible worlds shaped by the two drivers of change (Adapted from: ASEFInnoLab seminar, 2024)

The Four Scenarios

In this section, we present the four scenarios (or four "future worlds"), highlighting the possible features that each specific scenario might exhibit in general and in relation to student feedback and assessment.

Scenario 1: Inclusive innovation (high equity, tech-centred)

In this scenario, AI development is primarily driven by technological advancements and optimisation, focusing on creating efficient, high-performance systems. Moreover, policies and initiatives ensure that these cutting-edge AI technologies are accessible to all segments of society, reducing potential for digital divide. Investments in infrastructure and education are prioritised, ensuring that people across various socio-economic backgrounds have access to the latest AI tools and resources. However, the primary goal is to maximise the technological potential of AI, sometimes leaving more overall considerations of human wellbeing aside. In relation to student feedback and assessment, this future scenario might entail the following features:

- ***Learning Analytics:*** AI-empowered learning analytics tools including those employed for student feedback and assessment can track, analyse and offer insights into student performance, enabling tailored educational strategies. For example, automated grading systems can provide immediate, personalised feedback on assignments and assessments. "Personalised education" becomes a reality leveraging AI tools to optimise student engagement and knowledge retention. However, with this somewhat "evasive" approach, some ethical dimensions of technological advancement, such as data privacy, are neglected.

- ***Equitable Access to Educational Resources:*** Advanced and open AI tools ensure equitable access to high-quality education for students from diverse socio-economic backgrounds. Society can bridge the educational divide with AI-powered assessment and feedback mechanisms, which are accessible to all students. However, technology companies are encouraged to develop and offer AI tools without any real control over the ethical implications of their actions and products.

- ***Risk analysis:*** Arguably, access to powerful AI imposes some risks if in the "wrong" hands, whether those belong to companies, governments, or universities.

  - If technological companies are not incentivised to make student feedback and assessment algorithms transparent and to involve educators in the development process, the algorithms may not be optimised in an appropriate direction. In this case, for example, benchmarking of students may take the place of the assessment of competences.

  - If governments regulate the use of AI systems in universities, the opinions of students and professors could influence their success in these institutions. Even in law-abiding societies, proving misuse of AI may be difficult due to limited transparency and a lack of concrete evidence.

  - If the universities supervise algorithmic feedback and assessment, they will need to have the budget for hiring enough staff to be the human in the loop. Without this, students will optimise their performance towards the median, which is easily recognised by the AI as correct. Out-of-the-box thinking may be discouraged by algorithmic assessment.

In addition to all the possibilities related to the ownership of the algorithm, we must also factor in extensive collection of student data, some of which may preferably remain in the private space, for learning analytics. This necessity makes data breaches more likely to occur, making students highly vulnerable to malicious actors.

Scenario 2: Human-centric growth (high equity, human-centred)

In this scenario, AI development is driven by a focus on human well-being, ethical considerations, and enhancing human capabilities. Policies ensure that AI technologies are accessible to all, reducing the digital divide and empowering underserved communities. Investments in education and community engagement, including student feedback and assessment algorithms, ensure that people from all backgrounds can benefit from and contribute to AI advancements. AI systems are designed with significant input from diverse stakeholders, leading to solutions that address a wide range of societal needs. The primary goal is to solve societal issues, sometimes leaving more overall technological advancement considerations aside.

"Smart" (AI-based) technologies that allow students to develop at their own pace their understanding of and skills in specific subjects may be a key aspect of this scenario. Furthermore, and in relation to student feedback and assessment, this future scenario might entail the following:

- ***Ethical and Inclusive Assessment:*** AI-driven analytics systems are designed with diverse stakeholder inputs to ensure fairness and inclusivity in student evaluations. Thus, the emphasis is on human-focused AI tools providing unbiased, equitable assessment methods that cater to diverse learning needs. There is a general tendency to cater for Holistic Student Development, which practically means:

  - Developing student feedback and assessment AI systems in a way that prioritises student well-being, offering comprehensive feedback that eventually supports emotional and intellectual growth.

- "Personalised education", which includes feedback and assessment mechanisms that enhance students' critical thinking and creativity, fostering holistic development.

- ***Empowering Underserved Communities:*** Another aspect of the ethical, human-centred AI is that accessible AI technologies deliver high-quality feedback and assessment tools to empower students in underserved and marginalised communities. Thus, community-engaged AI initiatives ensure that educational advancements reach and benefit students from all socio-economic backgrounds.

- ***Risks:***
  - Slow development because of extensive testing and adjustments
  - Complex regulation
  - High costs

Scenario 3:
Deepening divide
(low equity, human-centred)

In this scenario, AI development prioritises human-centred goals, but benefits are concentrated among elite groups with greater access to technology. Significant disparities exist in access to AI technologies, with underserved communities neglected and left behind. Ethical considerations and human well-being are prioritised, but primarily for those who can afford and engage with advanced AI solutions. AI innovations including student feedback and assessment systems primarily serve the needs and interests of affluent populations, potentially widening social and economic gaps. The primary goal is to solve societal issues for those who can afford to pay for the solutions.

In relation to student feedback and assessment, this future scenario might entail the following:

- ***Educational Advantages for the Privileged:*** The advanced AI-driven students' feedback and assessment systems are used to offer personalised educational benefits primarily to students at elite institutions. Thus, high-cost AI assessment tools provide superior, tailored feedback, accessible mostly to select educational institutions. Such disparities in AI access and AI resources eventually lead to a widening gap in educational outcomes between wealthy and other student populations.

- ***Ethical AI for the Privileged:*** In this scenario, ethically designed AI tools indeed prioritise well-being and personalised feedback. However, they are predominantly available to those who can afford them. Innovations regarding student assessment within the "Human-centred AI" perspective largely benefit privileged groups, leaving marginalised students behind.

- ***Risk Analysis:*** Privileged classes' interests may not align with those of the masses and/or society at large, especially if those holding the reins of AI development prioritise some aspects such as profit-seeking, power, social control, etc., which may influence or shape the role of universities and learning in general.

Scenario 4:
Privileged excellence
(low equity, tech-centred)

In this scenario, AI development is primarily focused on technological advancements and optimisation, with little regard for equitable access. Benefits of AI, including student feedback and assessment systems, are concentrated among those with the resources and skills to leverage advanced technologies. Large segments of the population are excluded from the benefits of AI, increasing existing social and economic inequalities. The focus on the benefits of technology for few leads to societal tensions, as parts of the society are marginalised for the technology and its development.

- ***Advanced Feedback for the Privileged and Growing Educational Inequities:*** In this dystopian scenario, sophisticated high-tech, optimised AI systems deliver precise, personalised feedback and assessment exclusively to those with the resources to access them. As a result, educational disparities are ever widened as underprivileged students lack access to AI-enhanced feedback and assessment tools, increasing social and economic inequalities in education.

- ***Marginalised Student Populations:*** Large segments of students being marginalised from the benefits of AI-driven assessment leads to heightened social tensions. Technological advancements in student feedback and assessment exacerbate existing inequities, leaving many students behind in educational progress.

No-Regret Moves

In this section, we describe four no-regret moves recommended for university stakeholders, which we consider relevant to the four scenarios depicted in the previous section. By "no-regret move" (NRM), we refer to actions or decisions in a strategic context that are beneficial across multiple scenarios ensuring the decision-makers do not regret their choice in hindsight, regardless of the outcome (Hugh et al., 1997). In simple words, a no-regret move is a strategic action guaranteeing that no harm will occur, independent of how the situation evolves. We propose the following no-regret moves:

No-Regret Move 1: Promote AI literacy

To succeed in any future situation, it is crucial to constantly improve one's understanding and knowledge of AI. This entails incorporating extensive AI courses into school curricula and providing cross-cultural workshops to enhance comprehension. Utilising efficient teaching techniques, which include student feedback and assessment algorithms, and incorporating game-based approaches can enhance the engagement and accessibility of AI education. Institutions may ensure that students are well-prepared to utilise AI for enhanced feedback and assessment by conducting surveys and practical applications in higher education to establish and validate AI literacy.

Key Evidence for No-Regret Move 1

Several researchers have examined the promotion of AI literacy in student feedback and evaluation.

- Kong et al. (2022) and Korte et al. (2024) highlight the significance of pedagogical delivery and cross-cultural workshops in augmenting AI literacy.
- Tubino & Adachi (2022) and Voulgari et al. (2021) examine the impact of AI on the development of feedback literacy and the utilisation of game-based methodologies for instructing machine learning.
- Ng et al. (2023) and Hooda et al. (2022) examine the development and verification of AI literacy surveys and the application of AI for evaluating and providing feedback in higher education.
- Hornberger et al. (2023) offers valuable insights into the present level of AI literacy among university students, emphasising the necessity for well-designed AI courses.

These studies highlight the importance of AI literacy in education and the potential of AI to improve student feedback and assessment. This NRM would address especially the risks associated with Scenario 2, i.e., the more people are educated about AI, the less easy it will be to marginalise them. Promoting AI literacy among stakeholders can potentially mitigate risks in Scenario 1, too, by ensuring that stakeholders have the understanding necessary for making decisions, which does not yet seem to be the case at present. Furthermore, the risk of slow development in Scenario 3 would also be mitigated by this measure.

No-Regret Move 2: Organise knowledge transfer events for all stakeholders (governments, companies, universities, etc.)

Achieving success in all possible future scenarios necessitates the collective endeavours of institutions, stakeholders, and governments through collaborative seminars and observatories. These partnerships should concentrate on creating ethical AI systems that give priority to the welfare of humans and cater to the distinct requirements of educational stakeholders. Through promoting global collaboration and open dialogues, these knowledge transfer events have the potential to improve understanding of AI, stimulate the creation of AI solutions that prioritise human needs, and close the divide between technological progress and educational needs.

Key Evidence for No-Regret Move 2

A series of research activities in various fields has been carried out to investigate the efficiency of collaboration for AI.

- Raftopoulos (2023) and Dickler et al. (2022) have primarily concentrated on the development and execution of AI systems. The former has placed particular emphasis on designing AI systems that prioritise human well-being and adhere to ethical principles. On the other hand, Dickler et al. (2022) have focused on bridging the divide between AI initiatives and the requirements of educational stakeholders.

- Korte et al. (2024) and Dodig-Crnkovic (2023) have conducted research on the impact of AI on literacy and its effects on society. The former specifically demonstrate a noteworthy improvement in AI literacy among international students.

- Shin et al. (2023) have explored the incorporation of AI in the process of humans working together to generate ideas, while Delgado et al. (2023) have examined the involvement of stakeholders and individuals with a vested interest in the design of AI systems.

- Finally, Bobak et al. (2020) and Wang et al. (2020) have investigated the capacity of AI to enhance patient results in healthcare and the prospects for collaboration between humans and AI in the future.

These works emphasise the significance of inclusive collaboration and ethical considerations in the creation and application of AI systems.

This NRM would address the risks outlined in Scenario 1, i.e., the shortcomings of AI implementation without sufficient multi-stakeholder oversight and could potentially mitigate some of the risks in Scenario 3, i.e., low equity. This NRM would also be indispensable for mitigating a range of risks in Scenario 4.

No-Regret Move 3: Create feedback mechanisms for AI development

It is crucial to exchange AI knowledge and successful strategies to effectively respond to different future situations. AI has the potential to greatly improve the learning and mentoring processes, particularly in specialised areas such as coding, architecture and design. It is however imperative to tackle issues like privacy concerns and algorithmic prejudice and ensure ethical adoption of AI by promoting competent training, ethical discourse, and university-industry cooperation. Such actions are expected to become the basis for the effective integration of AI in higher education and to ensure that institutions will productively utilise AI's potential to enhance student feedback and evaluation. Thus, the proposed NRM, by addressing initially at a general level the requirement of creating feedback mechanisms for AI development, is also strongly related to the more specific case of fostering student feedback and assessment.

Key Evidence for No-Regret Move 3
Various studies have investigated the application of AI in higher education, specifically focusing on university experiences in Europe and Asia.

- Li et al. (2021) and Klamma et al. (2020) emphasise the capacity of AI to improve learning and mentoring procedures. The former specifically focuses on its implementation in architecture and design courses.
- Holmes et al. (2021) and Mehrfar et al. (2024) offer comprehensive analyses on the potential of AI to revolutionise learning and education. They also address the obstacles that need to be overcome, including privacy issues and algorithmic prejudice.
- Rezaev et al. (2023) stress the necessity of proficient training and cooperation in incorporating AI into university instruction, and also emphasise the significance of ethical deliberations.
- Cai et al. (2019) and Al-Emran et al. (2024) use a pragmatic perspective, exploring the capacity of AI to enhance collaboration between universities and industries, and examining the factors that influence the utilisation of AI-powered chatbots for sharing knowledge, respectively.

This NRM is an extension of the second NRM, as knowledge transfer is specifically employed during the development process as a feedback loop. Legal, educational, and technological expertise must be applied jointly during the development of AI systems for educational use so that all these aspects are optimised in existing systems.

No-Regret Move 4: Establish diverse (human) networks

As AI systems are likely to reach the point of singularity (i.e. a hypothetical idea where artificial intelligence is more intelligent than humans) by 2060, it is essential that human intelligence is also pooled efficiently. For this, networks of diverse individuals are needed so that everyone's perspective is considered. If we want to achieve full transparency about the societal effects of algorithms, we must empower representatives of different races, genders, religions, ages, etc. to articulate their concerns and perspectives.

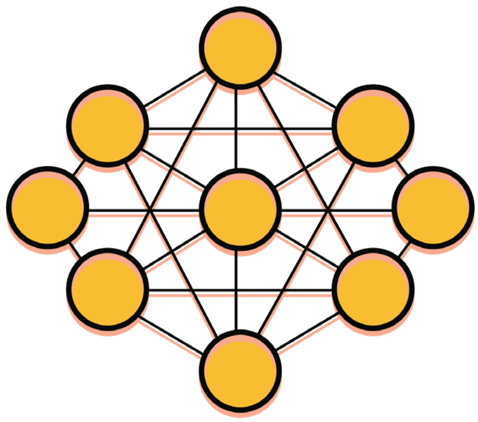
Diverse networks can better safeguard against bias, misrepresentation, marginalisation, thus taking on scenarios where low equity is a concern. These networks can form the basis of co-learning, co-creation and collaboration.

Key Evidence for No-Regret Move 4
Several studies have analysed the AI-based enhancement and dissemination of biases, discriminations and language toxicity.

For example:

- Certain studies demonstrate how Stable Diffusion's text-to-image models amplify stereotypes about race and gender (Nicoletti & Bass, 2023; Luccioni et al., 2023).
- Knapton (2023) emphasises that biases are an innate feature of Large Language Models (LLMs) providing basis to several AI systems and that addressing these biases is paramount to the responsible and equitable implementation of LLM-based technologies.
- Solaiman et al. (2023) call attention to the fact that although GenAI systems have broad social impacts, there is not currently an official standard for means of evaluating those impacts. They further present a guide that promotes a standard approach in evaluating a base generative AI system.
- Many other publications (whose number is ever increasing) identify and discuss various forms of biases disseminated by GenAI technologies and express warnings analysing their possible consequences (for example, Feng et al. (2023), Ferrera (2023) and Gehman et al. (2020)).
- Finally, several publications analyse real-case examples of bias in (generative) AI, referring, for example, to discriminations against coloured people (Angwin et al., 2016), gender-based biases (Gross, 2023) and even cultural expressions such as the "smiling pattern" as a source of biases (Jenka, 2023).

This NRM has a strong connection to the concept of bias intruding in the training data and affecting subsequent operation of LLMs. Depending on their type, biases may have various effects on students' AI-based processes of feedback and assessment. As the NRM suggests, establishing human networks is expected to counterbalance the issue of AI-disseminated biases both at a general level and in the specific case of "student feedback and assessment".



Summary

This position paper outlines future scenarios about the impact of AI on universities and society in 2060. We highlight potential outcomes of AI applications, using as a conceptual vehicle the function of students' feedback and assessment systems, when the drivers of human vs. technology-centred as well as high and low-equity implementations are concerned. Based on these drivers, four scenarios are envisioned for the future:

1. **Inclusive innovation (high equity, tech-centred)**
   AI advancements focus on creating efficient, high-performance systems accessible to all, reducing the digital divide but potentially neglecting ethical considerations such as data privacy and human oversight.

2. **Human-centric growth (high equity, human-centred)**
   AI development prioritises human well-being and ethical considerations, ensuring accessibility and empowering underserved communities, but may face challenges like slow development and high costs due to extensive testing and complex regulations.

3. **Deepening divide (low equity, human-centred)**
   Benefits of AI are concentrated among elite groups with greater access, widening the gap in educational outcomes and leaving underserved communities behind.

4. **Privileged excellence (low equity, tech-centred)**
   AI benefits are concentrated among those with resources, increasing social and economic inequalities and leading to societal tensions due to the marginalisation of large segments of the population.

No-Regret Moves

To navigate these scenarios, the paper proposes a scheme of four no-regret moves, each linked to mitigating risks and maximising opportunities in different scenarios:

1. **Promote AI literacy**
   Enhancing AI literacy is crucial for ensuring equitable access and ethical use of AI technologies across all socio-economic groups. This move addresses the risks in Scenario 2 by preventing marginalisation and mitigates risks in Scenario 1 by ensuring informed decision-making among stakeholders. Scenario 3 would also benefit from this no-regret move.

2. **Organise knowledge transfer events for all stakeholders**
   Collaborative seminars and observatories involving governments, companies, and universities can foster ethical AI systems that prioritise human welfare. This move addresses the risks in Scenario 1 by ensuring multi-stakeholder oversight and mitigates risks in Scenario 3 and Scenario 4 by promoting inclusive collaboration and reducing inequalities.

3. **Create feedback mechanisms for AI development**
   Developing robust feedback mechanisms during AI development ensures transparency, addresses privacy concerns, and prevents algorithmic biases. This move extends the second no-regret move and is essential for mitigating risks in all scenarios by ensuring that AI systems are ethically developed and optimised for educational outcomes.

4. **Establish diverse human networks**
   Building diverse networks of individuals can safeguard against bias, misrepresentation, and marginalisation. This move addresses the risks in Scenario 3 and Scenario 4 by promoting inclusive co-learning, co-creation, and collaboration, ensuring that AI technologies benefit a wide range of communities.

All the above recommendations emphasise the role of universities in safeguarding ethical considerations, collaboration, and inclusivity in leveraging AI for all students, professors and stakeholders. By addressing the potential risks and opportunities associated with each scenario, the paper provides a comprehensive framework for navigating the evolving landscape of AI in higher education.

Disclaimer

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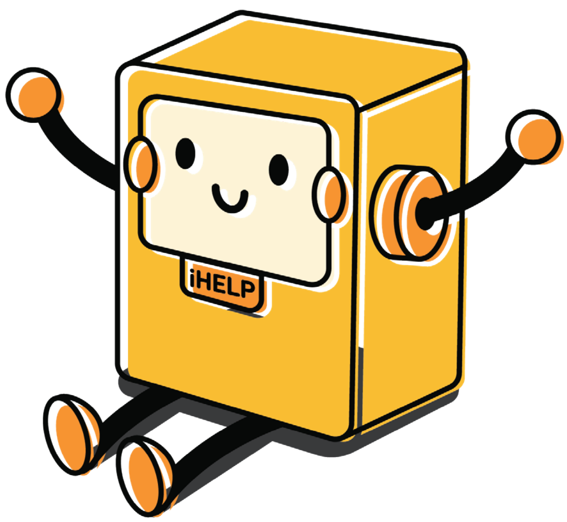


References

Al-Emran, M., AlQudah, A. A., Abbasi, G. A., Al-Sharafi, M. A., & Iranmanesh, M. (2024). Determinants of using AI-based chatbots for knowledge sharing: Evidence from PLS-SEM and fuzzy sets (fsQCA). *IEEE Transactions on Engineering Management, 71*, 4985-4999. https://doi.org/10.1109/tem.2023.3237789

Angwin, J., Larson, J., Mattu, S., & Kirchner, L. (2016, May 23). *Machine Bias: There's software used across the country to predict future criminals. And it's biased against blacks*. ProPublica. https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing

ASEFInnoLab seminar (2024). https://asef.org/projects/innolab5/

Atlas, S. (2023). *ChatGPT for Higher Education and Professional Development: A Guide to Conversational AI*. DigitalCommons@URI, University of Rhode Island. https://digitalcommons.uri.edu/cba_facpubs/548

Bender, E.M., Gebru, T., McMillan-Major, A., Shmitchell, S. (2021). On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜. In *Proceedings of the ACM FAccT '21 Conference* (pp. 610–623). ACM. https://doi.org/10.1145/3442188.3445922

Bobak, C. A., Svoboda, M., Giffin, K. A., Wall, D. P., & Moore, J. (2020). Raising the stakeholders: Improving patient outcomes through interprofessional collaborations in AI for healthcare. *Biocomputing 2021,* 351-355. https://doi.org/10.1142/9789811232701_0035

Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E. et al. (2024). A meta systematic review of artificial intelligence in higher education: a call for increased ethics, collaboration, and rigour. *Int J Educ Technol High Educ 21*(4). https://doi.org/10.1186/s41239-023-00436-z

Cai, Y., Ramis Ferrer, B., & Luis Martinez Lastra, J. (2019). Building university-industry Co-innovation networks in transnational innovation ecosystems: Towards a Transdisciplinary approach of integrating social sciences and artificial intelligence. *Sustainability, 11*(17), 4633. https://doi.org/10.3390/su11174633

Dai, W., Lin, J., Jin, F., Li, T., Tsai, Y., Gasevic, & D., Chen, G. (2023). Can Large Language Models Provide Feedback to Students? A Case Study on ChatGPT. *EdArXiv Preprints*. https://doi.org/10.35542/osf.io/hcgzj

Delgado, F., Yang, S., Madaio, M.A., & Yang, Q. (2023). *The Participatory Turn in AI Design: Theoretical Foundations and the Current State of Practice*. 3rd ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization. https://doi.org/10.1145/3617694.3623261

Dickler, R., Dudy, S., Mawasi, A., Whitehill, J., Benson, A., & Corbitt, A. (2022). *Interdisciplinary approaches to getting AI experts and education stakeholders talking*. Artificial Intelligence in Education. Posters and Late Breaking Results, Workshops and Tutorials, Industry and Innovation Tracks, Practitioners' and Doctoral Consortium. https://doi.org/10.1007/978-3-031-11647-6_20

Dodig-Crnkovic, G. (2023). *AI for people and with people workshop*. International Conference on Human-Agent Interaction. https://doi.org/10.1145/3623809.3623980

Essel, H.B., Vlachopoulos, D., Essuman, A.B., & Amankwa, J.O. (2024). ChatGPT effects on cognitive skills of undergraduate students: Receiving instant responses from AI-based conversational large language models (LLMs). *Computers and Education: Artificial Intelligence, 6*. https://doi.org/10.1016/j.caeai.2023.100198

Feng, S., Park, C.Y., Liu, Y., & Tsvetkov, Y. (2023). *From Pretraining Data to Language Models to Downstream Tasks: Tracking the Trails of Political Biases Leading to Unfair NLP Models*. arXiv. https://arxiv.org/pdf/2305.08283.pdf

Ferrera, E. (2023). *Should ChatGPT be Biased? Challenges and Risks of Bias in Large Language Models*. arXiv. https://arxiv.org/pdf/2304.03738.pdf

Gehman, S., Gururangan, S., Sap, M, Choi, Y., Smith, N., & Allen, P.G. (2020). Evaluating Neural Toxic Degeneration in Language Models. *Findings of the Association for Computational Linguistics: EMNLP 2020*, 3356–3369.

Gross, N. (2023). What ChatGPT Tells Us about Gender: A Cautionary Tale about Performativity and Gender Biases. *AI. Soc. Sci. 2023, 12*(8), 435. https://doi.org/10.3390/socsci12080435
jenka. (2023). *AI and the American Smile. How AI misrepresents culture through a facial expression*. Medium. https://medium.com/@socialcreature/ai-and-the-american-smile-76d23a0fbfaf

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning.* Routledge/Taylor & Francis Group. https://doi.org/10.4324/9780203181522

Holmes, W, Bidarra, J, & Køhler Simonsen, H. (2021). Artificial Intelligence in Higher Education: A Roadmap and Future Perspectives. In: H Køhler Simonsen (Ed.) *Forsøg med Uddannelsesdigitalisering og Hybride Formater*. (pp. 121-138). SmartLearning.

Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial intelligence for assessment and feedback to enhance student success in higher education. *Mathematical Problems in Engineering*, 1-19. https://doi.org/10.1155/2022/5215722

Hornberger, M., Bewersdorff, A., & Nerdel, C. (2023). What do university students know about artificial intelligence? Development and validation of an AI literacy test. *Computers and Education: Artificial Intelligence, 5*. 100165. https://doi.org/10.1016/j.caeai.2023.100165

Hugh, C., Kirkland, J. & Viguerie, P. (1997). *Strategy Under Uncertainty*. Harvard Business Review. https://hbr.org/1997/11/strategy-under-uncertainty

Hwang, G.-J., & Chen, N.-S. (2023). Editorial Position Paper: Exploring the Potential of Gen-erative Artificial Intelligence in Education: Applications, Challenges, and Future Research Directions. *Educational Technology & Society, 26* (2). https://doi.org/10.30191/ETS.202304_26(2).0014

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F. et al. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*. 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kelly, J., Zafar, S.A., Heidemann, L., Vitor-Zacchi, J., Espinoza, D., & Mata, N. (2024). *Navigating the EU AI Act: A Methodological Approach to Compliance for Safety-critical Products*. arXiv. https://arxiv.org/abs/2403.16808

Klamma, R., De Lange, P., Neumann, A. T., Hensen, B., Kravcik, M., Wang, X., & Kuzilek, J. (2020). Scaling mentoring support with distributed artificial intelligence. *Intelligent Tutoring Systems*, 38-44. https://doi.org/10.1007/978-3-030-49663-0_6

Knapton, F. (2023, September 26). *Navigating the biases in LLM generative AI: A Guide To Responsible Implementation*. Forbes Technology Council. https://www.forbes.com/sites/forbestechcouncil/2023/09/06/navigating-the-biases-in-llm-generative-ai-a-guide-to-responsible-implementation

Kong, S., Zhang, G., & Cheng, M. (2022). Pedagogical Delivery and Feedback for an Artificial Intelligence Literacy Programme for University Students with Diverse Academic Backgrounds: Flipped Classroom Learning Approach with Project-based Learning. *Bulletin of the Technical Committee on Learning Technology, 22*(1), 8-14. https://ieeecs-media.computer.org/tc-media/sites/5/2021/10/25204858/bulletin-tclt-2022-0101016.pdf

Korte, S., Cheung, W. M., Maasilta, M., Kong, S., Keskitalo, P., Wang, L., Lau, C. M., Lee, J. C., & Gu, M. M. (2024). Enhancing artificial intelligence literacy through cross-cultural online workshops. *Computers and Education Open, 6*. 100164. https://doi.org/10.1016/j.caeo.2024.100164

Li, S., Ng, K., & Lee, L. (2021). A study on the application of AI experiential learning in the architecture and design courses of a Taiwan University. *Lecture Notes in Computer Science*, 103-115. https://doi.org/10.1007/978-3-030-80504-3_9

Lo, C.K. (2023). What Is the Impact of ChatGPT on Education? A Rapid Review of the Literature. *Educ. Sci. 13, 410*. https://doi.org/10.3390/educsci13040410

Luccioni, A.S., Akiki, C., Mitchel, M., & Jernite, Y. (2023). *Stable Bias: Evaluating Societal Representations in Diffusion Models*. arXiv. https://arxiv.org/pdf/2303.11408.pdf

Nicoletti, L. & Bass, D. (2023). *Humans Are Biased. Generative AI Is Even Worse: Stable Diffusion's text-to-image model amplifies stereotypes about race and gender — here's why that matters*. Bloomberg. https://www.bloomberg.com/graphics/2023-generative-ai-bias/

Mehrfar, A., Zolfaghari, Z., Bordbar, A., & Karimimoghadam, Z. (2024). *The evolution of E-learning towards the emergence of artificial intelligence (A narrative review)*. 2024 11th International and the 17th National Conference on E-Learning and E-Teaching (ICeLeT). https://doi.org/10.1109/icelet62507.2024.10493104

Mollick, E. & Mollick, L. (2023, September 25). *AI as Feedback Generator. Harnessing the Power of Instant Input. Harvard Business Publishing Education*. Harvard Business Publishing. https://hbsp.harvard.edu/inspiring-minds/ai-as-feedback-generator

Ng, D. T., Wu, W., Leung, J. K., Chiu, T. K., & Chu, S. K. (2023). Design and validation of the AI literacy questionnaire: The affective, behavioural, cognitive and ethical approach. *British Journal of Educational Technology, 55*(3), 1082-1104. https://doi.org/10.1111/bjet.13411

Paschke, M., Mihálka, R., & Sudau, M. (2024). Cases for Research Integrity: Generative AI. *ETH Zurich, Zurich-Basel Plant Science Center*. https://doi.org/10.3929/ethz-b-000664648

Raftopoulos, M. (2023). *Augmented humans: Provocations for collaborative AI system design*. 26th International Academic Mindtrek Conference. https://doi.org/10.1145/3616961.3616969

Rezaev, A. V., & Tregubova, N. D. (2023). ChatGPT and AI in the universities: An introduction to the near future. *Vysshee Obrazovanie v Rossii = Higher Education in Russia, 32*(6), 19-37. https://doi.org/10.31992/0869-3617-2023-32-6-19-37

Shin, J. G., Koch, J., Lucero, A., Dalsgaard, P., & Mackay, W. E. (2023). Integrating AI in Human-Human Collaborative Ideation. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23)*. Association for Computing Machinery. https://doi.org/10.1145/3544549.3573802

Solaiman, I, Talat, Z., Agnew, W. et al. (2023). *Evaluating the Social Impact of Generative AI Systems in Systems and Society*. arXiv: https://arxiv.org/pdf/2306.05949.pdf

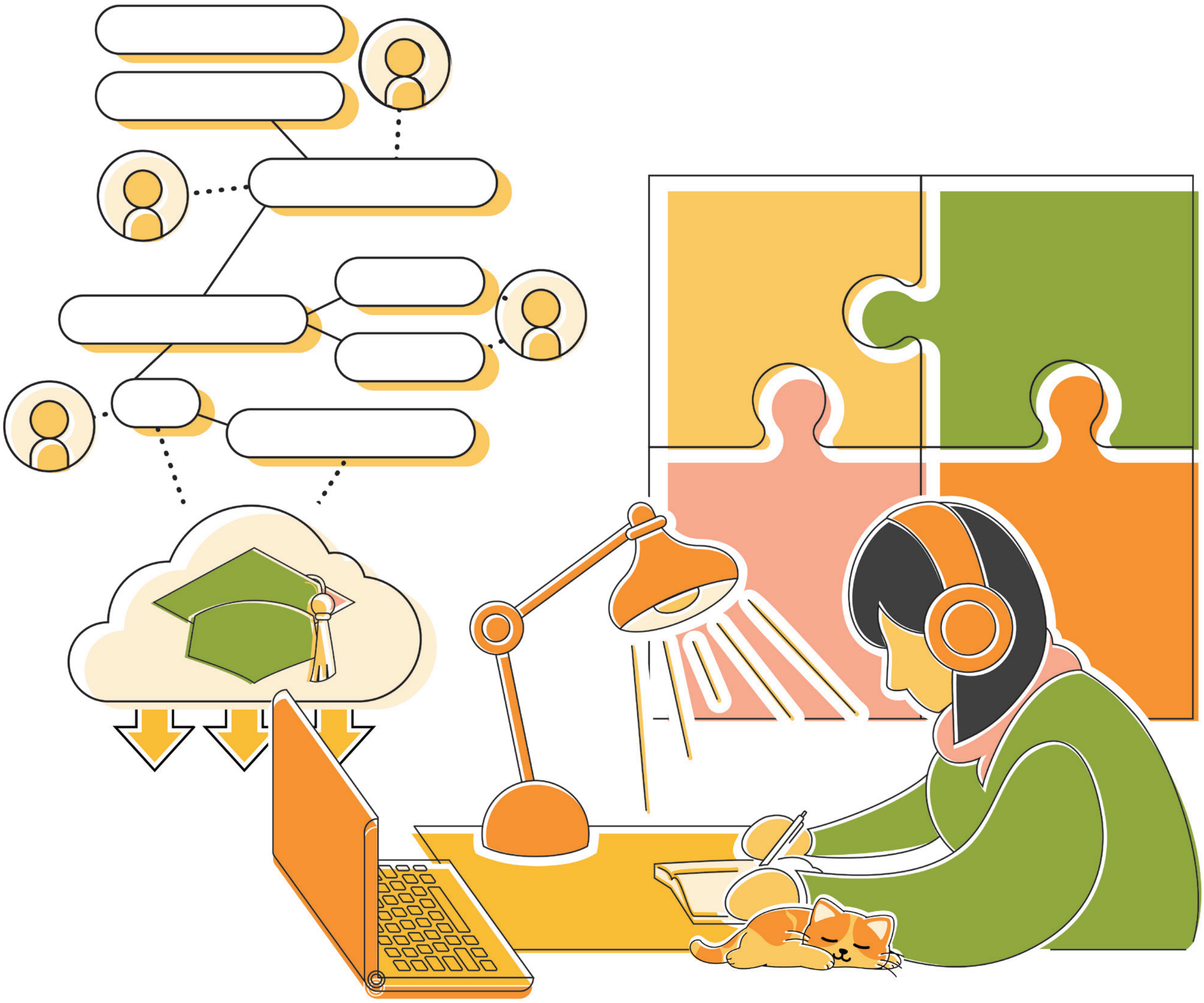
Tubino, L., & Adachi, C. (2022). Developing feedback literacy capabilities through an AI automated feedback tool. *ASCILITE Publications, e22039*. https://doi.org/10.14742/apubs.2022.39

UNESCO. (2023). *ChatGPT and Artificial Intelligence in Education*. https://unesdoc.unesco.org/ark:/48223/pf0000385146

Voulgari, I., Zammit, M., Stouraitis, E., Liapis, A., & Yannakakis, G. (2021). Learn to machine learn: Designing a game-based approach for teaching machine learning to primary and secondary education students. *Interaction Design and Children*. https://doi.org/10.1145/3459990.3465176

Wang, D., Churchill, E., Maes, P., Fan, X., Shneiderman, B., Shi, Y., & Wang, Q. (2020). From human-human collaboration to Human-AI collaboration. In *CHI EA '20: Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*. https://doi.org/10.1145/3334480.3381069

World Economic Forum. (2024). *Shaping the Future of Learning: The Role of AI in Education 4.0. Insight Report, April 2024*. https://www.weforum.org/publications/shaping-the-future-of-learning-the-role-of-ai-in-education-4-0/



Shaping the Future of Education: Strategic AI Investments for a Borderless and Equitable Learning Landscape



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Introduction

Over the past years, technological advances have transformed the economy, education, and everyday life. As we look towards 2060, the landscape is facing a significant transformation driven by advances in artificial intelligence (AI). Regulations, however, have struggled to keep pace. As a result, students may experience completely different approaches to education depending on the country, region or institution. The role of universities and educators is already changing due to AI, yet some remain reluctant to embrace these changes. Despite the continuous technological development, the implementation of AI-based solutions, whether commercial or developed on-premise, remain costly. The challenge is compounded by limited resources – computing power, limited authorised access to data, and insufficient collaboration at various levels. The aim of the position paper is to present potential scenarios for the future of AI for better learning outcomes. The paper also outlines solutions that can help achieve equitable access to the benefits of the technology, to avoid scenarios that are detrimental to humanity.

Based on the prevailing current situation, this paper explores four potential scenarios for AI in education, ranging from highly equitable and technology-focused models to systems that exacerbate existing inequalities. "AI-based Education for All" presents a vision of a world with high equity, developed personalised learning experiences and access to a wide range of knowledge from around the world. Thanks to developments in technology, solutions are widely available, yet controlled to some extent by large corporations. "Empowering Minds" represents a future with high equity and human-centred future, where regulations have been structured to support ethical values and equity of access, transcending barriers. The third scenario, the "Digital Divide," represents a low equity and technology-centred future, where AI takes the lead. Selected parts of society benefit fully from all these assets, while certain portions of society are excluded due to the tiered system of access to knowledge. The last scenario, called "Exclusive AI Education," represents a low equity human-centred future where the level of access to knowledge is strongly dependent on financial situation and social stratum, which ultimately favours the upper class, reducing the potential of AI based solutions across humanity.

While AI is an agent of change, the university should be one of the drivers. Furthermore, changing the culture and mindset is extremely important to adapt to face the new reality. To mitigate these challenges and maximise the benefits of AI in education, several highly actionable no-regret moves have been proposed. These initiatives include AI literacy programmes, free internet access zones, AI-based online learning platforms, dedicated interactive course centres, open-source AI initiatives and university AI resource sharing programmes. The actions aim to democratise AI education, promote equality and ensure that all students, regardless of their socio-economic background, can benefit from technological advances.

Several of the proposed solutions are characterised by the possibility of relatively affordable and efficient implementation for many universities around the world. In addition, a number of them have already been the subject of pilot projects at a selection of institutions. To address the challenges, however, let us first return to the current situation.

The Status Quo

Education today faces a complex landscape influenced by the rapid development of AI. However, the progress of AI in education is significantly affected by various legal, financial, and institutional factors. These challenges vary by region and influence how AI is integrated into education systems. The key aspects are discussed in detail below.

Varied approaches to AI in education

The adoption of AI in education is influenced by the regulatory environment, which differs markedly across regions. In Asia, particularly in developing countries like the Philippines, the situation is complex. While interest in AI is growing, the lack of coherent, enforceable policies and disparities in technological infrastructure are hampering progress. The lack of a unified regulatory framework contributes to inconsistent quality and unequal access to AI-driven educational tools.

Changes in the roles of universities and educators due to AI

AI is reshaping the roles of universities and educators, but the pace and extent of these changes vary widely. In Europe, many institutions are embracing AI, recognizing its potential to enhance teaching and learning. Continuous professional development for educators is emphasised, with strong support from established educational frameworks.

Some less progressive countries, on the other hand, are still dominated by traditional teaching methods, with significant resistance to the introduction of AI into education. Educators often lack the training and resources necessary to adopt AI-driven approaches. This reluctance limits AI's potential to improve educational outcomes.

High initial cost for AI adoption

Financial barriers present significant challenges to AI adoption, although their impact varies by region. Developed countries with substantial financial resources and government support have managed the initial costs of AI infrastructure, facilitating successful AI implementation in education.

In low-income countries, however, the high initial cost of AI adoption is a major barrier, especially in rural areas with limited budgets. These financial constraints exacerbate existing inequalities, restricting the ability of schools and universities to deploy AI and benefit from AI-enhanced education.

Limited research resources

The advancement of AI in education is also hindered by limited research resources. High-quality, open-source datasets and collaborative research networks are crucial for developing effective AI tools.

Well-developed countries benefit from strong investment in research and collaboration. This environment has led to significant advances in the areas mentioned above, contributing to more equitable educational outcomes. Many countries, however, lack such collaborative programmes. This tends to stifle the development of AI technologies that address local educational needs. Limited research infrastructure and support further limits the potential for innovation, reducing the growth and effectiveness of AI in education.

The Drivers of Change

The task of describing possible scenarios for the world in 2060 is not a simple one. To do this well, two factors have been chosen: equity in technology and a human-centred vs a technology-centred future. Here is why it is worth maintaining a middle ground, rather than going to extremes.

Driver of Change 1: Human-centred vs technology-centred AI

A human-centred approach prioritises the needs, experiences and well-being of students, educators and other stakeholders in the educational setting. It emphasises the ethical use of AI, ensuring that technology serves as a tool to enhance human capabilities rather than replace them. On the other hand, technology-centred approach focuses on the capabilities and potential of AI to drive efficiency, innovation, and scalability in education. It prioritises the technological aspects of AI, sometimes at the expense of human-centred concerns.
Balancing human centred and technology centred approaches ensures that AI tools help rather than hinder learning. The result is more effective and empathetic learning that meets learners' individual needs, while maintaining the importance of human interaction and ethical usage.

Driver of Change 2: Equity in technology access (high vs low)

Addressing inequalities in access to technology ensures that all students, regardless of socio-economic status, can access AI-powered educational tools, enabling more equitable learning outcomes across diverse communities.
If we combine all the marginal values of these two drivers, we get four possible scenarios of the future world. These are discussed in the next section.

The Four Scenarios

The drivers of change point to important aspects of an AI-related future. This section, which presents scenarios, draws on these potential developments and describes them in a "from the future" perspective. Each vision is described in two parts. The first addresses the overall vision of the world and the potential impact of the extremes of the drivers of change. The second focuses on the theme of the paper – AI for better learning outcomes. There are common elements in the scenarios. However, each scenario has unique characteristics that correspond to the extremes of the drivers in question.

Scenario 1: AI-based education for all (high equity, tech-centred)

It is the year 2060. AI regulations have been settled for several years and assured to be sustainable and equitable in implementation. However, some of the introduced regulations favour large companies rather than the welfare of individuals.

Government investment in infrastructure and education has increased significantly since 2024, thanks to the pressure from universities. They ensure equitable access to AI-based educational tools, bridging the digital divide and enabling students from all socio-economic backgrounds to benefit.

With relevant policies and initiatives jointly developed by governments and universities, combined with public consultation, AI has transformed education. It has fostered significant improvements in learning outcomes and prepared students for a technologically advanced future. Leveraging AI for better learning outcomes offers valuable potential by providing personalised learning experiences, intelligent tutoring, and efficient assessment.

Therefore, everyone has full access to knowledge from all over the world – provided by universities and beyond. AI tools have long been fully approved to be used in education, allowing the tools to be further enhanced.

Scenario 2: Empowering minds (high equity, human-centred)

It is the year 2060. The introduction of a global education budget in 2040 has been a breakthrough in financial barriers. Competitors to services such as Starlink have driven down costs, making high-speed internet and educational tools universally accessible. The world is now connected by a high-speed, zero-latency network, making virtual and augmented reality tools available globally.

In recent decades, companies have had less control and have been regulated by governments to ensure that privacy policies and ethical aspects of AI are well implemented with equity in mind.

AI for better learning outcomes prioritises human well-being, ethical considerations and the enhancement of human capabilities. With significant investment in education and community engagement, people from diverse backgrounds can benefit from and contribute to the development of AI.

Education is uniting students around the world, strengthening underserved communities and narrowing the digital divide. AI systems are designed with input from diverse stakeholders. This ensures that solutions address a wide range of societal needs, including the development of diverse skills to enhance human capabilities. AI-powered educational tools promote personalised learning (i.e. in terms of interactions between individuals and groups), equitable access and ethical implementation, ultimately leading to better learning outcomes for all students.

Scenario 3: Digital divide (low equity, tech-centred)

It is the year 2060. The world has been transformed by the AI industry controlled by large companies. These companies have created a monopoly by limiting the availability of computing power and components to the rich, thus creating large financial chains.

This class-driven society, determined by access to technology, exacerbates power imbalances, corruption and social instability. It has deepened the digital divide and exacerbated social and economic inequality. Consequently, it has led to higher crime rates and poorer healthcare.

The potential of AI to improve learning outcomes is hampered by inequitable access. These platforms prioritise technological advancement and availability over social impact, requiring extensive personal data integration for personalised experiences. Basic educational resources are universally accessible, whereas more advanced courses require a contribution beyond the financial means of the student, creating a tiered system of access.

Privileged students benefit from AI-enhanced learning, while many others are left behind, increasing social tensions and hindering educational equity and inclusion. Moreover, this education system favours top experts and marginalises middle-rank educators.

Scenario 4: Exclusive AI education (low equity, human-centred)

It is the year 2060. AI technologies are mainly for the benefit of wealthy communities and institutions. This exclusive system primarily benefits the upper class, exacerbating social polarisation.

As the other parts of society are only catering to the rich, there is a sense that there is no higher purpose, and people are becoming disconnected from the world in which they live. While people live in survival mode, job hopping, trying to find places for themselves, they still work for the rich, who end up dominating.

For decades, universities have wanted to implement “no child left behind” programmes, but in practice it has not been properly executed. Collaboration between leading universities has resulted in a personalised learning system that significantly improves learning outcomes but costs more than traditional programmes. While effective and convenient, the high cost means that many potential beneficiaries fail to benefit from it.

This imbalance hinders progress towards equitable learning outcomes, as underserved communities lack access to critical AI innovations. While everyone has the technology to learn, only a select few receive a quality education.

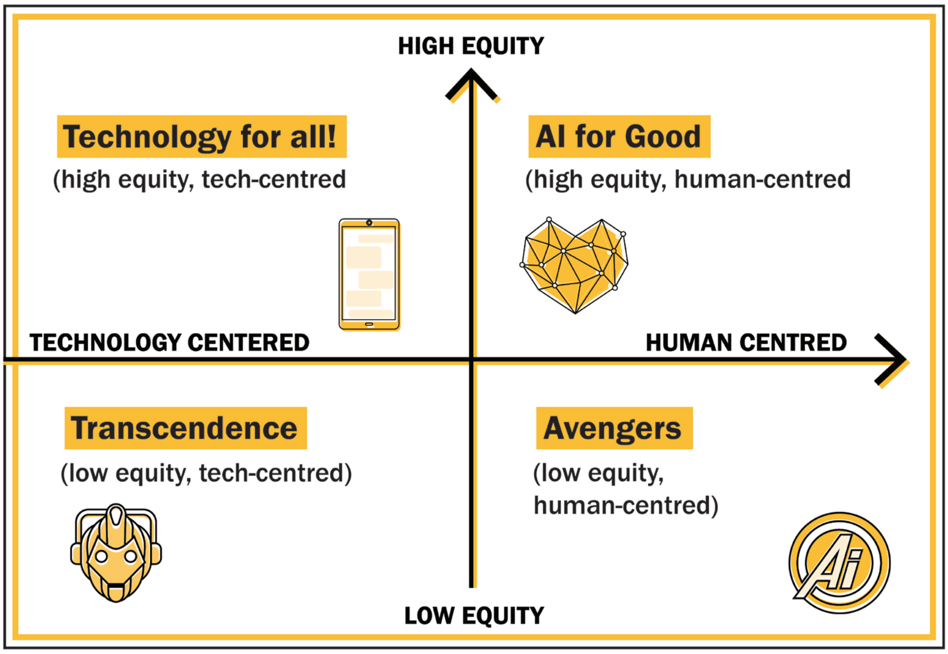

Figure 1. Four scenarios

The No-Regret Moves

The proposed scenarios show different possible pathways for the development of education using AI. Some of the transformations are likely to have a major positive impact on society as a whole, while others are likely to have the opposite effect.

Decisive action is required to ensure that these negative effects do not outweigh the positive ones. For this reason, actionable solutions are presented that can be selected and implemented by universities right away. In doing so, universities will become the drivers of the future, rather than mere observers of a rapidly changing environment.

No-Regret Move 1: AI literacy programme

The development of AI is progressing rapidly. However, in some countries, e.g. the UK, as many as 30% of people surveyed have not heard of AI tools such as Chat GPT, Midjourney etc. (Reuters, 2024).

To address this gap, AI literacy programmes aim to provide accessible online courses on AI, including its applications and risks. These courses, developed at regional or national levels, can be tailored to specific industries making high-quality resources available to all. Under the No Child Left Behind initiative, the programme emphasises equity by offering no-code/low code courses and a nationwide AI education platform, ensuring education is accessible to everyone, regardless of socio-economic status. This approach prepares students for a future shaped by AI and promotes a more inclusive society where the benefits of AI are shared equitably.

Key Components

- **Investment in No-code/Low-Code Courses:** The development and implementation of courses teaching no-code/low-code platforms that make AI accessible to people without advanced programming skills.

- **Nationwide AI Education Platform:** Creation of a platform tailored to different sectors, ensuring that students, educators and communities have access to high-quality AI learning resources.

- **Quality Education for All:** Ensuring that AI literacy programmes are inclusive and equitable. Providing quality education to all students, not just the wealthy.

Relevance in Europe

- **Digital Skill Gap:** Europe faces a growing digital skills gap, which AI literacy programmes can address by equipping more individuals with essential AI skills (Eurostat, 2024).

- **Innovation and Economic Growth:** Countries like Estonia and Finland have successfully implemented AI-driven educational programmes (Education_Estonia, 2023); EBLIDA 2023).

Relevance in Asia

- **Rapid Technological Adoption:** Asia, particularly in regions like South Korea and Singapore, is witnessing rapid technological adoption and digital transformation (ADB, 2023).

- **Equity and Inclusion:** Many Asian countries face significant disparities in digital access and education (UNESCO, 2023).

No-Regret Move 2: Access point zones for all-access education

The creation of Access Point Zones aims to create inclusive spaces that provide free, high-speed Internet access for educational purposes. These zones allow individuals to access online educational resources, participate in virtual classes and engage in research activities. Universities can utilise these zones to promote their programmes, increase brand visibility and foster community engagement.

Key components

- **Free Internet access:** Reliable, high-speed connectivity to access digital libraries and educational portals.

- **University Promotion:** Promotional materials and branding for university programmes.

- **Community Engagement:** Creating a space for educational and community activities.

Relevance in Europe

- **Free Internet access:** Reliable, high-speed connectivity to access digital libraries and educational portals.
- **University Promotion:** Promotional materials and branding for university programmes.
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Relevance in Asia

- **Expanding Educational Access:** Enhances educational opportunities in rural and underserved areas. Asia's diverse regions face challenges in providing uniform access to education (UNESCO, 2020)
- **Boosting Digital Literacy:** Promotes skills development and participation in the digital economy. ASEAN (2022)

No-Regret Move 3: AI-powered online learning platforms

This initiative focuses on creating AI-powered online learning platforms that offer personalised and adaptive educational experiences. By leveraging AI, these platforms tailor content to individual learners, monitor their progress, and provide real-time feedback. Features like intelligent tutoring systems and predictive analytics ensure that the diverse needs of students are met.

Additionally, the integration of tokenisation and blockchain technology can support a global system of education tokens, enabling a decentralised approach to recognizing and rewarding educational achievements.

Key components

- **Personalised Learning Experiences:** AI algorithms that tailor content and pace to individual learners, while adapting in real-time based on performance.
- **Intelligent Tutoring:** AI-powered tutors that provide on-demand assistance and support. Analysis of learning patterns to predict outcomes and recommend interventions.
- **Blockchain and Tokenisation:** Potential integration for tracking achievements and facilitating global recognition of credentials.

Relevance in Europe

- **Enhancing digital education:** The European Commission's Digital Education Action Plan highlights the importance of digital technologies in education (EUC, 2021).
- NVIDIA's collaboration with the University of Florida serves as a model for preparing graduates for tech jobs (NVIDIA, 2024).
- **Addressing Skills Gaps:** European countries are experiencing skills shortages in technology and engineering (Cedefop, 2018).

Relevance in Asia

- **Expanding Access to Quality Education:** Asia's diverse educational needs and rapidly growing population requires scalable solutions (The Head Foundation, 2016).
- **Supporting Language Diversity:** Provides multilingual, adaptive content delivery to support diverse linguistic communities (UNICEF, 2021).

No-Regret Move 4: Dedicated interactive course centres for educators

The initiative establishes dedicated interactive course centres, to help educators create high-quality interactive courses without managing the underlying technology. These centres will provide educators with the infrastructure, tools and support to develop engaging and effective digital content. By working with governments and leveraging existing initiatives, universities will ensure compliance with educational standards and integrate innovative teaching methods.

The centres will make courses accessible and tailored to individual needs, building on the strengths of the no-regret moves 1 and 3. Universities will act as hubs of excellence in educational technology, enhancing online learning quality and allowing educators to focus on course content rather than technical complexities.

Key components

- **Comprehensive Support:** Providing tools, training and resources for educators to create interactive content. Managing technical aspects of course development, including multimedia integration, AI tools and interactive elements through establishing Quality Enhancement Units.
- **Government Partnerships:** Working with government bodies to align with education policy and secure funding and resources.
- **Inclusive Access:** Ensuring that courses are designed to be accessible and inclusive, in line with wider initiatives on access to education.

Relevance in Europe

- **Advancing Educational Quality:** Europe prioritises high-quality education through initiatives like the Bologna Process, enhancing quality and comparability (EUC, 2020).
- **Government Collaboration:** Strong partnerships exist between educational institutions and governments in Europe (Eurydice NES, 2020).

Relevance in Asia

- **Meeting Diverse Educational Needs:** Asia's educational landscape requires scalable solutions to address varying educational requirements (UNESCO AP, 2023).

- **Government Support and Policy Alignment:** Governments in Asia increasingly support initiatives enhancing educational quality and accessibility (OECD EPO, 2019).

No-Regret Move 5: University AI resource sharing programme

The University AI Resource Sharing Programme seeks to democratise access to AI-driven educational tools by enabling resource-sharing among institutions. It encourages universities with advanced AI infrastructures to provide software, hardware, and expertise to less-equipped institutions through partnerships and open access platforms. This initiative aims to ensure that all students benefit from personalised learning and AI innovations, promoting equitable learning outcomes and reducing socio-economic disparities.

Key components

- **Digital Divide and Inequality:** Unequal access to AI deepens social and economic inequalities. Students from wealthier backgrounds benefit more from AI tools, leading to better personalised learning and outcomes (OECD, 2020).

- **Collaborative Models:** Resource-sharing programmes in other sectors (like the EU's Horizon 2020) demonstrate the potential for similar initiatives in education (European Commission, 2021).

- **Global Educational Needs:** Europe faces infrastructure disparities that require cross-border collaboration (European Parliament, 2020). Asia's rapid tech growth necessitates balanced access, making resource-sharing vital to ensure all students benefit from AI (UNESCO, 2019).

Relevance in Europe

- **Educational Disparities:** Differences in resources and digital infrastructure between Western and Eastern Europe highlight the need for collaborative resource-sharing.

- **Policy Support:** The EU's Digital Education Action Plan (2021-2027) promotes digital skills and education initiatives (European Commission 2021).

Relevance in Asia

- **Rapid Technological Growth:** Asia's technological advancements are uneven. Resource-sharing can address disparities between countries like Japan and South Korea and those that lag behind.

- **Educational Initiatives:** UNESCO's initiatives emphasise the need for inclusive education in Asia (UNESCO, 2019).

No-Regret Move 6: Open-source AI research initiative

Investing in an open-source AI research initiative can rapidly advance AI development. This initiative would operate under an open-source license, allowing universities to share achievements, source code, datasets (with privacy safeguards), and data centre resources. It would also include global workshops and challenges, such as those on Kaggle.com, to accelerate development.

Successful implementation requires establishing broadly acceptable cooperation terms and fair-use license to balance innovation with protection. This collaborative approach would foster innovation, transparency, and inclusivity, offering significant advancement in AI research.

Pilot programmes and initiatives

- **Philippines**: The Department of Science and Technology (DOST) has launched open-source AI initiatives to enhance local research and development, providing access to AI tools and fostering education.

- **Singapore**: The AI Singapore programme funds open-source AI development and supports collaborative research. Additionally, the NUS Machine Learning Course offers up to 90% funding.

Relevance in Europe

- **Open-source AI initiative:** The EU's Horizon 2020 programme funds open-source projects like AI4EU, which fosters collaboration and innovation in AI across Europe (AI4EU, 2020).

- **Policy Alignment:** The EU's Digital Education Action Plan supports open-source AI initiatives to enhance research and ensure AI advancements benefit all citizens (European Commission, 2021).

Relevance in Asia

- **Bridging the Digital Divide:** Open-source AI initiatives address disparities in technology access and education empowering underserved communities (TECHS4GOOD, 2024).

- **Economic and Social Development:** Promoting open-source AI can drive economic and social growth by fostering innovation and creating new opportunities (Chong et al, 2022).

The solutions presented will certainly not solve all existing problems, as many of them are not yet known. However, they are a good start for any university to keep the momentum going and to implement new solutions wisely. Some of the no-regret moves can be implemented almost immediately, e.g. access point zones, and some require preparation and negotiation at a higher level, e.g. 1, 3, 5. Nevertheless, each of them aims to lead to the centred development of education with the use of AI for better learning outcomes.

Summary

Within the reach of a single generation, 2060 is both so far away and so close. Looking back over the last few decades, it is clear that this has been one of the most dynamic periods of technological development in history. This trend shows no sign of slowing down, and we continue to read about new discoveries, including those in the field of AI. We can also see the extent to which it is already having an impact on different areas of everyday life. In the context of education, there are different approaches to AI, which are often rather conservative. Perhaps this is due to a reluctance to embrace change. Nevertheless, education should be at the forefront of the development and application of AI.

This position paper sets out a number of potential scenarios for how the future of AI for better learning outcomes could unfold – with a high or low level of equity, and with a human-centred or technology-centred approach. The scenarios we have created have allowed us to ask the question: How can we begin to change the reality today, with low risk investment, so that universities are the drivers of change in AI for better learning outcomes? The proposed no-regret moves 1 through 6 allow universities with different backgrounds to decide on action(s) that suits them and not to remain passive in the context of the changes that are taking place. There is still time to start working on it, but it would be much better to begin right away.

Building a resilient and equitable future hinges on leveraging AI to bridge the digital divide, ensuring that quality education transcends borders and reaches all corners of the globe. By 2060, strategic investments and innovations in AI-driven education can transform learning environments, making them more inclusive and accessible, ultimately creating a world where knowledge is truly borderless and equitable. All we have to do is start right now.

References

ASEAN. (2022). *ASEAN Digital Literacy Programme.* https://asean.org/asean-digital-literacy-programme/

Cedefop. (2018). *Skill shortages in Europe: Which occupations are in demand – and why*. https://www.cedefop.europa.eu/en/publications-and-resources/publications/9123

EUC European Commission. (2021). *Digital Education Action Plan* (2021-2027). https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

European Parliament. (2020). *Digital education policies in Europe and beyond: Key design principles for more effective policies.* https://www.europarl.europa.eu/RegData/etudes/STUD/2020/642869/EPRS_STU(2020)642869_EN.pdf

Eurydice. (2020). *Promoting educational equity.* https://eurydice.org/eurydice/2020-promoting-educational-equity

Ipsos. (2023). Global opinions on products and services using AI. In *AI Index Report 2024*. https://aiindex.stanford.edu/wp-content/uploads/2024/05/HAI_AI-Index-Report-2024.pdf

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education.* Pearson. https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/Intelligence-Unleashed-Publication.pdf

McKinsey & Company. (2023). *AI in education: Enhancing teacher competencies through CPD*. https://www.mckinsey.com/industries/education/our-insights/ai-in-education-enhancing-teacher-competencies-through-cpd

OECD. (2019). *Education policy outlook in Asia: Shaping responsive and resilient education in the region*. https://www.oecd.org/education/education-policy-outlook-in-asia.pdf

OECD EPO. (2019). *Education Policy Outlook in Asia: Shaping Responsive and Resilient Education in the Region*. https://www.oecd.org/education/policy-outlook/
OECD. (2020). Education at a glance 2020: OECD indicators. OECD Publishing. Retrieved from https://www.oecd.org/education/education-at-a-glance/

ONS Office for National Statistics. (2023). *Public awareness, opinions, and expectations about artificial intelligence.* https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/articles/blicawarenessopinionsandexpectationsaboutartificialintelligence/julytooctober2023

Reuters Institute. (2023). *What does the public in six countries think of generative AI news?* https://reutersinstitute.politics.ox.ac.uk/what-does-public-six-countries-think-generative-ai-news#header--3

TechHQ. (2022). *Ensuring EdTech adoption without compromising the user experience.* https://techhq.com/2022/edtech-adoption-user-experience/

The Head Foundation. (2016). *Equity, access, and educational quality in three South-East Asian countries.* https://www.theheadfoundation.org/equity-access-educational-quality/
UNESCO. (2019). Education for sustainable development goals: Learning objectives. https://unesdoc.unesco.org/ark:/48223/pf0000261805

UNESCO. (2020). *Understanding access to higher education in the last two decades.* https://unesdoc.unesco.org/ark:/48223/pf0000261805

UNESCO. (2022). *Digital transformation in education in Asia Pacific: Policy brief.* https://unesdoc.unesco.org/ark:/48223/pf0000261805

UNICEF. (2021). *Early literacy and multilingual education in South Asia.* https://www.unicef.org/rosa/reports/early-literacy-and-multilingual-education-south-asia

World Bank. (2020). *Closing the digital divide can boost educational outcomes for disadvantaged students*. https://www.worldbank.org/en/news/feature/2020/10/27/closing-the-digital-divide-can-boost-educational-outcomes-for-disadvantaged-students

ADB. (2023). *Digital Technology in Asia and the Pacific.* https://www.adb.org/what-we-do/topics/digital-technology

EBLIDA. (2023). *SDG 10 - Oriented Projects*. https://www.eblida.org/News/2022/EBLIDA-SDG-10-oriented-library-projects.pdf

Education_Estonia. (2023). *Empowering Learners with AI in Education.* https://www.educationestonia.org/empowering-learners-with-ai-in-education/

EUC. (2024). *Council Recommendation on Key Competences for Lifelong Learning*. https://education.ec.europa.eu/focus-topics/improving-quality/key-competences

EUROPA. (2024). *EU Artificial intelligence ambition*. https://education.ec.europa.eu/focus-topics/digital-education/action-plan

Eurostat. (2024). *Digital skills in 2023: impact of education and age*. https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240222-1#:~:text=In 2023%2C 55%25 of people,individuals%27 levels of digital skills

NVIDIA. (2024). NVIDIA and the University of Florida are partnering to prepare graduates for technology jobs. https://www.nvidia.com/en-us/case-studies/bringing-ai-education-to-every-college-and-discipline/#:~:text=NVIDIA and the University of Florida Are Partnering to Prepare,scientists and tech-savvy workers.

Stanford. (2024). *Artifical Intelligence Index Report 2024*. https://aiindex.stanford.edu/wp-content/uploads/2024/04/HAI_AI-Index-Report-2024.pdf

UNESCO. (2023). *Empowering Minds: A Round Table on Generative AI and Education in Asia-Pacific*. https://www.unesco.org/en/articles/unesco-convene-experts-round-table-opportunities-and-risks-generative-ai-education-asia-pacific

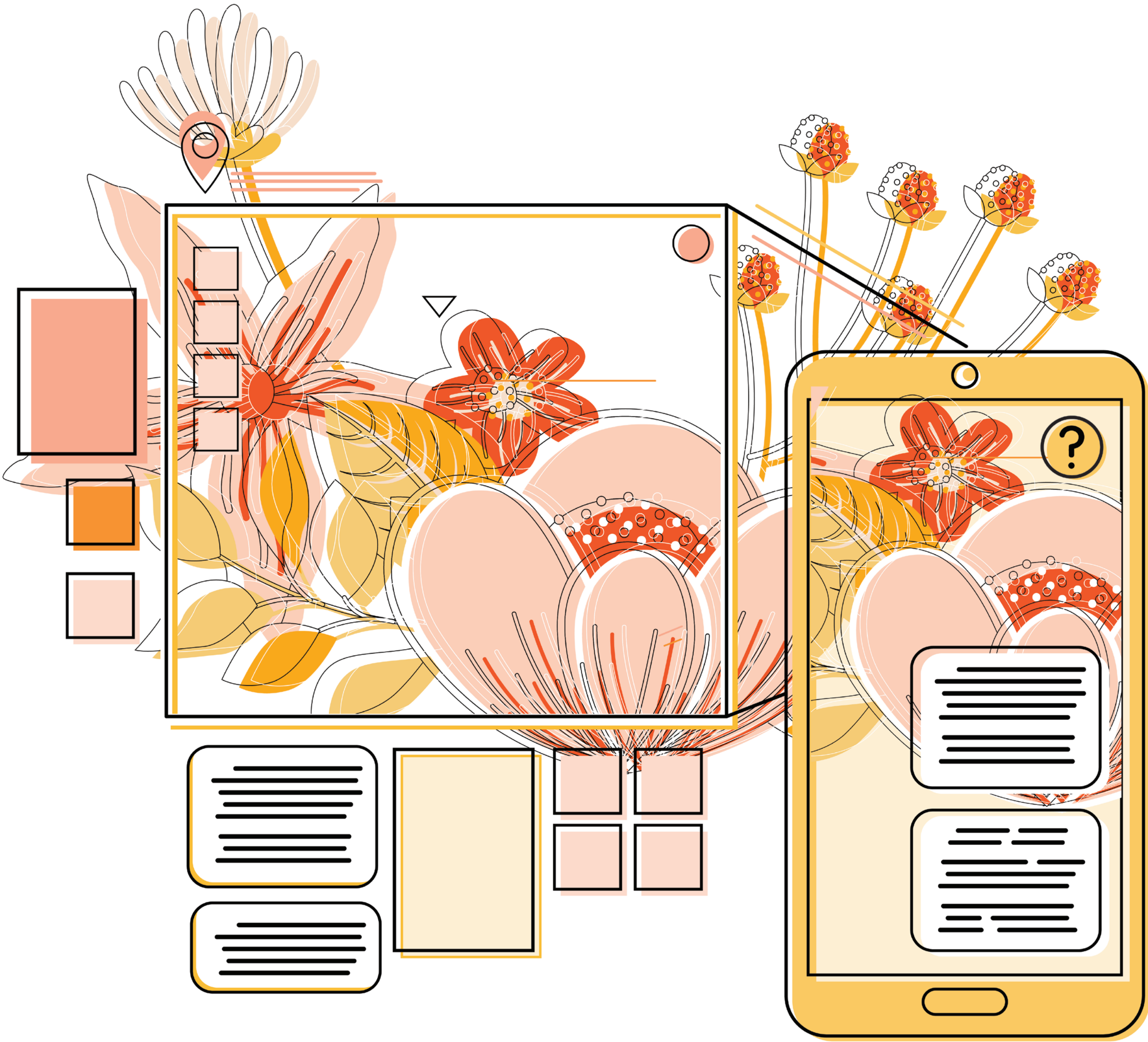
UNESCO AP. (2023). *Addressing learning needs in the Asia-Pacific region: teachers' guide on diagnostic assessment*. https://unesdoc.unesco.org/ark:/48223/pf0000387897

ASEAN EdTech. (2022). *2022 EdTech Ecosystem in Southeast Asia*. https://access-asean.com/2022-edtech-ecosystem-in-southeast-asia-top-investors-growth-segments-and-country-snapshots/

EUC European Commission. (2020). *The Bologna Process and the European Higher Education Area*. https://education.ec.europa.eu/education-levels/higher-education/inclusive-and-connected-higher-education/bologna-process

Eurydice NES. (2020). *National Education Systems*. https://eurydice.eacea.ec.europa.eu/

CCSSO. (2023). *How SEAs Can Modernise the K-12 Education System to Put Student Learning at the Center*. https://learning.ccsso.org/imagining-more-how-state-education-agencies-can-modernize-the-k-12-education-system-to-put-student-learning-at-the-center



AI-Buddy: The 2060 Higher Education AI Assistant

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Introduction

By 2060, universities will be pivotal in artificial innovation (AI) ecosystems, significantly influencing technology and society. This position paper explores the education landscape of the future, with a focus on the potential impact of an AI-based Educational Buddy. Universities are projected to evolve from mere knowledge centres to dynamic hubs that integrate advanced AI research, industry partnerships, and student-centred learning. A central challenge will be harnessing AI's power while preserving the humanistic essence of education. In an increasingly technological yet unequal society, universities must adopt AI-driven adaptive learning tools while promoting inclusivity and comprehensive education.

Collaboration among educators, industry leaders, and policymakers will be vital in balancing AI proficiency with creativity and critical thinking. Through interdisciplinary engagement, equitable access to resources, and the promotion of lifelong learning, universities can bridge the skills gap and prepare students for an ever-changing future. AI tools offer the potential to personalise learning experiences while maintaining essential mentorship and emotional support. Partnerships with industry will ensure that education remains aligned with labour market needs, and ethical frameworks will help safeguard AI's transparent and supportive role in education. This position paper explores the education landscape in 2060, focusing on the impact of an AI-based Educational Buddy. Using scenario-based methodology (Wilburn & Wilburn, 2011), four primary scenarios are created based on two drivers of change: Human- vs. technology-centred society and the level of equity in technology. Additionally, seven no-regrets moves crucial for a sustainable future are proposed.

The Status Quo

The current state of AI integration in education signals a transformative phase for universities, shifting them from traditional knowledge repositories to dynamic hubs of AI research, industry collaboration, and student-centred learning (Milberg, 2024; World Economic Forum, 2024b). This evolution significantly impacts technology and society.

The primary challenge is leveraging AI's potential while preserving education's humanistic facets. Universities must implement inclusive, AI-empowered adaptive learning systems and ensure comprehensive education so that AI can enhance personalised learning, but it must be managed to avoid exacerbating inequalities (Office of Educational Technology, 2023, 2024).

Successful AI integration requires collaboration amongst academia, policymakers, the public, and the private sector (Office of Educational Technology, 2024) , which promotes equitable education and innovation. Such collaboration is crucial for closing the skills gap and aligning with the United Nations' Sustainable Development Goals (Nahar, 2024; Singh et al., 2024).

Ethical frameworks and continuous professional development for educators are essential to maintain AI's supportive and transparent role (Montenegro-Rueda et al., 2023). Industry partnerships provide hands-on training, aligning curricula with labour market demands (Abulibdeh et al., 2024).

In summary, AI integration in education underscores universities' roles as innovation hubs, necessitating ethical AI use, interdisciplinary engagement, and collaborative stakeholder efforts to ensure equitable benefits while preserving education's humanistic essence.

The Four Scenarios

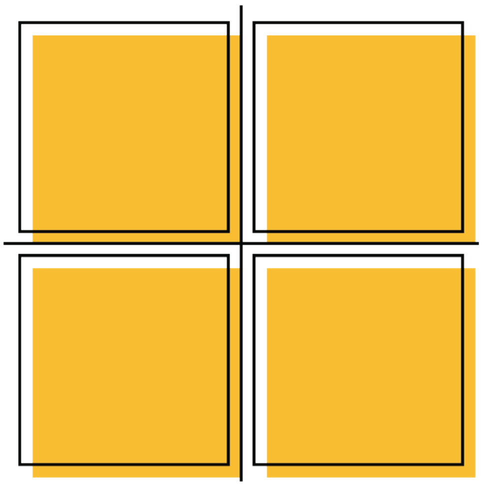
According to scenario-based methodology (Wilburn & Wilburn, 2011), four scenarios were derived from two key drivers of change: a) Human-centred vs technology-centred, and b) Equity in Technology (high vs low). These scenarios describe the educational landscape by 2060, thus allowing us to construct patterns that will help to prepare for any possible future. The following scenarios were derived (see Fig. 1):

1. **Cognitive Coders and Sustainable Cities**
   (high-equity, tech-centred)

2. **Bridging Gaps: AI as an Assistant in a Sustainable and Inclusive World**
   (high-equity, human-centred)

3. **Silicon Towers and Iron Gates**
   (low-equity, tech-centred)

4. **Digital Elites: The New Class Divide**
   (low-equity, human-centred)



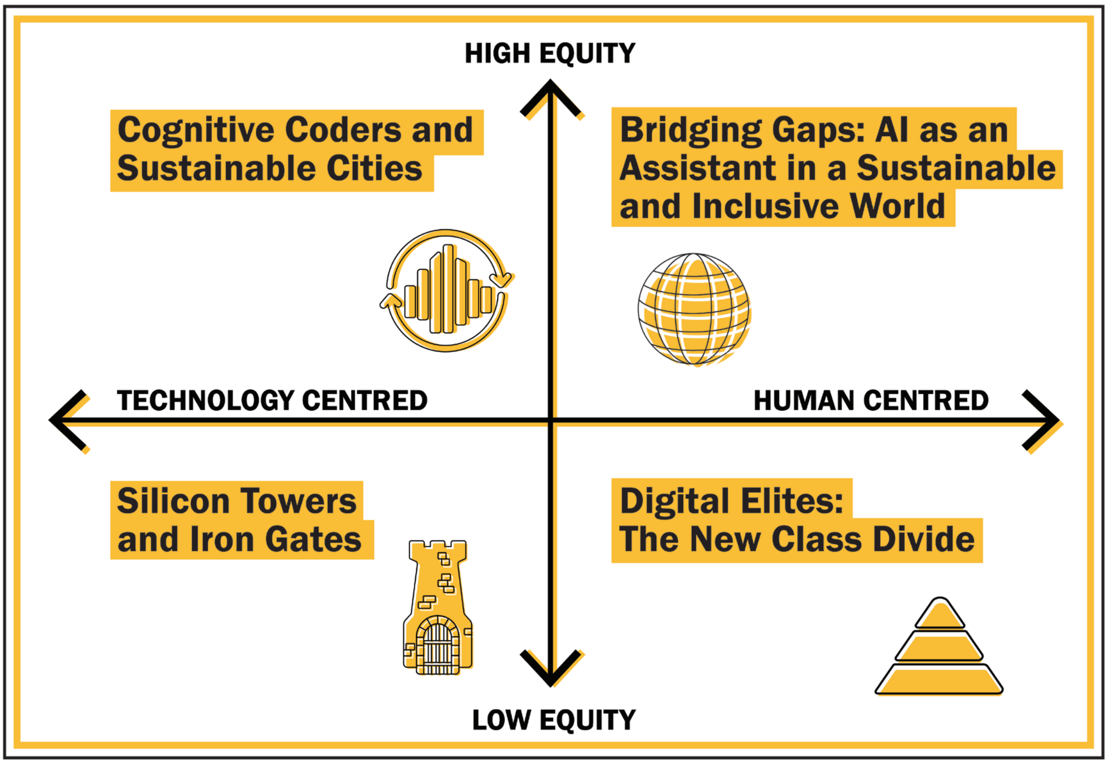


Figure 1. The Four Scenarios

Scenario 1: Cognitive Coders and Sustainable Cities (high-equity, tech-centred)

The role of educators has evolved significantly, driven by advancements in AI. Traditionally, teachers delivered lectures and managed classroom activities, but now they serve as facilitators of learning, guiding students through critical thinking and problem-solving exercises. AI technologies have taken over routine tasks such as creating lectures, designing assessments, and refining syllabi, allowing educators to focus on engaging, interactive teaching methods.

Student experience has become more dynamic and personalised, as AI tools provide tailored learning experiences and interactive resources that address individual strengths and weaknesses. Universities operate under standardised guidelines that leverage AI for diverse fields. Thus, AI systems generate and update relevant content, which educators use to connect theoretical knowledge with real-world issues. This approach ensures students learn and apply academic concepts to contemporary societal challenges.

Accessibility to AI tools is a cornerstone of this new educational landscape. Thanks to significant investments in educational infrastructure, state-of-the-art technologies are available to all students, regardless of their socio-economic background. Continuous training programmes support both students and teachers in adapting to and utilising these technologies effectively.

In the classroom, teachers collaborate with AI to enhance the learning experience. While AI handles administrative tasks and offers personalised learning experiences, teachers concentrate on fostering more profound understanding and encouraging intellectual curiosity. This partnership allows for a more dynamic and supportive educational environment.

Policies are in place to ensure equitable access to AI technologies and address ethical considerations, ensuring that educational advancements benefit all students. These measures include continuous feedback mechanisms to improve AI tools and teaching methods.

The impact of these changes extends beyond the classroom. By preparing students for a technology-driven future, the educational system equips them with essential skills to address global challenges. This shift not only advances individual careers but also supports the development of sustainable cities. As students learn to harness AI for real-world applications, they contribute to innovative solutions for environmental and societal issues. Daily life is enriched as technology integrates more seamlessly into education, promoting lifelong learning and informed citizenship.

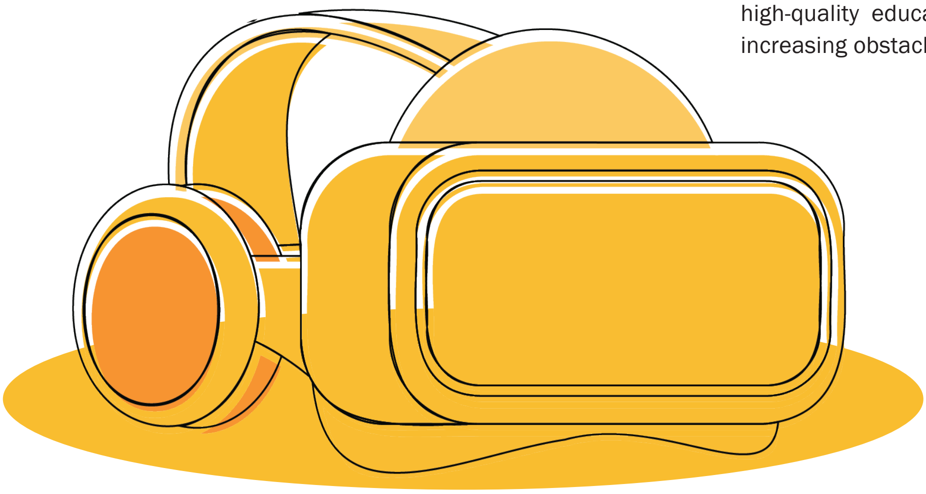
Thus, AI-driven education transforms teaching and learning, making high-quality education more accessible and effective. This evolution prepares students for a future where they can tackle complex global challenges, from sustainability to technological innovation, ultimately fostering a more informed and resilient society.

Scenario 2: Bridging Gaps: AI as an Assistant in a Sustainable and Inclusive World (high-equity, human-centred)

By 2060, AI is a powerful ally in fostering a more equitable and culturally rich world. Envision a future where AI is not just a tool but also a dynamic partner dedicated to enhancing human well-being and preserving our diverse cultural heritage. In the future, AI will support indigenous and underserved communities by documenting, preserving, and sharing their unique traditions, languages, and cultural practices.

AI-driven interactive learning platforms use cutting-edge technologies like virtual reality (VR) and augmented reality (AR) to provide immersive educational experiences that bring cultural heritage to life. These platforms are designed to be inclusive, bridging the digital divide and making advanced educational tools accessible to all. AI tools also focus on language preservation, utilising speech recognition and synthesis technologies to record endangered languages and develop educational materials in native tongues.

Digital archives created by AI serve as comprehensive repositories for cultural artefacts, stories, and rituals, offering a global audience a chance to explore and appreciate these valuable traditions. Developing these technologies involves close collaboration with community members to ensure the AI systems meet their specific cultural and educational needs.
AI's adaptive learning systems personalise education to fit individual learning styles and cultural contexts, making the learning process both engaging and effective. This future vision results in empowered communities that take pride in their heritage, increased global cultural awareness, and more significant educational equity for remote and underserved populations. The ongoing preservation efforts ensure that cultural heritage remains vibrant and accessible for future generations.



Scenario 3: Silicon Towers and Iron Gates (low-equity, tech-centred)

The education sector faces profound challenges in a society where technology drives progress yet needs to improve with equity. As AI development accelerates, traditional educational institutions grapple to keep up. Historically viewed as centres of knowledge and opportunity, universities need help bridging the gap between their theoretical teachings and the practical skills demanded by the rapidly evolving tech industry.

Universities offer a broad, theoretical foundation in fields like cloud engineering and AI, believing that a robust conceptual base will prepare students for the future. However, this approach must be revised because the industry requires immediate, practical expertise. While universities teach abstract concepts, the tech industry demands specialists with hands-on skills who can navigate complex, real-world problems from day one. The curriculum's focus on theoretical principles contrasts sharply with the applied knowledge needed for today's tech-driven roles. In response, educational institutions have started integrating computer science into all disciplines. This mandate reflects the belief that understanding technology is essential for all students, regardless of their career paths. By embedding coding and computational thinking into various fields, educators aim to create a generation of innovative thinkers who can use AI and computational tools to address diverse challenges.

Yet, this shift is marred by significant inequalities. Wealthier institutions leverage advanced AI technologies to offer personalised learning experiences and real-time feedback. In contrast, less affluent schools struggle to provide even primary resources, creating a stark divide between elite and average educational institutions. This disparity deepens the educational divide and exacerbates broader social and economic inequalities.

The educational sector stands at the intersection of tradition and innovation, challenged to adapt to a tech-centred world while striving for fairness. This struggle reflects a broader quest for equity, as those with access to advanced technologies and high-quality education advance while those left behind face increasing obstacles.

Scenario 4: Digital Elites: The New Class Divide (low-equity, human-centred)

This scenario explores the implications of AI as an education buddy where access to advanced AI educational tools is limited to those with significant financial resources, thus exacerbating existing social and economic disparities.

The advanced technologies of AI have become a powerful educational tool. However, this technological advancement could be more liberatory from a Marxist perspective. Instead, it serves as a gatekeeping mechanism that further entrenches the divide between the wealthy and the underprivileged.

In affluent institutions, AI technologies are integrated seamlessly into the educational experience. Here, students benefit from personalised learning tools, efficient administrative systems, and superior resources that lead to impressive academic outcomes. These institutions, backed by substantial financial resources, harness AI to create high-performing educational environments where success is almost guaranteed. The high costs of developing and maintaining such advanced technologies ensure that only the wealthy can afford them, reinforcing the divide between the privileged and the less fortunate.

On the other side of this divide, underprivileged institutions struggle to keep up. They need access to these transformative tools while facing significant challenges in providing quality education. This disparity highlights a growing gap in educational performance that mirrors broader socio-economic inequalities. While the rich enjoy the benefits of cutting-edge AI, the poor need to catch up and cannot compete in an increasingly technology-driven educational landscape.

Private companies and investors, driven primarily by profit, invest heavily in AI advancements that cater to affluent markets. Their focus is on creating superior technologies for those who can pay rather than addressing the needs of underserved communities. This profit-driven approach skews the development of AI towards elite markets, sidelining the groups that could benefit the most from these advancements.

Ethically, this scenario raises serious concerns. AI technologies, which should be a basic need for educational success, are accessible only to those who can afford them. This contradiction between the ideal of equitable access to basic needs and the reality of unequal distribution creates a cycle where the rich benefit while the poor fall further behind.

Ultimately, this situation not only exacerbates existing socio-economic disparities but also raises important ethical questions about justice and fairness in the role of technology in education.

The No-Regret Moves

In this section, No-regret moves are presented. They consist of actions that will pay off regardless of what happens and that are a crucial component of any strategy, helping us to prepare for any conceivable future. In this case, motivated by the development of an AI-Educational Buddy, the following actions are described:

No-Regret Move 1: Knowledge database for AI-powered education AI assistant

A centralised and continually updated knowledge database would serve as the foundation for AI-powered educational tools like study buddies. This database could aggregate educational resources, research, and expert insights from across the globe. Public sector involvement will be key in ensuring this database remains an open and equitable resource, funded through government-backed initiatives to promote access to quality education for all. International cooperation, spearheaded by institutions like the OECD and UNESCO, would ensure that contributions to this database remain diverse, inclusive, and relevant to a wide range of educational contexts (OECD, 2021).

The public sector would play a pivotal role by establishing regulatory frameworks for data privacy and encouraging collaboration between educational institutions, industry, and government bodies. These regulations would also help maintain ethical AI use in education, ensuring that AI systems remain tools for empowerment rather than increasing inequality (European Commission, 2020). Governments can also provide funding for sustainable infrastructure to host the database, ensuring that it aligns with green initiatives (UNESCO, 2022).

The database must prioritise sustainability, not only in terms of education but also in its environmental impact. By incorporating energy-efficient data storage solutions and AI processes, the system could minimise its carbon footprint. Public funding could incentivise the use of green technologies, ensuring that the infrastructure behind the AI-powered study buddy system aligns with global sustainability goals (United Nations, 2022).

The creation of this database and its use in AI tools would transform the role of educators. With AI-powered systems handling routine tasks, such as grading or answering frequently asked questions, teachers would be freed to focus on personalised guidance, mentoring, and more creative approaches to teaching. Moreover, educators could use AI-generated insights to track student progress more effectively, allowing for tailored interventions that enhance student outcomes (Luckin et al., 2016). This move aligns with the Cognitive Coders and Sustainable Cities scenario, where a centralised knowledge database ensures AI-powered educational tools are accessible and contribute to sustainable urban development. By providing personalised learning experiences and supporting global challenges, this initiative helps create tech-driven, equitable cities that align with sustainability goals.

It also supports the Bridging Gaps scenario by fostering inclusivity through open access to AI resources, particularly for underserved communities. The database plays a crucial role in preserving cultural heritage and promoting equitable education through immersive, AI-powered learning tools.

Furthermore, this move addresses concerns in both the Silicon Towers and Digital Elites scenarios by reducing educational inequalities. A publicly funded knowledge database prevents AI technology from becoming exclusive to wealthy institutions, ensuring that even underprivileged communities can access high-quality, AI-powered education, thus countering the divide between affluent and underprivileged learners.

No-Regret Move 2: Ethical AI practices and regulation

Universities will be crucial in developing and implementing frameworks for ethical AI practices (George et al., 2024; Yulianto et al., 2024) and educational standards (Mahrishi et al., 2024). Their contribution will involve conducting research to inform policy, namely regulations and oversight mechanisms to ensure responsible AI development and use, developing educational curricula incorporating ethical considerations for AI, and offering training programmes for students and professionals on ethical AI use. Additionally, universities can facilitate dialogues and collaborations among academia, industry, and policymakers to align ethical standards globally. Specifically, Universities will facilitate the discussion amongst international bodies such as the OECD (OECD.AI Policy Observatory, 2024), UN, UNESCO, and the European and Asian counterparts to create and enforce these frameworks, promoting ethical guidelines for AI development and providing continuous professional development for educators and developers (European Commission, 2024b).

A few things to look forward to are making sure AI laws are uniform among nations, offering sufficient funding for moral AI activities, modernising curriculum, promoting interdisciplinary cooperation, and involving stakeholders in the creation of inclusive AI frameworks for global cooperation and innovation.

Our no-regret decisions will likely positively affect responsible AI development by establishing ethical standards and legal frameworks that encourage accountability and openness. Europe and Asia can take the lead in developing ethical AI, and trust in AI technology is growing. Universities will shape future AI developers, and by combining regulatory and ethical studies, interdisciplinary innovation fosters a comprehensive approach while ensuring that AI tools benefit all societal segments, preventing the exacerbation of inequities seen in the “Silicon Towers and Iron Gates” and “Digital Elites” scenarios.

No-Regret Move 3: Sustainable innovation and urban development

Develop and promote urban innovation hubs (Kim et al., 2021) focused on green technologies (OECD, 2022) and sustainable infrastructure. These hubs will be strategically located in major metropolitan centres across Europe (FutureHubs.eu, 2024) and Asia, serving as catalysts for research, innovation (World Intellectual Property Organization, 2023), development, and deployment of renewable energy solutions (European Commission, 2024d), smart city infrastructure (FutureHubs.eu, 2024; Smart Cities Council, 2024), and circular economy practices. Key actions include funding state-of-the-art facilities, offering incentives for startups and businesses focused on sustainability, and fostering collaborations between universities, industry, government, and local communities.

Universities that can provide adequate funds, update their curricula to include sustainable technologies and infrastructure development and fortify industry-academia relationships are eligible to take part in innovation hubs. Standardised sustainable practices can be implemented to overcome regulatory challenges. Already many modern Universities have science and innovation centres or hubs, that focus on being part of the start-up ecosystem. Many initiatives focus on sustainable innovations, thus providing a decent infrastructure for future developments. By supporting environmentally friendly technologies and sustainable infrastructure, these hubs can spur economic growth and innovation while spawning new businesses and employment possibilities. Sustainable methods can improve resource efficiency and lessen their negative effects on the environment. Examples of these techniques are renewable energy sources and circular economy concepts. Richer curricula can lead to educational advancement, and smart city infrastructure can enhance resource efficiency and urban living circumstances. Through these hubs, global competitiveness can be improved.

This move aligns with the “Cognitive Coders and Sustainable Cities” scenario, where technological innovation is key to urban development. By promoting green technologies and smart city infrastructure, universities help create environments that are not only technologically advanced but also equitable, supporting the “Bridging Gaps” scenario’s focus on inclusivity and sustainability.

No-Regret Move 4: Lifelong learning and skills development

Implementing comprehensive lifelong learning programmes (Just Think, 2024) and upskilling initiatives to prepare the workforce (Mahmud, 2024) for future roles in an AI-driven economy (Deloitte, 2020). This includes developing flexible, modular learning pathways (OECD, 2024b) that allow individuals to update their skills continuously throughout their lives. Collaboration between universities, governments (European Commission, 2024a; UNESCO, 2023), and industries is essential to create and deliver these programmes. Funding and incentives (SkillsFuture, 2024) should be provided to support participation in lifelong learning, particularly for those in underserved communities.

Developing flexible curricula for programmes that promote lifelong learning, guaranteeing that everyone has access to it, obtaining financial support and incentives, forming alliances with businesses, governments, and educational institutions, and recognising and accrediting skills obtained through lifelong learning are among the few considerations in implementing this no-regret move.

Universities already provide courses for lifelong learning to bridge the digital divide. However, a stronger focus on emerging technologies, such as AI is, needed.

Lifelong learning programmes are critical in all scenarios, as they ensure individuals continuously adapt to technological advancements. They can also lead to economic resilience, enhanced employability, and the effects of ongoing upskilling on these factors and reduced inequality brought about by the skills gap. In high-equity scenarios like “Cognitive Coders and Sustainable Cities,” these programmes keep the workforce skilled and competitive. In low-equity scenarios, they provide opportunities for marginalised communities to bridge the skills gap, supporting the “Bridging Gaps” scenario.

No-Regret Move 5: Access to education and bridging the digital divide

Launch large-scale initiatives to provide equitable access (Adeleye et al., 2024; OECD, 2021; Sanders & Scanlon, 2021) to educational technologies, focusing on underserved (Fox, 2016) and underrepresented communities (Kazmi, 2023). This involves investing in infrastructure projects to enhance internet connectivity, providing affordable digital devices, and offering training programmes to improve digital literacy. Collaboration with governments (World Bank, 2016), educational institutions, and private sector partners is essential to implement these initiatives effectively (International Telecommunication Union, 2018).

In order to ensure inclusivity for all students, especially those from marginalised or economically disadvantaged backgrounds, the plan calls for addressing technological disparities, securing funding for digital devices and connectivity, updating educational curricula to include digital literacy and AI education, and forging strong partnerships between the public and private sectors in order to pool resources, share expertise, and maximise the impact of these initiatives.

This no-regret move calls for universities to lead the cooperation between the public and private sectors in the creation of initiatives that foster inclusivity and availability of education in this topic, by focusing on sharing the already existing infrastructure and by partnering with the private sector, as mentioned before.

Bridging the digital divide aims to guarantee that all students, regardless of socioeconomic background, have equal access to education and technical resources, which is essential for preventing the disparities highlighted in the “Digital Elites” and “Silicon Towers and Iron Gates” scenarios. Global competitiveness, economic expansion, social inclusion, and skill development follow from this. Therefore, ensuring equitable access to educational technologies, like improving AI and digital literacy education, will reduce social inequality and strengthen marginalised areas while giving students the skills they need for the future. This also promotes social inclusion and reduces the divide between affluent and underprivileged institutions, thus aligning with both high and low-equity scenarios

No-Regret Move 6: Public-private partnerships and global cooperation

Establish robust public-private partnerships (Diakite & Wandaogo, 2024) through the use of different models and initiative (Alizade, 2024; OECD, 2024a) and foster global cooperation (GPAI, 2024) (European Commission, 2024c) to drive innovation and address global challenges. This involves creating collaborative frameworks where governments (World Economic Forum, 2024a), educational institutions (PAI, 2024), industries, and international organisations (United Nations, 2024) work together on common goals. Key actions include setting up joint research initiatives, shared funding mechanisms, international conferences, and digital platforms for knowledge exchange and best practices.

The main factors that need to be highlighted in this move are resource allocation, regulatory alignment, intellectual property rights, cultural and institutional differences, and sustainability in fostering collaboration and innovation. Long-term sustainability that is in line with global goals is also essential.

Universities have experience in global cooperation and already existing networks for exchange of information. Stronger focus and financial support are needed to further leverage their research capabilities and international reach Strengthened partnerships between universities, industry, and governments can help ensure that cutting-edge research is effectively translated into real-world solutions, driving sustainable growth and fostering inclusive development across sectors and regions. Collaborative networks contribute to a more resilient and integrated global community by fostering social cohesion, accelerating innovation, improving educational quality, creating global solutions, and boosting economic growth, which aligns with the goals of tech-centred and human-centred scenarios. They make it possible for various stakeholders to combine their resources, skills, and knowledge, which improves research and educational capacities while ensuring that technological advancements do not lead to further societal divides.

No-Regret Move 7: Blockchain and AI for transparent governance and empowered economies

Establishing a global blockchain infrastructure (OECD, 2019a; World Economic Forum, 2018) enhanced by AI for real-time fraud detection (Ambolis, 2024; Kuznetsov et al., 2024) will foster transparency and accountability. Decentralised governance frameworks (European Commission, 2023; Neloy et al., 2023; The Geneva Association, 2023) will empower local communities through blockchain-based voting, while local currencies and smart contracts will secure and streamline transactions (Venkatesan & Rahayu, 2024) (MIT Media Lab, n.d.), boosting local economies. Collaborative regulatory policies will ensure ethical use, supported by widespread education and sustainable technology (OECD, 2019a). This will reduce corruption and empower communities (ITU, 2024).

This action must address the main issues, including improving technological literacy, encouraging the ethical use of blockchain and AI, addressing the impact on the environment, and fostering international cooperation to ensure the interoperability and global reach of these efforts.

Universities can drive innovation in blockchain and AI by conducting interdisciplinary research, developing ethical frameworks, and enhancing technological literacy through education. They also serve as neutral platforms for testing decentralised governance models and collaborating with governments and industries on regulatory and scalable solutions. By fostering international cooperation and sharing knowledge, universities empower local communities and contribute to the global adoption of these technologies for transparent governance and economic growth.

There are already initiatives in Europe concerning decentralised identity based on blockchain.

Blockchain and AI technologies encourage accountability, openness, faith in institutions, economic empowerment, and creativity. They also lessen corruption, foster regional development, and open up new business prospects across a range of industries. Such outcomes are crucial in low-equity scenarios. Blockchain and AI technologies also support high-equity scenarios by promoting transparency and trust in technological solutions, which are vital for societal acceptance.

No-Regret Move 8: Investment in education, R&D, and infrastructure for a skilled workforce and economic integration

Strategic investment in education, R&D (PCAST, 2024), and infrastructure (USAID, 2022) with a strong focus on AI integration to bolster the economy (The Brookings Institute, 2024) and support a skilled workforce. This includes AI-driven lifelong learning programmes, equitable access to AI-enhanced education (European Commission, 2024a; Roland et al., 2020), industry partnerships for AI training (McKisney, 2024) and AI-powered research hubs with funding incentives. We will expand digital infrastructure with AI-optimised high-speed internet, robust cybersecurity, and smart city technologies while focusing on sustainable physical infrastructure and advanced transportation networks utilising AI for efficiency. Economic viability, environmental impact, social equity, and AI-friendly regulations are vital considerations. These AI-driven investments will yield a highly skilled workforce, sustainable growth, enhanced connectivity, and improved quality of life, positioning us to meet future challenges and seize opportunities (OECD, 2019b; United Nations, 2024; World Economic Forum, 2023).

Universities can collaborate with private companies to create AI-driven internship programmes that provide students with hands-on experience and exposure to cutting-edge technologies. These partnerships offer students a direct pathway to employment, with companies granting future job placements to those who excel during their internships. By aligning academic curricula with industry needs, universities ensure that students are equipped with the skills necessary for the workforce, fostering both innovation and economic growth.

The plan prioritises social equality, environmental effect, economic viability, and regulatory framework for infrastructure projects. It encourages diversity, lessens inequality, and prioritises green technologies. It also emphasises a regulatory framework that promotes both public safety and innovation.

This leads to a skilled workforce, enhanced connectivity, and improved quality of life in a country, contributing to sustainable economic growth, global competitiveness, and reduced regional disparities. This is relevant in all scenarios, whether it’s to support sustainable development (“Cognitive Coders and Sustainable Cities”) or mitigate the digital divide (“Digital Elites: The New Class Divide”).

Summary

This position paper examines the evolving role of universities in an AI-driven future, mainly focusing on the impact on AI-based Educational Buddy on education and society by 2060. Four major scenarios are presented, considering different societal and technological outcomes:

Cognitive Coders and Sustainable Cities envision AI tools benefiting all societal segments. Educators will use AI for routine tasks and focus on critical reasoning and problem-solving skills (Kamruzzaman et al., 2023).

Bridging Gaps: AI as an Assistant in a Sustainable and Inclusive World emphasises AI's role in preserving cultural heritage and supporting underserved communities through interactive learning platforms and language preservation tools (Das, B. R., Maringanti, H. B., & Dash, 2022; Muhathir et al., 2023; Yu et al., 2022).

Silicon Towers and Iron Gates explore a future where AI advancements widen social and economic disparities, resulting in a significant skills gap in education (Sartori & Theodorou, 2022). Affluent institutions can afford cutting-edge AI technologies, while less wealthy schools face educational inequity due to lack of access (Feijao et al., 2021; Trucano, 2023). This uneven implementation of AI as an academic assistant leads to personalised learning experiences and efficient administrative support for privileged students.

Digital Elites: The New Class Divide explores a scenario in which AI developments primarily benefit affluent groups, creating a divide in educational access (Milberg, 2024; World Economic Forum, 2024b). It highlights the need for ethical considerations and equitable access to prevent the academic gap from further widening.

To ensure a positive trajectory for AI in education, the paper identifies several no-regret moves: including establishing ethical frameworks, fostering cross-sector collaborations, and investing in digital infrastructure. This involves creating regulations, aligning policies, providing resources, and updating curricula to include ethical AI practices. Promoting urban innovation hubs and green technologies is essential for economic resilience, including funding facilities, supporting sustainability-focused startups, and fostering collaborations between academia, industry, government, and communities. Also, lifelong learning and upskilling programmes should be implemented to prepare the workforce for an AI-driven economy, ensuring adaptable curricula, accessibility, securing funding, and building partnerships. Moreover, investing in infrastructure for internet connectivity and digital devices is essential to ensure equitable access to educational technologies and to foster collaborations among governments, academic institutions, industries, and international organisations to drive innovation and address global challenges. Utilising blockchain and AI and investing in education, R&D, and infrastructure also play critical roles in supporting a skilled workforce and economic integration.

By taking proactive measures, stakeholders can ensure AI in education evolves to maximise societal benefits, uphold ethical standards, and prepare future generations for a rapidly changing technological landscape. This comprehensive approach will enable universities to adapt and shape AI innovation, leading to a more equitable and advanced global society by 2060.

References

Abulibdeh, A., Zaidan, E., & Abulibdeh, R. (2024). Navigating the confluence of artificial intelligence and education for sustainable development in the era of industry 4.0: Challenges, opportunities, and ethical dimensions. *Journal of Cleaner Production, 437*, 140527. https://doi.org/10.1016/j.jclepro.2023.140527

Adeleye, O. O., Eden, C. A., & Adeniyi, I. S. (2024). Educational technology and the digital divide: A conceptual framework for technical literacy inclusion. *International Journal of Science and Research Archive, 12*(1), 150–156. https://doi.org/10.30574/ijsra.2024.12.1.0405

Alizade, C. K. (2024). Public-private partnership models in industry. *The 20th International Scientific and Practical Conference "Trends in the Development of Quality Training of Future Specialists".*

Ambolis, D. (2024). All About The Amazing : *AI, Blockchain, And The Future of Governance In USA In 2024.* Blockchain Magazine. https://blockchainmagazine.net/ai-blockchain-and-the-future/

Das, B. R., Maringanti, H. B., & Dash, N. S. (2022). Role of Artificial Intelligence in Preservation of Culture and Heritage. In D. Mishra & S. R. Samanta (Eds.), *Digitalization Of Culture through Technology* (pp. 92–97). Routledge.

Deloitte. (2020). *The upskilling imperative: Building a future-ready workforce for the AI age.* https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/Analytics/ca-en-deloitte-analytics-upskilling-aoda.pdf

Diakite, M., & Wandaogo, A.-A. (2024). *Cross-Country Empirical Analysis of GovTech Platforms on Citizen Engagement*.

European Commission. (2023). *Blockchain Strategy.* https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy

European Commission. (2019). *Ethics guidelines for trustworthy AI.* https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

European Commission. (2024a). *Digital Education Action Plan* (2021-2027). https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

European Commission. (2024b). *European approach to artificial intelligence.* https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence

European Commission. (2024c). *European Commission – AI4EU Initiative.* https://www.ai4eu.eu/

European Commission. (2024d). *The European Green Deal.*

Feijao, C., Flanagan, I., Stolk, C. Van, & Gunashekar, S. (2021). *The global digital skills gap: Current trends and future directions*. https://www.rand.org/pubs/research_reports/RRA1533-1.html

Fox, S. (2016). An Equitable Education in the Digital Age: Providing Internet Access to Students of Poverty. *Journal of Education & Social Policy, 3*(3).

FutureHubs.eu. (2024). *Urban Innovation.* https://futurehubs.eu/topics/urban-innovations-unveiled/

George, A. S., Baskar, T., & Pandey, D. (2024). Establishing Global AI Accountability: Training Data Transparency, Copyright, and Misinformation. *Partners Universal Innovative Research Publication (PUIRP), 2(*3), 75–91. https://doi.org/10.5281/zenodo.11659602

GPAI. (2024). *Global Partnership on Artificial Intelligence.* https://gpai.ai/

International Telecommunication Union. (2018). *Measuring the Information Society Report 2018.*

ITU. (2024). *Blockchain for Development*. International Telecommunication Union. https://www.itu.int/en/ITU-T/ssc/resources/Pages/topic-004.aspx

Just Think. (2024). *The importance of lifelong learning in an AI-driven economy.* https://www.justthink.ai/blog/the-importance-of-lifelong-learning-in-an-ai-driven-economy

Kamruzzaman, M. M., Alanazi, S., Alruwaili, M., Alshammari, N., Elaiwat, S., Abu-Zanona, M., Innab, N., Mohammad Elzaghmouri, B., & Ahmed Alanazi, B. (2023). AI- and IoT-Assisted Sustainable Education Systems during Pandemics, such as COVID-19, for Smart Cities. *Sustainability, 15*(10), 8354. https://doi.org/10.3390/su15108354

Kazmi, Z. S. (2023). *Exploring the Digital Divide in Educational Technology across Illinois School Districts: a Focus on Business Education in Urban, Suburban, and Rural Schools*. Illinois State University.

Kim, H. M., Sabri, S., & Kent, A. (2021). Smart cities as a platform for technological and social innovation in productivity, sustainability, and livability: A conceptual framework. In *Smart Cities for Technological and Social Innovation* (pp. 9–28). Elsevier. https://doi.org/10.1016/B978-0-12-818886-6.00002-2

Kuznetsov, O., Sernani, P., Romeo, L., Frontoni, E., & Mancini, A. (2024). On the Integration of Artificial Intelligence and Blockchain Technology: A Perspective About Security. *IEEE Access, 12*, 3881–3897. https://doi.org/10.1109/ACCESS.2023.3349019

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education.* https://www.pearson.com/content/dam/corporate/global/pearson-dot-com/files/innovation/Intelligence-Unleashed-Publication.pdf

Mahmud, N. S. (2024). Navigating AI Integration in Sabah's Traditional Industries: Opportunities, Challenges, and Strategies for Inclusive Growth. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.4806156

Mahrishi, M., Abbas, A., & Siddiqui, M. K. (2024). Global Initiatives Towards Regulatory Frameworks for Artificial Intelligence (AI) in Higher Education. *Digital Government: Research and Practice.* https://doi.org/10.1145/3672462

McKisney. (2024). *Gen AI and the future of work*. https://www.mckinsey.com/quarterly/the-five-fifty/five-fifty-gen-ai-and-the-future-of-work

Milberg, T. (2024). *The future of learning: How AI is revolutionizing education 4.0.* World Economic Forum. https://www.weforum.org/agenda/2024/04/future-learning-ai-revolutionizing-education-4-0/

MIT Media Lab. (n.d.). *AI and Blockchain for Social Good*.

Montenegro-Rueda, M., Fernández-Cerero, J., Fernández-Batanero, J. M., & López-Meneses, E. (2023). Impact of the Implementation of ChatGPT in Education: A Systematic Review. *Computers, 12*(8), 1–13. https://doi.org/10.3390/computers12080153

Muhathir, Khairina, N., Barus, R. K. I., Ula, M., & Sahputra, I. (2023). Preserving Cultural Heritage Through AI: Developing LeNet Architecture for Wayang Image Classification. *International Journal of Advanced Computer Science and Applications, 14*(9). https://doi.org/10.14569/IJACSA.2023.0140919

Neloy, M. N., Wahab, M. A., Wasif, S., All Noman, A., Rahaman, M., Pranto, T. H., Haque, A. K. M. B., & Rahman, R. M. (2023). A remote and cost-optimized voting system using blockchain and smart contract. *IET Blockchain, 3*(1), 1–17. https://doi.org/10.1049/blc2.12021

OECD.*AI Policy Observatory.* (2024). OECD AI Principles. https://oecd.ai/en/ai-principles

OECD. (2019a). Blockchain technologies as a digital enabler for sustainable infrastructure. *OECD Environment Policy Papers, 16*. https://doi.org/10.1787/0ec26947-en

OECD. (2019b). *Artificial Intelligence in Society.* OECD. https://doi.org/10.1787/eedfee77-en

OECD. (2021). *Bridging digital divides in G20 countries.* https://doi.org/10.1787/35c1d850-en

OECD (2021), *OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots*, https://doi.org/10.1787/589b283f-en

OECD. (2022). G*reen Economy Transition in Eastern Europe, the Caucasus and Central Asia.* OECD. https://doi.org/10.1787/c410b82a-en

OECD. (2024a). *OECD AI Policy Observatory.* https://oecd.ai/

OECD. (2024b). *The OECD Learning Compass 2030*. https://www.oecd.org/en/data/tools/oecd-learning-compass-2030.html

Office of Educational Technology. (2023). *Artificial Intelligence and Future of Teaching and Learning: Insights and Recommendations*.

Office of Educational Technology. (2024). *Designing for Education with Artificial Intelligence: An Essential Guide for Developers.*

PAI. (2024). *Partnership on AI*. https://www.partnershiponai.org/
PCAST. (2024). Harnessing Artificial Intelligence to Meet Global Challenges.

Roland, N., Allinckx, I., & Karno, A. (2020). *Vocational education and training for the future of work: Belgium.*

Sanders, C. K., & Scanlon, E. (2021). The Digital Divide Is a Human Rights Issue: Advancing Social Inclusion Through Social Work Advocacy. *Journal of Human Rights and Social Work, 6*(2), 130–143. https://doi.org/10.1007/s41134-020-00147-9

Sartori, L., & Theodorou, A. (2022). A sociotechnical perspective for the future of AI: narratives, inequalities, and human control. *Ethics and Information Technology, 24*(1), 4. https://doi.org/10.1007/s10676-022-09624-3

SkillsFuture. (2024). *SkillsFuture Singapore*. https://www.skillsfuture.gov.sg/

Smart Cities Council. (2024). *Smart Cities Council*. https://www.smartcitiescouncil.com/

The Brookings Institute. (2024). *AI Governance*. https://www.brookings.edu/tags/ai-governance/

The Geneva Association. (2023). *Assessing the Potential of Decentralized Finance and Blockchain*. https://www.genevaassociation.org/sites/default/files/2023-08/DeFi insurance_WEB.pdf

Trucano, M. (2023). *AI and the next digital divide in education.* https://www.brookings.edu/articles/ai-and-the-next-digital-divide-in-education/

UNESCO. (2023). *Global Education Monitoring Report*.

United Nations. (2024). *AI for Good Global Summit*. https://aiforgood.itu.int/summit24/

United Nations. (2022). *The Sustainable Development Goals Report 2022* https://unstats.un.org/sdgs/report/2022/

USAID. (2022). *Artificial Intelligence Action Plan*. https://www.usaid.gov/sites/default/files/2022-05/USAID_Artificial_Intelligence_Action_Plan.pdf

Venkatesan, K., & Rahayu, S. B. (2024). Blockchain security enhancement: an approach towards hybrid consensus algorithms and machine learning techniques. *Scientific Reports, 14*(1), 1149. https://doi.org/10.1038/s41598-024-51578-7

Wilburn, K., & Wilburn, R. (2011). Abbreviated Scenario Thinking. *Business Horizons, 54*(6), 541–550. https://doi.org/10.1016/j.bushor.2011.07.002

World Economic Forum. (2018). *Blockchain Beyond the Hype: A Practical Framework for Business Leaders.* https://www3.weforum.org/docs/48423_Whether_Blockchain_WP.pdf

World Economic Forum. (2023). *The Future of Jobs Report 2023*. https://www.weforum.org/publications/the-future-of-jobs-report-2023/

World Economic Forum. (2024a). *Centre for the Fourth Industrial Revolution.* https://centres.weforum.org/centre-for-the-fourth-industrial-revolution/home

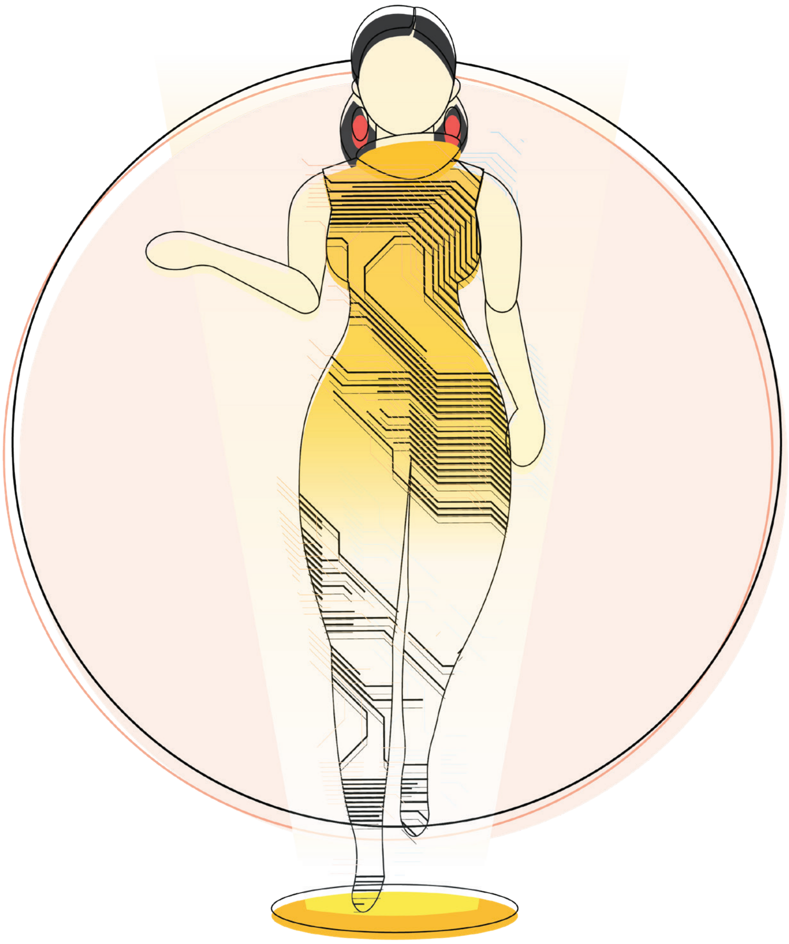
World Economic Forum. (2024b). *Shaping the Future of Learning: The Role of AI in Education 4.0.* https://www3.weforum.org/docs/WEF_Shaping_the_Future_of_Learning_2024.pdf

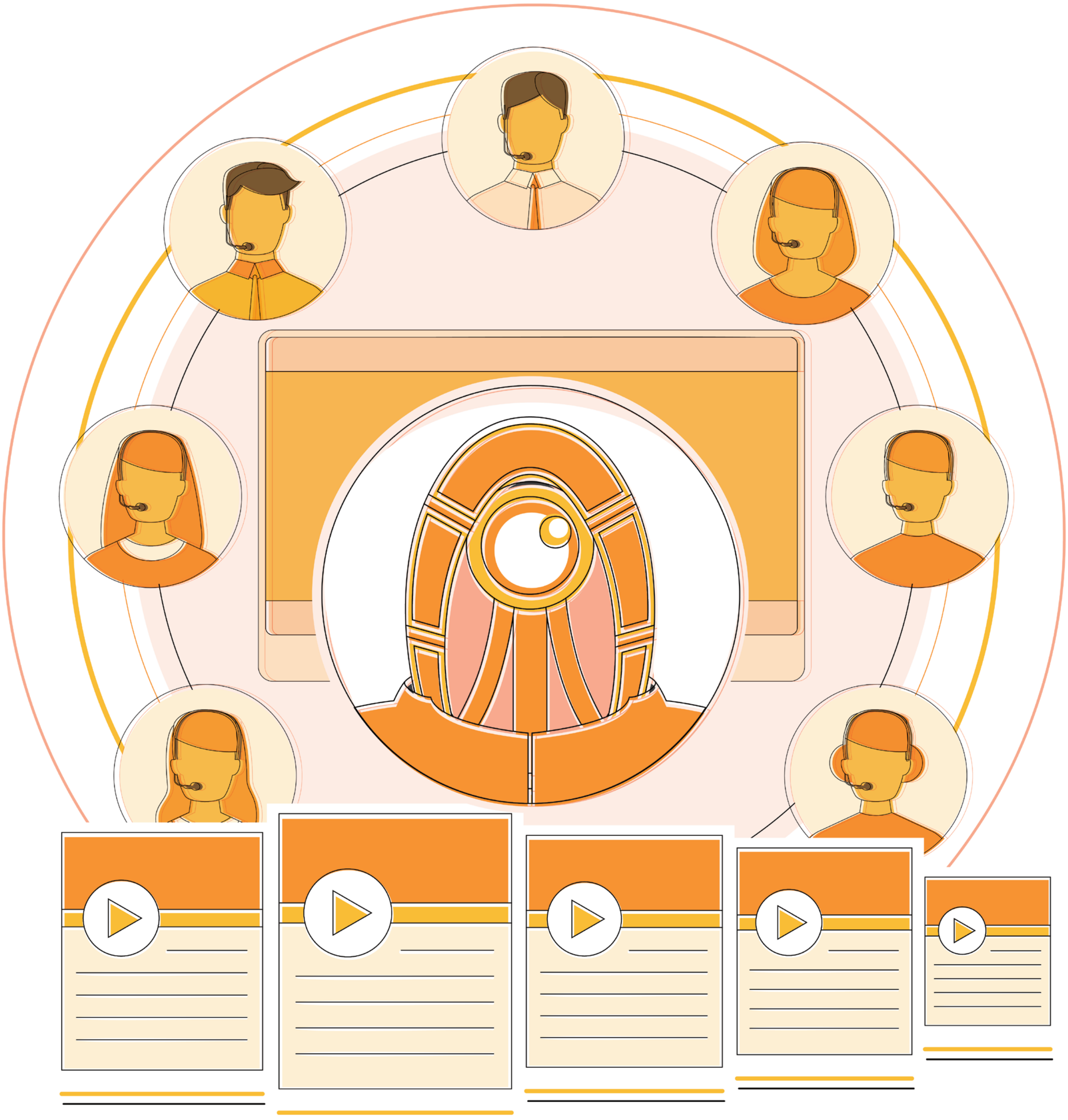
World Intellectual Property Organization. (2023). *Global Innovation Index.* https://www.wipo.int/global_innovation_index/en/

WorldBank. (2016). *World Development Report 2016: Digital Dividends*. https://www.worldbank.org/en/publication/wdr2016

Yu, T., Lin, C., Zhang, S., Wang, C., Ding, X., An, H., Liu, X., Qu, T., Wan, L., You, S., Wu, J., & Zhang, J. (2022). Artificial Intelligence for Dunhuang Cultural Heritage Protection: The Project and the Dataset. *International Journal of Computer Vision, 130*(11), 2646–2673. https://doi.org/10.1007/s11263-022-01665-x

Yulianto, S. F., Rahmawati, N. R., Falach, G., & Fanani, M. Z. (2024). Studies of Etichal Dimensions of Educationin Artifical Intellegence Era: A Study from A Humanism Philosophy Perspective Inspired by Carl Rogers. *Proceeding International Conference on Religion, Science and Education (Vol.3)*, 413–419.





Advancing Continuous Professional Development for Equitable and Ethical AI Integration in Higher Education

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Introduction

The rapid advancement of Artificial Intelligence (AI) is poised to revolutionise the education sector, offering unprecedented opportunities to personalise learning, automate tasks, and enhance educational outcomes (Abgaryan et al., 2023; Neuron Learning Team, 2024). However, the integration of AI in education also presents significant challenges (O'Dea & O'Dea, 2023). These challenges include not only ethical considerations and equitable access but also a need for a fundamental shift in how educators perceive and utilise AI (Ghnemat et al., 2022).

In the context of AI education, equitable access ensures that all individuals, regardless of their socioeconomic background, geographic location, or individual circumstances, have the opportunity to participate in and benefit from AI learning experiences (Digital Competence Framework for Educators, n.d.). This involves not only providing access to AI tools and technologies but also addressing potential barriers such as affordability, language differences, and varying levels of digital literacy (EU AI Act, 2023; Potkalitsky et al., 2024).

This position paper delves into the current state of Continuous Professional Development (CPD) for Equitable and Ethical AI Integration in Higher Education, highlighting the existing gaps and disparities in access to quality training programmes. Examples of CPD possibilities might include, but may not be limited to, a university department hosting a workshop series for faculty on integrating AI-powered research tools into their workflows or a micro-credential programme in AI use for educators, academics and researchers (Ghnemat et al., 2022; O'Dea & O'Dea, 2023).

Currently, much of the focus around AI in education seems to centre around generative AI (Neuron Learning Team, 2024; Potkalitsky et al., 2024). It is crucial to move beyond this current focus to embrace the broader potential of AI to transform various aspects of teaching and learning (López-Chila et al., 2023). Additionally, there is a pressing need to establish robust support systems within universities that foster interdisciplinary collaboration and equip educators and academics with the necessary knowledge and skills to navigate this evolving landscape (EU AI Act, 2023; Tarisayi, 2024).

To address these issues, this position paper explores four potential scenarios for the future of AI education, each with varying degrees of technological advancement and equity considerations. Based on this analysis, we propose four no-regret moves that universities can adopt to ensure that AI is harnessed responsibly and effectively to benefit all stakeholders, especially academics and researchers in higher education.

These recommendations focus on:

- Championing Ethical AI Development and Use
- Investing in Inclusive AI Education and Access
- Promoting Human-Centred AI Research and Innovation
- Supporting a Cultural Shift Towards AI in Education

By taking proactive steps in these areas, universities can play a pivotal role in shaping a future where AI serves as a tool for empowerment, equity, and educational excellence, while also addressing the unique challenges and opportunities academics in higher education face with this disruptive technology.

The Status Quo

The current state of AI worldwide is characterised by significant growth in research and applications across various domains, including higher education (Abgaryan et al., 2023; Okagbue et al., 2023). Literature has shown a steady increase in AI studies within higher education, focusing on computer science and social sciences (Okagbue et al., 2023). China and the United States lead in publication production and citations, with keywords such as "artificial intelligence," "chatgpt," and "machine learning" indicating prevalent trends and areas of interest (López-Chila et al., 2023). Similarly, the integration of AI in education pedagogy is expected to continue evolving, transforming seamlessly traditional instructional activities into digitised ones, thereby enhancing the efficiency and effectiveness of education (O'Dea & O'Dea, 2023).

In the context of continuing professional development (CPD) for higher education, the role of healthcare professionals, including pharmacists, is evolving. Lifelong learning and CPD are increasingly critical, as evidenced by a study on Japanese pharmacists that underscores the necessity for further education in undergraduate and postgraduate programmes to foster self-development and address the needs of citizens (Mamiya et al., 2023). This reflects a broader trend where higher education institutions are encouraged to embrace AI to meet industry needs and produce lifelong learners (Ghnemat et al., 2022).

Currently, CPD in AI education is in a nascent but rapidly evolving state (Fakhar et al., 2024). While there is a growing recognition of the need for AI literacy among academics, the availability and quality of CPD programmes remain uneven. Some universities and organisations offer specialised courses and workshops on AI in education, but these are often limited in scope and accessibility. Many educators and academics in higher education may lack the foundational knowledge and skills necessary to effectively integrate AI tools into their practice, and there is a significant gap in understanding the ethical implications of AI in educational settings. As AI technologies continue to advance at an unprecedented pace, the urgency for comprehensive and accessible CPD programmes in AI education becomes increasingly apparent (Adams et al., 2023). This recognition of the importance of CPD in higher education is essential for adapting to global health challenges and technological advancements, necessitating systematic educational approaches to support professionals' lifelong learning and development (López-Chila et al., 2023; Mamiya et al., 2023; Okagbue et al., 2023).

The Drivers of Change

Driver of Change 1:
Human-centred vs technology-centred AI

In the evolving landscape of AI integration in higher education, the balance between human-centred and technology-centred approaches represents a pivotal driver of change. A human-centred approach to AI development and implementation prioritises the well-being, needs, and values of individuals and communities. This perspective emphasises ethical considerations, social impacts, and the enhancement of human capabilities. It seeks to ensure that AI technologies are designed and deployed to improve human experiences, foster inclusivity, and address societal challenges such as healthcare, education, and environmental sustainability.

Conversely, a technology-centred approach focuses primarily on the advancement and optimisation of AI systems themselves. This perspective values technological efficiency, performance, and innovation, often emphasising the creation of high-performance AI tools and solutions. While this approach can lead to significant technological breakthroughs and enhanced capabilities, it may sometimes overlook the broader social, ethical, and human implications of AI deployment.

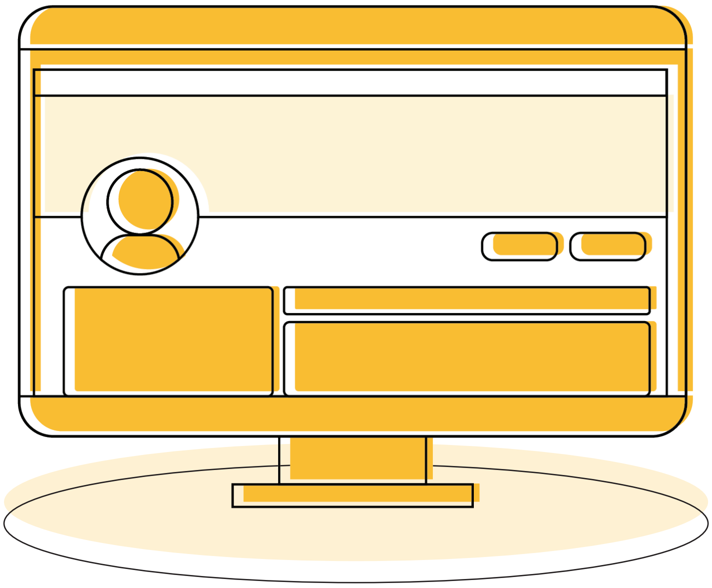
The tension between these two approaches is critical in shaping the future of AI in education. Universities, as key players in AI innovation ecosystems, must navigate this balance carefully. By fostering interdisciplinary collaboration, encouraging ethical reflection, and prioritising human-centred research, universities can ensure that AI serves as a tool for empowerment and societal good, rather than merely an instrument of technological progress.

Driver of Change 2:
Equity in technology access (high vs low)

Another crucial driver of change contributing to AI integration in higher education is the degree of equity in access to AI technologies. High equity in technology access ensures that all individuals, regardless of their socioeconomic background, geographic location, or individual circumstances, have the opportunity to benefit from AI advancements. This approach emphasises the democratisation of AI education, making AI tools, resources, and training accessible to a diverse range of learners. It involves proactive measures such as developing inclusive curricula, providing scholarships and financial support, and partnering with community organisations to bridge the digital divide.

High equity in technology access fosters a more inclusive and socially just educational environment, empowering underserved communities and promoting equal opportunities for all learners. It recognises that the benefits of AI should be widely distributed and that barriers such as affordability, language differences, and varying levels of digital literacy must be addressed to achieve this goal.
In contrast, low equity in technology access results in significant disparities amongst those who can benefit from AI advancements. This scenario often sees the advantages of AI concentrated among elite groups with greater resources and technological infrastructure, leaving underserved communities behind. Such disparities exacerbate existing social and economic inequalities, as individuals without access to AI tools and education are at a considerable disadvantage in the job market and broader society.

Universities play a vital role in mitigating these disparities by championing inclusive AI education and ensuring equitable access to AI technologies. By doing so, they can contribute to a more equitable and socially responsible AI innovation ecosystem, where the transformative potential of AI benefits all members of society, not just the privileged few.



The University of 2060: Four Scenarios for the Future of Academic Professional Development

Scenario 1: The AI Class of the Future

AI development is primarily driven by technological advancements and optimisation, focusing on creating efficient, high-performance systems. Policies and initiatives ensure that these cutting-edge AI technologies are accessible to all segments of society, reducing the digital divide. Investments in infrastructure and education are prioritised, ensuring that people across various socio-economic backgrounds have access to the latest AI tools and resources. The primary goal is to maximise the technological potential of AI, sometimes leaving overall considerations of human well-being aside.

In the near future, academics gather in a gleaming conference room, their eyes glued to the holographic display of the newest AI-powered teaching assistant. The presenter, a renowned AI engineer, extols the virtues of this cutting-edge technology: automated grading, personalised lesson plans, and even virtual simulations of challenging student interactions. Academics dutifully take notes, eager to further enhance their professional development and implement these tools in their classrooms. Yet, a sense of unease lingers in the air. Will this technology truly enhance their teaching, or will it simply automate their roles, leaving them feeling disconnected from their students and their passion for education?

Figure 1. The AI Class of the Future

Scenario 2: The Human Professional in the AI Class

AI development is driven by a focus on human well-being, ethical considerations, and enhancing human capabilities. Policies ensure that AI technologies are accessible to all, reducing the digital divide and empowering underserved communities. Investments in education and community engagement ensure that people from all backgrounds can benefit from and contribute to AI advancements. AI systems are designed with significant input from diverse stakeholders, leading to solutions that address a wide range of societal needs. The primary goal is to solve societal issues, sometimes leaving overall technological advancement considerations aside.

In a cozy seminar room, academics sit in a circle, sharing their experiences and insights on how to foster a more inclusive and equitable learning environment. A facilitator, an experienced educator with a deep understanding of human development, guides the conversation, encouraging academics to reflect on their own biases and assumptions. AI-powered translation devices ensure that everyone's voice is heard, regardless of their language background. While the technology is present, it is unobtrusive, serving as a tool to enhance human connection and collaboration. The academics leave the session feeling energised and inspired, ready to implement their newfound knowledge in their classrooms. However, a question persists in their minds: How can AI truly be used for the well-being of people, and not used in a way that can cause injustice or harm people? And how can they transmit this through their own lectures?

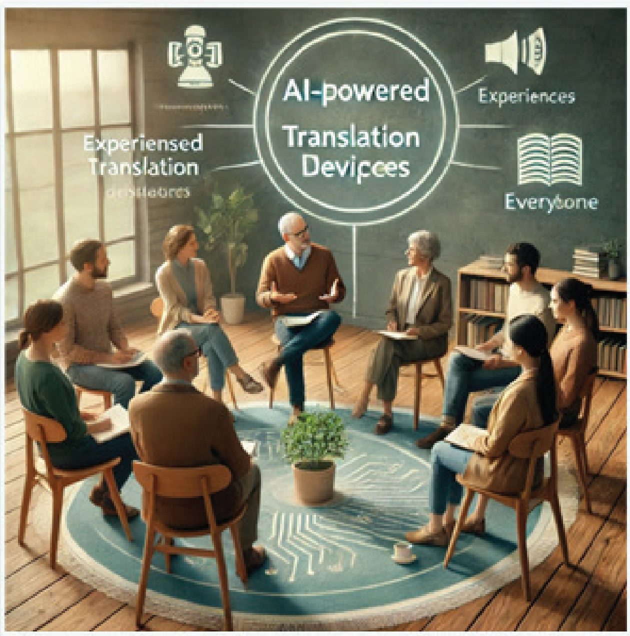


Figure 2. The Human Professional in the AI Class

Scenario 3: The Select Few

AI development prioritises human-centred goals, but benefits are concentrated among elite groups with greater access to technology. Significant disparities exist in access to AI technologies, with underserved communities left behind. Ethical considerations and human well-being are prioritised, but primarily for those who can afford advanced AI solutions. AI innovations serve the needs and interests of affluent populations, potentially widening social and economic gaps. The primary goal is to solve societal issues for those who can afford to pay for the solutions.

In a state-of-the-art training centre, a select group of academics gather for an exclusive workshop on utilising cutting-edge AI tools designed to enhance student engagement and personalise learning experiences. The atmosphere is electric with excitement as the facilitator, a renowned AI expert, showcases the latest advancements in virtual reality simulations, adaptive learning platforms, and AI-powered tutoring systems. Yet, a nagging question lingers in the back of some participants' minds: How will these expensive, resource-intensive tools benefit the students in underfunded universities that lack access to basic technology, let alone these sophisticated AI solutions? The stark contrast between the privileged few in the room and the vast majority of academics, educators, and students left behind casts a shadow over the promise of AI for education.

Figure 3. The Select Few

Scenario 4: The Hopeless Professionals

AI development is primarily focused on technological advancements and optimisation, with little regard for equitable access. Benefits of AI are concentrated among those with the resources and skills to leverage advanced technologies. Large segments of the population are excluded from the benefits of AI, increasing existing social and economic inequalities. The focus on the benefits of technology for a few leads to societal tensions, as parts of society are marginalised for the technology and its development.

In a dimly lit computer lab, a handful of academics struggle to keep up with a hastily organised training session on the latest AI-powered educational software. The instructor, a tech-savvy consultant hired by the district, rattles off jargon and acronyms, seemingly oblivious to the growing frustration in the room. The academics, already overworked and underpaid, feel overwhelmed by the complexity of the software and the lack of support provided. They wonder how they are supposed to integrate this new technology into their already packed curriculum, let alone ensure that all of their students, including those with limited access to technology at home, can benefit from it. A sense of resentment simmers beneath the surface, as the academics realise that this AI initiative, touted as a solution to educational inequities, is only exacerbating the existing divide.

Figure 4. The Hopeless Professionals

No-Regret Moves

To navigate the complex landscape of AI integration in higher education and ensure a responsible and equitable future, universities must adopt strategic initiatives that yield significant benefits regardless of how the broader AI ecosystem evolves. These initiatives, referred to as "no-regret moves," are proactive steps that institutions can take to harness the potential of AI while mitigating its risks and addressing its challenges. These moves are designed to be universally beneficial, enhancing the capabilities and preparedness of universities to leverage AI for the greater good of all stakeholders.

The following four no-regret moves provide a comprehensive framework for universities to champion ethical AI development, promote inclusive access to AI education, foster human-centred research and innovation, and support a cultural shift towards the integration of AI in educational contexts. By implementing these strategies, universities can position themselves at the forefront of AI innovation, ensuring that their actions contribute positively to the academic community and society at large.

No-Regret Move 1: Championing ethical AI development and use

Universities establish comprehensive ethical guidelines for AI research and development, ensuring that AI technologies are designed and implemented with fairness, transparency, and accountability at their core. This includes fostering a culture of ethical reflection among academics, researchers, and industry partners while promoting public discourse on the societal implications of AI.

Examples Include:

- Universities regularly host CPD events resembling "show and tell" type CPD events that help promote ethical AI development in the context of work or public use. These events feature best practice examples where academics showcase their use of AI tools, techniques, and applications. They emphasise specific instances of ethical AI development and implementation, inviting researchers to present projects where ethical considerations were pivotal in design and implementation. Discussions are encouraged on applying ethical frameworks to mitigate biases and ensure transparency in AI decision-making processes, alongside sharing lessons learned and practical strategies for integrating ethical principles into AI projects.

- Universities establish partnerships with industry leaders to co-develop and deliver workshops on ethical AI practices, ensuring that both academic research and real-world applications adhere to ethical standards while facilitating dialogues to develop balanced guidelines and create practical resources like case studies and toolkits for implementing ethical AI principles.

Key Evidence for Recommendation 1

The European Union's AI Act (2023) and the growing concern over algorithmic bias and discrimination highlight the need for robust ethical guidelines in AI development and use. In Asia, countries like Singapore and Japan have also begun developing their own ethical AI frameworks. As AI becomes more integrated into society, the potential for misuse and unintended consequences will increase. A strong ethical foundation is crucial to ensure that AI benefits humanity as a whole.

Relevance in Europe and Asia:

- Europe: The EU's focus on human rights and data protection makes ethical AI development a priority. Universities can play a leading role in shaping the ethical landscape of AI in Europe.

- Asia: With its rapid technological advancement and diverse cultural values, Asia presents a unique opportunity for universities to develop culturally relevant ethical AI frameworks that can serve as models for the rest of the world.

No-Regret Move 2: Investing in inclusive AI education and access

Universities prioritise equitable access to AI education and resources for all learners, regardless of their socioeconomic background or geographic location. This involves developing accessible AI curricula, offering scholarships and financial support, and partnering with community organisations to bridge the digital divide. By democratising AI education, universities can empower a diverse range of individuals to effectively use AI tools and technologies.

Examples Include:

- Universities establish dedicated funds and time allowances for faculty to attend AI conferences, ensuring they stay updated with the latest advancements.

- Universities foster a culture where faculty members not only participate in continuing professional development events but also actively share their newly acquired AI knowledge with colleagues, enriching the entire academic community.

Key Evidence for Recommendation 2

The widening digital divide and the lack of AI literacy among the general population highlight the need for accessible and inclusive AI education. As AI transforms the job market, individuals without AI skills will be at a significant disadvantage. Inclusive AI education is essential for ensuring equal opportunity and social mobility. Collaborative projects, such as ASEFInnoLab5 (2024), showcase the potential for promoting the above-mentioned culture of knowledge sharing between European and Asian stakeholders in higher education. The focus should therefore be on the extension of programmes such as this, rather solely focusing on new projects.

Relevance in Europe and Asia:

- Europe: The EU's emphasis on social inclusion and lifelong learning makes inclusive AI education a natural fit. Universities can help to upskill and re-skill the workforce for the AI age.

- Asia: With its large and diverse population, Asia has a vast untapped potential for AI talent. Investing in inclusive AI education can unlock this potential by spreading knowledge and education levels thus driving economic growth

Figure 5. Inclusive AI Education

No-Regret Move 3: Promoting human-centred AI research and innovation

Universities invest in interdisciplinary research that prioritises human well-being, social impact, and collaboration between technical and social sciences. This involves funding research projects that explore the ethical, social, and economic implications of AI, and supporting the use of AI by academics, especially those that address pressing societal challenges, such as healthcare, education, and environmental sustainability. By fostering human-centred AI innovation, universities ensure that AI technologies are developed and deployed in ways that benefit society as a whole.

Examples Include:

- Universities initiate and support human-centred AI projects that focus on community impact and legitimise these projects as CPD.

- Universities set up and financially support university-based research clusters (e.g. AI Research Cluster), each of which consists of an inter-faculty collaboration of academics and higher education professionals from diverse disciplines, who work in or wish to collaborate on AI-driven research projects with a human-centred focus.

Key Evidence for Recommendation 3

Many AI applications are developed with a narrow focus on technological optimisation, often neglecting the broader social and ethical implications. As AI becomes more powerful, it is crucial to ensure that it is used to address the most pressing human needs and challenges, such as climate change, healthcare, and inequality. In parallel to the evidence presented for the previous no-regret move, another example of a project that could be extended and more widely promoted is the Qatar WISE initiative (n.d.). This brings together professionals from both Europe and Asia to collaborate on human-centred AI projects. By working alongside each other, participants conduct empirical research on the impact of AI on areas such as professional development in a higher education context with the aim of eventually presenting this at a conference in New York. While funding is provided, time constraints on participants could be eased by working more closely with participating institutions.

- Europe: The EU's commitment to research and innovation in AI provides a strong foundation for universities to lead in human-centred AI research (AI in Science, 2024).

- Asia: With its rapidly growing economies and diverse societal needs, Asia offers a fertile ground for developing and testing innovative AI solutions that can benefit humanity

No-Regret Move 4: Supporting a cultural shift towards AI in education

Universities actively promote a cultural shift within their institutions, encouraging academics and faculty members to embrace AI as a valuable tool for enhancing teaching, learning, and research. This involves dispelling misconceptions about AI, highlighting its diverse applications beyond generative AI, and showcasing successful examples of AI integration in various disciplines. By cultivating a positive and informed attitude towards AI, universities create a more receptive environment for innovation and experimentation, ultimately leading to more effective and widespread adoption of AI in education (Tarisayi, 2024).

Examples Include:

- Faculty learning communities focused on exploring AI tools and sharing best practices.

- Universities hold informative CPD sessions that help promote a human-centred angle on future AI-related research.

- Universities develop an AI literacy campaign to educate the university community about the potential benefits and ethical considerations of AI.

- Universities create incentives and recognition programmes for academics who successfully integrate AI into their teaching or research.

Key Evidence for Recommendation 4

Research suggests that faculty attitudes and beliefs about technology significantly influence their willingness to adopt and effectively use new tools in their teaching (Abgaryan, 2023). Studies have shown that a lack of understanding about AI and its potential applications can lead to resistance and scepticism among educators (Samuel et al., 2024). Successful AI integration in education often relies on a supportive institutional culture that encourages experimentation and risk-taking (Fakhar et al., 2023).

Relevance in Europe and Asia:

- Europe: Initiatives like the European Commission's Digital Competence Framework for Educators (n.d.) emphasise the importance of digital literacy and skills development for educators.

- Asia: Countries like Singapore and China are investing heavily in AI education and research, recognising the potential of AI to drive economic growth and innovation.

Summary

This position paper examines the current state of CPD in AI education, emphasising the need for comprehensive and accessible programmes to address the growing demand for AI literacy among academics and higher education professionals. It identifies two key drivers of change in our current society: the tension between human-centred and technology-centred approaches to AI development, and the issue of equity in access to AI technologies.

The paper presents four potential scenarios for the future of AI in education in relation to academics' professional development at higher education, each with varying degrees of technological advancement and equity considerations. These scenarios highlight critical issues such as the risk of dehumanisation in education, the exacerbation of existing inequalities, ethical concerns surrounding AI use, and the need for adequate academic training and support.

To address these challenges, the paper proposes four no-regret moves for universities:

- Championing Ethical AI Development and Use
- Investing in Inclusive AI Education and Access
- Promoting Human-Centred AI Research and Innovation
- Supporting a Cultural Shift Towards AI in Education

The paper provides evidence for these recommendations, citing examples from Europe and Asia, and emphasises the importance of collaboration between academics at universities, policymakers, and industry partners to ensure that AI is harnessed responsibly and effectively to benefit all learners.

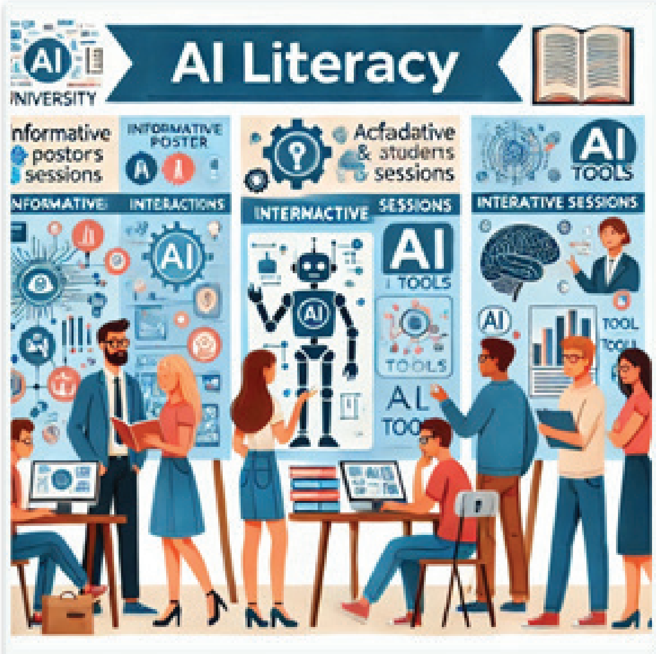


Figure 6. Cultivating a positive and informed attitude towards AI

Disclaimer

The images included in this paper were generated using DALL-E AI image generator.

References

5th ASEF Higher Education Innovation Laboratory (ASEFInnoLab5). (n.d.). Asia-Europe Foundation (ASEF). https://asef.org/projects/innolab5/

Adams, S., Tesene, M., Gay, K., Brokos, M., Swindell, A., McGuire, A., & Rettler-Pagel, T. (2023). Communities of Practice in Higher Education: A Playbook for Centering Equity, Digital Learning, and Continuous Improvement. Every Learner Everywhere. https://www.everylearnereverywhere.org/resources/communities-of-practice-in-higher-education/

Abgaryan, H., Asatryan, S., & Matevosyan, A. (2023). Revolutionary Changes In Higher Education With Artificial Intelligence. *Main Issues Of Pedagogy And Psychology, 10*. https://doi.org/10.24234/miopap.v10i1.454

European Commission. (n.d.). *Digital Competence Framework for Educators (DigCompEdu)*. European Commission. https://joint-research-centre.ec.europa.eu/digcompedu/digcompedu-framework_en

European Commission. (2023). *EU AI Act: First regulation on artificial intelligence*. European Commission. https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence

European Commission. (2024). *AI in Science: Living guidelines on the responsible use of generative AI in research (1st ed.)*. European Commission. http://data.europa.eu/eli/dec/2011/833/oj

Fakhar, H., Lamrabet, M., & Echantoufi, N. (2024). Towards a new artificial intelligence-based framework for teachers' online continuous professional development programs: Systematic review. *International Journal of Advanced Computer Science and Applications, 15*(4), 480-493.

Ghnemat, R., Shaout, A., & Al-Sowi, A. M. (2022). Higher Education Transformation for Artificial Intelligence Revolution: Transformation Framework. *International Journal of Emerging Technologies in Learning (iJET), 17*. https://doi.org/10.3991/ijet.v17i19.33309

López-Chila, R., Sumba-Nacipucha, N., Llerena-Izquierdo, J., & Cueva-Estrada, J. (2023). Artificial Intelligence in Higher Education: An Analysis of Existing Bibliometrics. *Education Sciences, 14*. https://doi.org/10.3390/educsci14010047

Mamiya, K. T., Iwasaki, T., Irie, T., & Takahashi, K. (2023). Japanese Pharmacists' Perceptions of Self-Development Skills and Continuing Professional Development. *Pharmacy, 11*. https://doi.org/10.3390/pharmacy11020073

Neuron Learning Team. (2024). *The State of AI in Education 2024 Report*. Neuron Learning. https://www.neuronlearning.com/the-state-of-ai-in-education-2024-report/

O'Dea, X., & O'Dea, M. (2023). Is Artificial Intelligence Really the Next Big Thing in Learning and Teaching in Higher Education? A Conceptual Paper. *Journal of University Teaching and Learning Practice, 20*. https://doi.org/10.53761/1.20.5.05

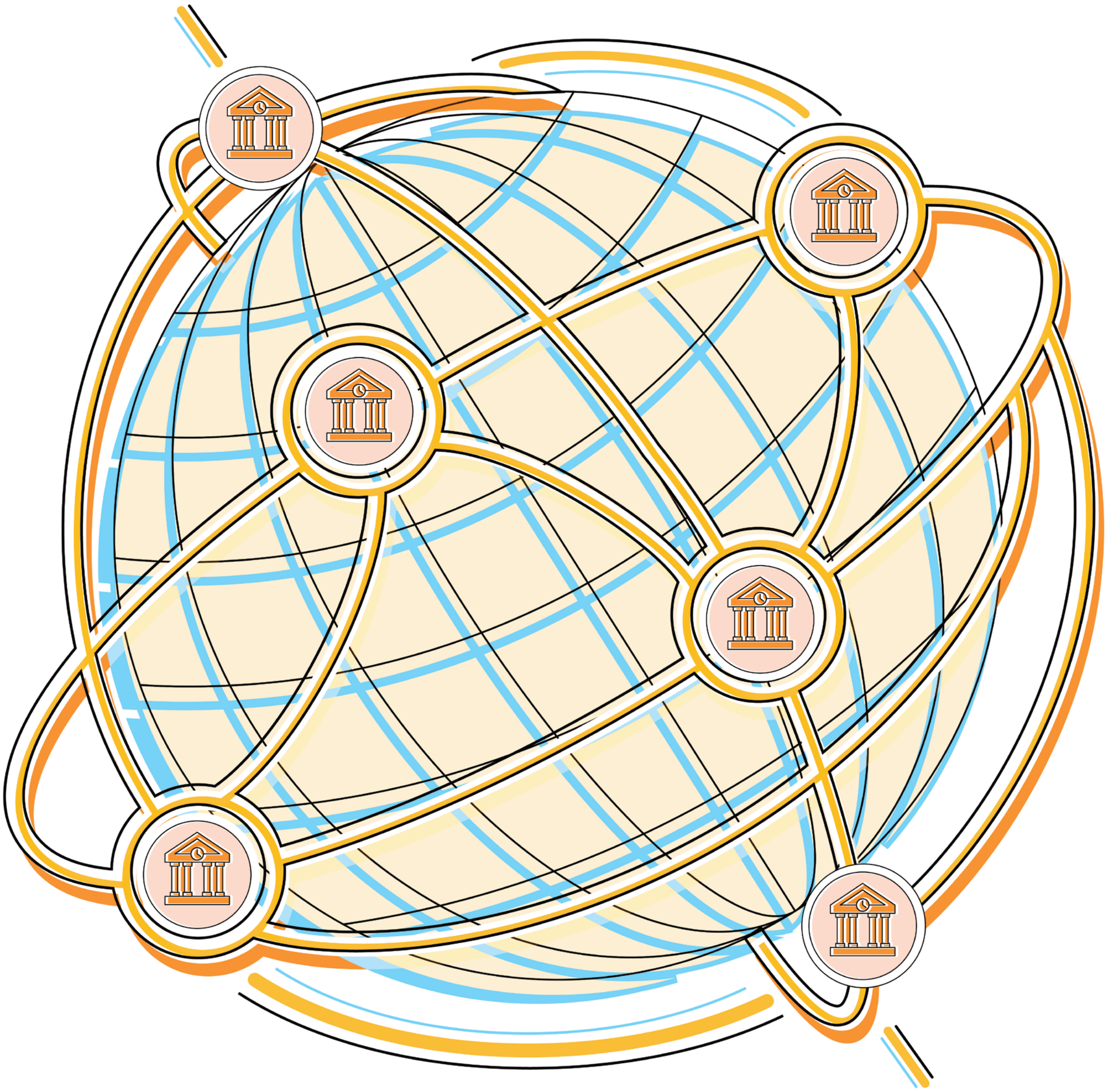
Okagbue, E. F., Ezeachikulo, U. P., Akintunde, T. Y., Tsakuwa, M. B., Ilokanulo, S. N., Obiasoanya, K. M., Ilodibe, C. E., & Ouattara, C. A. T. (2023). A comprehensive overview of artificial intelligence and machine learning in education pedagogy: 21 Years (2000–2021) of research indexed in the scopus database. *Social Sciences & Humanities Open, 8*. https://doi.org/10.1016/j.ssaho.2023.100655

Potkalitsky, N., Watkins, M., & Cummings, L. (2024). *AI Adoption in Education in 2024: An Overview. Educating AI*. https://nickpotkalitsky.substack.com/p/ai-adoption-in-education-in-2024

Samuel, J., Khanna, T., & Sundar, S. (2024, April 8). Fear of Artificial Intelligence? NLP, ML and LLMs based discovery of AI-phobia and fear sentiment propagation by AI news. https://doi.org/10.31234/osf.io/j6fnm

Tarisayi, K. S. (2024). Strategic leadership for responsible artificial intelligence adoption in higher education. *CTE Workshop Proceedings, 11*. https://doi.org/10.55056/cte.616

WISE - Promoting Innovation in Education through Collaboration. (n.d.). WISE. https://www.wise-qatar.org/



Universities' Longevity in AI-Driven Ecosystems Anno 2060: Strategic Preparation of Universities for Future AI-Driven Sustainable Ecosystems

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Introduction and Status Quo

In 2024, collaborations among universities and with businesses increase. As universities are increasingly under financial pressure to ensure their existence, they increasingly establish university networks (e.g. Unite![1] in Europe, Asian University Alliance (AUA)[2] in Asia) or create ecosystems that combine sector-specific companies, startups and universities (e.g. InnoEnergy[3] in Europe, SGInnovate[4] in Asia). Where the university networks enable all their members to specialise and share knowledge at an increased pace, the industry-academia networks look for a sustainable solution for the universities in that ecosystem, by providing solutions to challenges that companies might face. These company-university networks enable the business stakeholders to gain access to much needed talent (i.e. students, startups, experts) that strengthen the companies. This mutual dependence brings universities and companies together to stay competitive, viable and self-sustainable.

Unequal access to finance (both governmental and corporate) as well as increasing symbolic capital favours the top-ranked universities, according to Harvey, C. et al., (2024). In many regions, the bigger national universities increase their position by relying on their symbolic capital, attracting more business collaborators, growing governmental support and a broader set of students to choose from. As an example "the Global Elite Universities (GEU) have more £1 million plus donors than other universities and receive more large gifts" (Harvey et al., 2024, p. 446). This pull by top-ranked universities decreases the impact and resources of smaller universities that are traditionally serving local students.

Regional access to technology also plays a big role in the opportunities that universities have exploring emerging technologies like Artificial Intelligence (AI). Not every university has equitable access to technology, nor can they offer the same access to quality education when it comes to tech-immersed education. "In a society that is thoroughly permeated by technology, those who possess access to it can influence processes and will have greater opportunities" (Bulathwela et al., 2024, p. 6). This divide to technological access and financial resources increases the disproportion of opportunities for bigger versus smaller universities.

In 2024, universities are still the stronghold for societal visions. Therefore, universities are research-driven for societal benefit and educating a wide variety of students to take up societal, as well as business roles. The general idea for universities is to educate students from varied backgrounds to ensure a knowledgeable and fair society. However, marginalised and minority groups (e.g. students from financially weaker families) are currently under-supported by universities. To address this, "policies must promote equitable and inclusive access to AI and the use of AI as a public good, with focus on empowering girls and women and disadvantaged socio-economic groups" (Miao and Holmes, 2021, p. 1). In addition to this, AI deployment and "their generalisability to low-resource settings is extremely limited" (Bulathwela et al., 2024, p. 7). This results in marginalised and minority groups having less access to high-end technology, e.g. exploring the opportunities and limitations of AI either at home or during their formative school years.

Universities worldwide are developing and adopting various AI policies and strategies to navigate the opportunities and challenges of AI. A key focus for many institutions is the establishment of ethical guidelines for responsible uses of AI tools in research and education (Northern Illinois University, n.d.). Universities are taking initiatives to provide training opportunities to equip students and faculty with the necessary skills and knowledge to engage with AI (Pelletier et al., 2022), (Wang et al., 2021). Universities are increasingly prioritising inclusiveness and equity in their AI policies to address the biases and disparities. These initiatives aim to create a more diverse and equitable environment within the field of AI, recognising that inclusivity is crucial for creating fair and representative AI systems (Tanveer et al., 2020), (AI Policy - Internet Policy Research Initiative at MIT, 2019). Universities are adopting AI to enhance teacher-student and teacher-teacher relationships. Stanford University, for instance, uses AI for real-time feedback, student interaction simulations, and post-lesson reports to improve classroom dynamics and personalised support for teachers and students (Home, 2024).

The increased adoption of AI in every aspect of life in those regions having access to wide-spread digital resources, results in both utopian and dystopian visions of how AI will impact society, including a post-human era. Post-human research has resulted in "the andro-humanoid robots like Sophia, developed by Hanson Robotics. The space agencies like NASA and ISRO are replacing human astronauts with humanoid robots for their next space expeditions. ISRO has already planned for its next unmanned Gaganyaan space mission with humanoid robot Vyomamitra" (Nath and Manna, 2023, p. 188).

In 2024, developing AI models is a very costly endeavour. This is why big tech companies are leading AI development. This affects transparency as "we become fundamentally dependent on technologies whose reliability is dubious and whose algorithms are secretly maintained behind the safety of corporate walls" (Gendron et al., 2024, p. 1). To control this development, governments are building AI guidelines to ensure equitable and safe access to AI for all citizens, e.g. the AI Act[5] of Europe.

[1] Unite! https://www.unite-university.eu/
[2] Asian University Alliance http://www.asianuniversities.org/index.htm
[3] EIT InnoEnergy network https://www.innoenergy.com/for-innovators/ecosystem/
[4] Singapore Innovation https://www.sginnovate.com/
[5] Artificial Intelligence Act Europe: https://artificialintelligenceact.eu/the-act/

In conclusion, in 2024 universities around the world are envisioning a balanced society where students of all groups within society can have access to quality education to ensure a knowledgeable and equal society. However, digital and societal divides exist, and they impact the growth and speed of AI adoption for universities, as well as their financial resources to attract so-called top students or enable financially profitable business and governmental collaborations. AI is increasingly pervading society and the interest in embedding AI for the benefit of society is high on the university agenda, though not necessarily backed by companies.

Methodology

In this position paper, we adopted the scenario planning method to think of possible futures and discuss what universities can do today to be more successful should any of these futures pan out.

The Drivers of Change

Driver of Change 1: Human-centred vs technology-centred AI
It is uncertain but important how far in the development of AI there will be a focus on the overall good of users versus technological development and the potential financial gains for the main commercial players.

Aspects like focus on human needs versus focus on technological advancement, focus on user experience versus technical capabilities, focus on ethical considerations versus innovation and efficiency, focus on collaboration and participation versus economic and market drivers, as well as social impact, reliable regulation, level of social acceptance, impact on industries, and level of application can be considered when analysing this driver of change.

Driver of Change 2: Equity in technology access (high vs low)
It is uncertain but important how equitable AI development is, meaning how much of the population has access to the advancement of AI and how much technology and knowledge might be concentrated in the hands of a few affluent groups.

Aspects like high access to technology versus low access to technology, affordable versus non-affordable technology, inclusive policy and regulation versus exclusive policy and regulation, broad-based investment versus uneven investment, level of cooperation between public and private funding, universal education versus restricted access to skills and training and others can be considered when analysing this driver of change.

The Four Scenarios

Based on the two key drivers of change, we have identified four possible scenarios that might be panned out in the future.

Scenario 1: Universities and corporations as enablers for good (high equity, technology-centred)

AI development is primarily driven by technological advancements and optimisation, focusing on creating efficient, high-performance systems. Policies and initiatives ensure that these cutting-edge AI technologies are accessible by all segments of society, reducing the digital divide, and are based on citizens' acceptance and participation (Horvath et al., 2023). Investments in infrastructure and education are prioritised, ensuring that people across various socio-economic backgrounds have access to AI tools and resources.

The primary goal is to maximise the technological potential of AI for human wellbeing. To ensure a strong AI embedment within society, universities and companies set up cooperations that provide a smooth integration to all of society towards an optimal AI-oriented future. This builds on initiatives that existed anno 2024 (e.g. AUA, Unite!, SGInnovate, InnoEnergy). Universities actively support activities for all citizens, including traditionally marginalised or minority groups, relating to a UNESCO guideline for policymakers from 2021 that states that "AI in education should be made accessible to all citizens regardless of gender, disability, socio-economic status, ethnic background or geographic location, especially for vulnerable groups such as refugees or students with learning disabilities, without exacerbating existing inequalities" (Miao and Holmes, 2021, p. 22).

AI is used to augment and support humanity, not replacing it. As performance is key in this scenario, all eligible employees and employers are provided with an updated, lifelong learning trajectory to ensure their ongoing understanding and performance within society. This is in line with the Finnish initiative Artificial Intelligence Collection[6] in 2023, which provides open courses to all citizens. As university performance affects their existence, it results in a more distributed cluster of universities, or a hierarchical global university structure where big universities distribute the roles of the regional, smaller universities in view of the technological demands.

Universities remain sustainable and relevant, though fitted to the needs of AI companies, but with clear AI research to improve humanity in function of performance. The universities ensure a broad uptake of AI innovation, engaging across different stakeholders such as government and tech companies.

[6] Artificial Intelligence Collection https://www.helsinki.fi/en/admissions-and-education/open-university/multidisciplinary-themed-modules/artificial-intelligence-collection

Scenario 2: Universities lead ethical and post-human societies (high equity, human-centred)

AI development is driven by a focus on human wellbeing, ethical considerations, and enhancing human capabilities. Policies ensure that AI technologies are accessible to all, reducing the digital divide and empowering underserved communities actively working on inclusion: “Data on and for inclusion (across languages, cultures, subject domains, geographic/virtual sites and disabilities) in education are essential” (Bulathwela, 2024, p. 7). AI systems are designed with significant input from diverse stakeholders, leading to solutions that address a wide range of societal needs. The primary goal is to solve societal issues (Pietronudo et al., 2022), sometimes leaving more overall technological advancement considerations aside.

In a world achieving post-divide status, universities lead the way to a more ethical and human society, where every person has access to education and to lifelong learning that results in a beneficial life with access to all digital sources and tools. Universities are distributed across the world to allow easy access to all citizens and to ensure accessible learning for all, throughout their lifetime.

The collaboration with companies is based on companies providing technologies that support the grander vision of universities and governments for their citizens. This fits the idea by Miao and Holmes (2021) that “AI by nature transcends the sectors, the planning of effective AI and education policies requires consultation and collaboration with stakeholders across disciplines and sectors” (p. 1).

Attaining optimal human wellbeing entails augmenting the human body and mind with regulated and monitored AI implants, increasing health and wellbeing, as noted by Nath and Manna (2021): “Through the advancement of modern science, technology, and medical science, it has been observed that implementing nano-technological tools are helpful to treat some medical conditions” (p. 5). Furthermore, “By merging university research and technology, a healthier, more balanced and cooperative human is ensured. This is achieved by brain scientists, neuroscientists, software developers, and experts from biology working towards the direction of enhancing human capacity with the help of AI technology in the future” (Nath and Manna, 2021, p. 4).

In this scenario, universities are sustainable, local and relevant. They ensure a post-human, post-divide wellbeing for all members of society, where global visions are coming from within universities in collaboration with governments while tech companies develop products to sustain human wellbeing.

Scenario 3: Universities for the elite (low equity, human-centred)

AI development is prioritised for human-centred goals, but benefits are concentrated among elite groups with greater access to technology, e.g. in education (Wang et al., 2024). Significant disparities exist in access to AI technologies, with underserved communities left behind. Ethical considerations and human wellbeing are prioritised, but primarily for those who can afford advanced AI solutions.

In case technology evolves but is distributed unevenly, universities take a more elite-driven approach, as highlighted by Harvey et al (2024), stating that “misrecognised systems of social relations therefore signal the presence of symbolic capital, and the imposition of a particular world-view by elite actors, a key mechanism in preserving their dominance in a field” (p. 435).

Although universities only tend to the few (the elite), in-depth research is still needed to sustain and support the elite. The elite needs equal access for their families, so gender equality and inclusivity are upheld by universities within the hub of the elite. “Having large philanthropic incomes and related infrastructural advantages accumulated over long periods, GEUs have the resources needed to sustain uniquely privileged academic settings favoured by the upper echelons in business, the professions, government and society-at-large” (Harvey et al., 2024, p. 438).

As the group leading the world is limited, the university location can be limited to those regions where the elite lives. The post-human world is a reality for the elite, enhancing their health, honouring their needs and wellbeing. Thus, our conception of humans is changed as “biotechnology, genetic engineering, stem cells, and cloning will lead us to a different conception of humanity, ... Where all these technologies aim towards immortality and go beyond humans’ natural limitations” (Nath and Manna, 2021, p. 11).

In this scenario, universities will be limited in numbers and focus on the elite. AI augmentation focuses on the elite and their leading position in society. The biggest part of the population is the underserved community, which only has basic access to technology.

Scenario 4: Corporatocracy of the elite replacing universities (low equity, technology-centred)

AI development is primarily focused on technological advancements and optimisation, with little regard for equitable access. The benefits of AI are concentrated among those with the resources and skills to leverage advanced technologies. Large segments of the population are excluded from the benefits of AI, increasing existing social and economic inequalities, e.g. those resulting from AI-based extreme labour displacement (Gruetzemacher et al., 2020). The focus on the benefits of technology for few leads to societal tensions, as part of the society is marginalised for the technology and its development. This scenario supports corporatocracy and the idea of 'divide and keep conquered' by using AI and technology for the elite and focusing on technology as society's main driver. Keeping global citizens under control ensures that the elite keeps its privileged position, keeping a large population of underserved communities in isolation, so as not to disturb the optimal position of the few. The global population is allowed to live if they ensure the optimal longevity of the elite.

This possibility might happen if we analyse research statements emphasising that "the greatest challenge is how to design AI to be a driver of equity and inclusion and not a source of greater inequality of opportunity" (Bulathwela, 2024, p. 16), where ethical AI vision is crucial to direct the further development of AI for societal reasons (Chen et al., 2023). This means that regulation can be used for the many or the few. If governments, academia and industry can influence for good, it can equally be stated that any powerful entity in the future can use the same effects of building regulations that align with the idea of dividing and serving the few.

Ethical considerations are skewed towards the elite and technologies, specifically to keep the elite in power, and technology for technologies sake. If universities still exist, they will support the vision and needs of the selected few, while emphasising a tech-centred development. Because companies shape technological visions in this scenario, universities can be replaced by L&D training to support technological developments. In this scenario, universities might become irrelevant, as the advancement of technology is driven by technology itself. The world is divided into elite and underserved communities. The elite is technologically-driven and part of a corporatocracy.

The No-Regret Moves

Based on the discussion of the four possible scenarios that might pan out in the future, the following no-regret moves have been recommended.

No-Regret Move 1:

Universities build capabilities in AI Ethics and Governance to ensure that AI is used responsibly and ethically for the benefit of humanity

As AI becomes more pervasive, universities that invest capabilities in AI ethics and governance will be positioned as leaders in shaping the ethical landscape of AI. They will be instrumental in contributing to responsible AI innovation and advocating the ethical and responsible use of AI to bring benefits to humanity and not the other way around.

Key Evidence for No-Regret Move 1

Example 1. The University of Oxford's Institute for Ethics in AI is a leading centre that brings together world-leading philosophers and other experts in the humanities with the technical developers and users of AI in academia, business and government to tackle the implications of AI from the philosophical and humanistic perspectives (The Institute for Ethics in AI, n.d.).

Example 2. The University of Tokyo has started an AI Ethics and Society programme that focuses on the issues surrounding the use of AI technology in our societies and how social injustices may arise as a result of unethical and irresponsible use of AI, and seeks new ways to address those ethical concerns (The University of Tokyo Global Unit Courses, n.d.).

No-Regret Move 2:

Universities build partnerships with government and tech corporations to strengthen its position as thought leaders in the AI world, ensuring sustainability and future readiness of the universities

Forming partnerships between universities and governments and corporations will allow universities to remain as thought leaders envisioning a performant world where problems are resolved using opportunities afforded by AI. Such partnerships enable universities to gain access to additional resources and practical applications for their research. This will ensure a stronger presence of the universities as well as building a mutually beneficial relationship between all stakeholders no matter which scenario plays out.

Key Evidence for No-Regret Move 2

Strong collaborations with governments and corporations strengthen the position of the universities as a societal stronghold. If universities do not take up equal partnerships with corporations or governments, their voices will become less important in societal debates.

Example 1. The ecosystem of InnoEnergy builds on European guidelines regarding SDGs in energy and climate. To realise these guidelines, InnoEnergy creates an ecosystem of corporate stakeholders as well as educational shareholders, enabling innovation at a more rapid pace. An important aspect of the ecosystem is the support of master students, across startups, all the way to unicorn status. This unique student journey (Master+) allows corporations to have access to talent, and universities to build strong partners with corporations, while following the vision of the EU (InnoEnergy, n.d.).

Example 2. Nanyang Technological University, Singapore (NTU Singapore) and Alibaba Group officially launched the Alibaba-NTU Singapore Joint Research Institute (JRI) in February 2018. The institute seeks to combine NTU's human-centred AI technology with Alibaba's leading technologies to push the frontiers of AI, transforming the current technology-centred philosophy of AI research into one which is human-centred. The goal is to make AI more effective, accessible and inclusive so that it can address future societal needs in ageless aging and human-centred mobility (Nanyang Technological University, n.d.).

Example 3. IBM and NUS announce intent to establish a research and innovation centre with the aim to accelerate advanced research to drive adoption of AI innovations within Singapore (The Straits Times, 2024).

No-Regret Move 3:

Establishing universities' role as an institution for public good by developing a culture of lifelong learning which integrates AI-driven technology into university curricula

To ensure that people can keep pace with the rapidly evolving technological landscape, it is important to recognise the importance of lifelong learning and commit to learn, unlearn and relearn. This is where AI can be leveraged to provide personalised learning experience that adapts to individual needs and interests and equip people with the skills to remain adaptable in this VUCA world. Promoting open access to AI research and education ensures equitable and inclusive access to knowledge for a better-informed global population and ensures that the voices of the many to be heard should any of the futures panned out.

Key Evidence for No-Regret Move 3
Education should be guaranteed for the broadest part of society. In failing to deliver lifelong learning, society risks being misled by single popular voices that do not have the benefit of humanity in mind.

Example 1. The University of Helsinki offers an open online AI course, "Elements of AI," which has been accessed by learners worldwide. This initiative democratises AI knowledge and makes it accessible to individuals from all walks of life (University of Helsinki, n.d.).

Below are other examples of universities who have supported in promoting a culture of lifelong learning for the public good.

- Fairleigh Dickinson University (Schipper, 2024)
- National University of Singapore (NUSnews, 2022)
- Universities of the 3rd age enable a traditionally under-supported learner group to become up to date with societal changes (IAUTA, n.d.)
- MIT open courseware universities are the go-to place for lifelong learning, strengthening the position of universities within an AI-driven world (MIT OpenCourseWare, n.d.)
- All Singaporean public universities (GovInsider, 2016)
- Unite! Europe. (n.d.) University Network for Innovation, Technology and Engineering (Unite! Europe, n.d.)

No-Regret Move 4:

Strengthen the research and innovation from within universities in AI technology and establish cross-disciplinary AI research hubs

Research and innovation enable universities to leverage AI advancements to address global challenges and improve the well-being of humanity. Furthermore, establishing cross-disciplinary research hubs ensures that the development of AI takes multiple perspectives into consideration. Universities that foster collaboration between diverse fields will be more adaptable to the different future scenarios.

Key Evidence for No-Regret Move 4
With AI pervading society, it is imperative that universities invest in AI research and innovation to stay relevant (Hardman, 2023). Universities are the stronghold for evidence-supported decision-making, including the need to supervise the outcomes and shaping of AI as augmentation of human capacities. In failing to do so, the development of AI might be more elite-driven and less societal.

Example 1. The deployment of AI4S (AI for Science) at Fudan University promotes integrated development of research innovation and talent training. They are deploying AI on major scientific issues and key research areas to create an innovation ecosystem. Their CFFF (Computing for the Future at Fudan) intelligent computing platform and the large-scale high quantity scientific database are focusing research on different scientific fields for the well-being of the community (Shanghai Municipal People's Government, n.d.).

Example 2. The idea of Higher Education for good is also taken up by academicians. One of the recent initiatives is the open book 'Higher Education for Good'. The idea of Higher Education for good empowers universities to be critical strongholds in an ever-changing world with emergent AI technologies (Czerniewicz & Cronin, 2023).

Example 3. Tsinghua University in China has set up the Institute for AI Industry Research (AIR), which focuses on research geared towards the internationalisation, 'intelligentisation', and industrialisation of the fourth technological revolution. The mission is to fuel the industrial upgrade and propel social advance with AI technologies. Based on the university-enterprise participation, the institute aims to make breakthroughs in core AI technologies, develop future industry leaders and achieve leapfrog progress with the industry (Institute for AI Industry Research, Tsinghua University, n.d.).

Example 4. The National University of Singapore has established the NUS AI Institute (NAII) to advance fundamental research, development, and application of AI technologies for the benefit of society (NUSnews, 2024).

Conclusion

Without a doubt, the advancement of AI will impact humans and society, whether for better or worse. As we cast our vision towards 2060, universities as knowledge and research hubs will have a pivotal role to play in ensuring a future where AI brings good to humanity and fosters a more inclusive world enabled by technology. To navigate those changes, universities should work on the strategies mentioned in each of the possible future scenarios. In addition, universities should make the proposed no-regret moves to ensure that they stay ahead of the curve and leverage on AI innovations to ensure equitable access to education and ethical use of technology to benefit humanity.

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References

Abdullah, Z. (2024, August 15). *IBM, NUS to set up new AI research and innovation centre in Singapore*. The Straits Times. https://www.straitstimes.com/tech/ibm-nus-to-set-up-new-ai-research-and-innovation-centre-in-singapore

Bulathwela, S., Pérez-Ortiz, M., Holloway, C., Cukurova, M., & Shawe-Taylor, J. (2024). Artificial intelligence alone will not democratise education: On educational inequality, techno-solutionism and inclusive tools. *Sustainability*, *16*(2), 781. https://www.mdpi.com/2071-1050/16/2/781/pdf

Chen, C., Chen, Z., Luo, W., Xu, Y., Yang, S., Yang, G., Chen, X., Chi, X., Xie, N., & Zeng, Z. (2023). Ethical perspective on AI hazards to humans: A review. *Medicine*, *102*(48), e36163.

Czerniewicz, L., & Cronin, C. (Eds.) (2023). *Higher Education for Good.* Open Book Publishers. https://doi.org/10.11647/obp.0363

Gendron, Y., Andrew, J., Cooper, C., & Tregidga, H. (2024). On the juggernaut of artificial intelligence in organizations, research and society. *Critical Perspectives on Accounting*, 102759.

GovInsider. (2016, April 10). *Lifelong learning units for all Singaporean public universities*. GovInsider. https://govinsider.asia/intl-en/article/lifelong-learning-units-for-all-singaporean-public-universities

Gruetzemacher, R., Paradice, D., Lee, K.B. (2020). Forecasting extreme labor displacement: a survey of AI practitioners. *Technological Forecasting and Social Change, 161*. https://doi.org/10.1016/j.techfore.2020.120323.

Hardman, P. (2023, July 18). *The invisible cost of resisting AI in higher education | LSE Higher Education*. LSE Higher Education. https://blogs.lse.ac.uk/highereducation/2023/07/18/the-invisible-cost-of-resisting-ai-in-higher-education/

Harvey, C., Gibson, A., Maclean, M., & Mueller, F. (2024). Philanthropy and the sustaining of global elite university domination. *Organization*, *31*(3), 433-457.
Horvath, L., James, O., Banducci, S., & Beduschi, A. (2023). Citizens' acceptance of artificial intelligence in public services: Evidence from a conjoint experiment about processing permit applications. *Government Information Quarterly*, *40*, 101876.

International Association of Universities of the Third Age. (n.d.). *IAUTA*. International Association of Universities of the Third Age. https://www.aiu3a.org/v2/about-en.html

Internet Policy Research Initiative at MIT. (2019, March 28). *AI Policy - Internet Policy Research Initiative at MIT.* Internet Policy Research Initiative at MIT. https://internetpolicy.mit.edu/research/machineunderstanding/

InnoEnergy. (n.d.). *Ecosystem*. InnoEnergy. https://www.innoenergy.com/for-innovators/ecosystem/

Institute for AI Industry Research, Tsinghua University. (n.d.). *Research-AIR*. Institute for AI Industry Research, Tsinghua University. https://air.tsinghua.edu.cn/en/Research1.htm

Institute for Ethics in AI. (n.d.). https://www.oxford-aiethics.ox.ac.uk/#:~:text=The%20Institute%20for%20Ethics%20in,in%20academia%2C%20business%20and%20government.

Miao, F., Holmes, W. (2021). *Artificial Intelligence and Education. Guidance for Policy-makers*. United Nations Educational, Scientific and Cultural Organization (UNESCO). Paris, France.

MIT OpenCourseWare. (n.d.). *MIT OpenCourseWare*. https://ocw.mit.edu/

Nanyang Technological University. (n.d.). *Alibaba-NTU Singapore Joint Research Institute*. Nanyang Technological University. https://www.ntu.edu.sg/alibaba-ntu-jri

Nath, R., & Manna, R. (2023). From posthumanism to ethics of artificial intelligence. *AI & SOCIETY*, *38*(1), 185-196.

Northern Illinois University. (n.d.). *Class Policies for AI Tools | Center for Innovative Teaching and Learning | Northern Illinois University*. Northern Illinois University. https://www.niu.edu/citl/resources/guides/class-policies-for-ai-tools.shtml

NUSnews. (2022, July 21). *NUS announces new initiatives to support the lifelong learning needs of Singapore's workforce.* NUSnews. https://news.nus.edu.sg/nus-announces-new-initiatives-to-support-the-lifelong-learning-needs-of-singapores-workforce/

NUSnews. (2024, March 25). *NUS Sets up AI Institute to Accelerate Frontier AI Research and Boost Real-world Impact for Public Good*. NUSnews. https://news.nus.edu.sg/nus-sets-up-ai-institute/

Pelletier, K., McCormack, M., Reeves, J., Robert, J., Arbino, N., Al-Freih, M., Dickson-Deane, C., Guevara, C., Koster, L., Sánchez- Mendiola, M., Bessette, L. S., & Stine, J. (2022). EDUCAUSE Horizon Report, teaching and learning edition. EDUCAUSE. https://library.educause.edu/-/media/files/library/2022/4/2022hrteachinglearning.pdf

Pietronudo, M.C., Croidieu, G., Schiavone, F. (2022). A solution looking for problems? A systematic literature review of the rationalizing influence of artificial intelligence on decision-making in innovation management. *Technological Forecasting and Social Change*, *182*, 121828 https://doi.org/10.1016/j.techfore.2022.121828.

Schipper, D. (2024, March 21). *Fairleigh Dickinson University Launches Lifeleong Learning Initiative. Fairleigh Dickinson University.* Fairleigh Dickson University. https://www.fdu.edu/news/fairleigh-dickinson-university-launches-lifelong-learning-initiative/

Shanghai Municipal People's Government. (n.d.). *Fudan launches largest cloud computing research platform*. Shanghai Municipal People's Government. https://www.shanghai.gov.cn/nw48081/20230630/e393cf424b4045288b5cc3ae696c1a3a.html

Stanford Institute for Human-Centered Artificial Intelligence. (2024, August 12). *Home*. Stanford Institute for Human-Centered Artificial Intelligence. https://hai.stanford.edu/

Tanveer, M., Hassan, S., & Bhaumik, A. (2020). Academic policy regarding sustainability and artificial intelligence (AI). *Sustainability, 12*(22), 9435. https://doi.org/10.3390/su12229435

The University of Tokyo. (n.d.). *Global Unit Courses (GUC): Summer 2023*. The University of Tokyo. https://www.u-tokyo.ac.jp/en/prospective-students/guc_23S302SC.html

Unite! Europe. (n.d.). https://www.unite-university.eu/

University of Helsinki. (n.d.). *Artificial Intelligence Collection*. University of Helsinki. https://www.helsinki.fi/en/admissions-and-education/open-university/multidisciplinary-themed-modules/artificial-intelligence-collection

Wang, N., Wang, X. & Su, Y.-S. (2024). Critical analysis of the technological affordances, challenges and future directions of Generative AI in education: a systematic review. *Asia Pacific Journal of Education*, *44*(1), 139-155.

Wang, S., Wang, G., Chen, X., Wang, W., & Ding, X. (2021). A Review of Content Analysis on China Artificial Intelligence (AI) Education Policies. In W. Wang, G. Wang,, X. Ding, & B. Zhang (Eds.), *Artificial Intelligence in Education and Teaching Assessment* (pp. 1-8). Springer eBooks. https://doi.org/10.1007/978-981-16-6502-8_1

Enhancing Collaborative Learning with AI




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Introduction

Education is the fundamental responsibility of universities. Learning is the essential process of education which involves collaboration of teachers, students and other academic, technical, and non-academic roles and agents. At the same time, education technologies and digital tools have a decisive impact on the extent and form of this collaboration, for example through online learning formats and multimedia group work.

Artificial intelligence (AI) can contribute in many ways to improve the collaboration between students, teachers and other actors, thus enhancing the collaborative learning experience. Besides, AI can provide real-time analytics and insights that guide students' engagement and streamline group engagement. AI can support educators in their role as facilitators and supervisors of group-based learning and helping them to identify students' strengths and weaknesses and to adjust their teaching strategies accordingly (Kamalov et al., 2022; Tan et al., 2023). Consequently, AI has the potential to change the role of educators in the learning process and lead to the emergence of new educational specialisations. It can boost the integration of universities into broader innovation ecosystems and drive a shift in curriculum design and delivery to accommodate AI-augmented learning.

In other words, AI has the potential to become a new agent in collaborative learning and revolutionise the learning experience. Such far-reaching change can have a significant social impact and will inevitably raise numerous legal and ethical questions. As with other disruptive technologies in the past, the pace and direction of change are still uncertain. There is no guarantee that the full potential of AI to promote human well-being will be realised and that the benefits will be shared on an equal and global basis.

In this position paper, we present different scenarios and discuss how universities should prepare for the future by pursuing no-regret moves that will help to maximise the impact of AI for collaborative learning. We continue with the presentation of the status quo in the next section, followed by four scenarios portraying four perspectives, which will be followed by a section on what we deem essential as far as universities and their governance are concerned for the beneficial integration of AI in enhancing the collaborative learning.

The Status Quo

Collaborative learning is a central component of the modern teaching methodologies. In its broadest definition, it comprises all formats that organise students to work in groups (Holt, 2018). The pedagogical aims of collaborative learning encompass project- and problem-based learning as well as peer learning and assessment. Examples include group projects, peer reviews, and discussion forums. Also, more elaborate "digitalised" formats, such as Collaborative Online International Learning (COIL), involve students and faculty from different countries working together in an online environment to learn and complete the projects.

Education technologies today play a pivotal role in facilitating collaborative learning. Platforms such as Learning Experience Platforms (LXP), Learning Management Systems (LMS), video conferencing platforms, and other collaborative software like Google Workspace enable students and the other agents involved in learning processes to interact and work together in real-time, regardless of their geographical location. The well-established role of communication and information technologies for collaborative learning is underscored by the emergence, more than two decades ago, of Computer-Supported Collaborative Learning (CSCL) as an interdisciplinary research field that focuses on how technology can facilitate and enhance collaborative learning experiences (Jeong et al., 2019). In recent years, AI has entered the collaborative learning landscape, opening new opportunities and offering a growing number of tools dedicated to learning in groups. Examples for such AI-powered tools include Payback Questions, which is an inquiry-driven discussion platform where AI provides instant feedback and ensures that discussions stay on track. Similarly, the Perusall platform allows students to read and collaboratively annotate the assigned text (Lee, 2023).

Numerous strategies and policies have been initiated in Europe as well as in Asia to promote and intensify collaborative learning, especially between different Higher Education Institutions (HEIs) across borders. European universities, for instance, implement collaborative learning through projects like the European Universities Initiative or exchange formats such as Blended Intensive Learnings (BIPs), which are financed within the Erasmus+ framework and combine short-term mobilities with virtual components to enable students and academic staff to work together. Similarly, University Mobility in Asia and the Pacific (UMAP) represents a consortium of universities that promote collaborative learning through various programmes, including COIL experiences.

The efforts and initiatives to foster collaborative learning, coupled with the fast development of new intelligent applications dedicated to learning, will boost the creation and diffusion of AI ecosystems for collaborative learning, consisting of platforms, applications, tools, data, smart classrooms, and end-user devices. The direction in which AI ecosystems will develop and the extent to which the benefits of these new technologies will be widely shared is however very uncertain and will depend on the strength and direction of the drivers of change.

Disruptive AI Scenarios for Collaborative Learning

This section presents four scenarios that describe how AI may transform collaborative learning in universities by 2060. The scenarios are the product of two drivers of change and their intersection. For each driver of change, the two extreme outcomes are assumed, resulting in four possible combinations and therefore four different scenarios for the future. The first driver concerns whether AI developments in universities will be guided by human-centred approaches or, on the contrary, by technology-centred imperatives. The second driver highlights how equitable AI developments will be, assuming that in the future everyone will have adequate access to AI-driven innovations or, conversely, that, quite oppositely, new technologies will be concentrated in the hands of a few affluent groups.

The scenarios are highly stylised and are not intended to predict future developments but rather to heuristically highlight possible outcomes and the challenges posed by the advancement of AI for collaborative learning. Important issues concern, among others, whether the enhancement of collaborative learning will meet human needs, the extent to which ethical considerations will be prioritised, the role of economic incentives and market drivers, and the extent to which the benefits from AI for collaborative learning will be shared by all or only by privileged groups.

Scenario 1: Learning along with intelligent machines (high equity, tech-centred)

In this scenario, by 2060 AI systems are widely used to enhance the learning experience, fundamentally reshaping the dynamics of collaboration between students, teachers and the academic ecosystems. AI-driven platforms are central to the collaborative learning process, often substituting or assisting human educators. Universities prioritise technological innovation and optimisation, focusing on creating efficient, high-performance applications and systems for collaborative learning rigorously supported by AI intervention. The process of developing and implementing technologies for academic settings involves all the stakeholders but prioritises the technology infrastructure providers and vendors as external actors. The HEIs have access to state-of-the-art AI technologies and, in their strategies, universities ensure that all students have access to these technologies, thereby reducing the digital divide. The primary goal is to maximise and optimise the technological potential of AI for knowledge transfer, educational performance, capacity building, and productivity of academic staff.

Scenario 2: Accessible, trustable, and responsible AI (high equity, human-centred)

AI solutions are used extensively into education to support a socially responsible learning experience that emphasises collaborative and participatory learning methodologies. Universities actively develop integrated strategies for AI-enhanced collaborative learning, prioritising their role as centres for critical reflection and addressing societal challenges through education. Engagement with stakeholders is broad and inclusive, with universities partnering closely with regulatory bodies and social stakeholders to ensure that AI technologies are developed and used ethically. There is a strong focus on making AI technologies accessible to all students and educational institutions, thus promoting equity and inclusion. The primary goal is to ensure that the collaborative learning experience prepares students to solve societal issues, while also reflecting on the legal and ethical implications of AI. This approach may constrain technological progress, as the emphasis on ethics and inclusivity may limit rapid advancements, reflecting a human-centred development model that prioritises social responsibility over technological efficiency. In order to achieve this, high demands are placed on governance and a high level of collaboration and international coordination across universities and stakeholders is required.

Scenario 3: Educating the tech-elites (low equity, tech-centred)

Universities focus on cutting-edge technologies in implementing AI applications for enhancing the collaborative learning experience. AI interventions economise the expenses by reducing the number of trainers or specialists and utilise human trainers in supervisory roles. At the same time, high-quality technological advancement, specifically the implementation of high-performance AI technology, necessitates substantial financial investment. The technological prioritisation also places considerable demands on staff and students. This pursuit of technological excellence is primarily beneficial to elite institutions with the resources to afford such advancements, thereby exacerbating inequalities. Universities with limited financial capabilities and lower prestige are left behind, widening the digital divide both within and between countries. AI interventions economise the expenses by reducing the number of trainers or specialists and utilise human trainers in supervisory roles. The allocation of limited resources is possibly based on merit but often follows a logic of preferential access for elites. This scenario illustrates the risks of unequal access to advanced AI, where only well-funded institutions can fully integrate AI into collaborative learning. Only selected groups of students take advantage of collaborative learning experiences enhanced through AI. The role of humans in the educational experience decreases and there is little focus on ethical considerations and human well-being in the learning process., widening the digital divide both within and between countries.

Scenario 4: Exacerbating inequalities (low equity, human-centred)

In this scenario, the integration of AI technology in education is guided by ethical considerations and human well-being, but the benefits are concentrated among privileged groups.

AI technologies implemented in collaborative learning are privately funded, proprietary, and for-profit, focusing on meeting the needs of those with sufficient economic resources. The AI interventions rely heavily on highly skilled educators, emphasising the human element in the learning process. This selective approach promotes well-being and enhancement of the learning experience exclusively for a privileged few. As a result, the deployment of AI in this scenario increases disparities in educational outcomes and life opportunities, between HEIs but especially between countries and regions. This human-centred yet inequitable approach to AI in education underscores the risk of reinforcing existing inequalities, as the benefits of AI-enhanced learning are concentrated among those endowed with sufficient resources, economically but also in terms of governance structures.

In conclusion, these scenarios illustrate the diverse paths AI integration into collaborative learning can take, emphasising the critical balance between human- and technology-centred development and the impact of equitable or inequitable access to AI tools. The learning experience can be significantly enhanced by AI, but this development must be approached with a thoughtful, inclusive mindset and accompanied with strategic action to ensure that the benefits of AI are widely shared, and that learning is promoted for the common good.

Strategic Moves: AI in Collaborative Learning

The following section outlines three "no-regret moves" essential for developing sustainable AI supported collaborative learning ecosystems in universities. Based on the conclusions drawn from the four scenarios, and mitigating the associated risks, the proposed strategies include: fostering community-based open-source AI development, ensuring equitable access to relevant technologies, and supporting stakeholders in identifying appropriate standards and guidelines. Addressing these areas is crucial for developing and sustaining AI-supported collaborative learning ecosystems and optimising their development and use.

No-Regret Move 1: Develop community-based open-source AI for collaborative learning

The development of community-based open-source AI-supported collaborative learning ecosystems addresses the challenges outlined in the four scenarios of this paper, particularly those faced by universities with limited financial resources. Community-based development ensures that the priorities of end-users shape the ecosystem. Open-source nature not only provides access to resource-constrained institutions but also enables easy customisation to meet specific needs and target groups. In this way, the collaborative dimension of the learning environment is effectively maintained.

Below are some key actions:

- Prioritise open-source, non-commercial solutions, as commercialisation could result in an unequal distribution of AI resources.
- Emphasise integrated strategies for community-based distribution of various AI resources (i.e., infrastructure, applications, APIs, learning gadgets, access to data).
- Develop strategies to engage various stakeholders, including industry, governments, non-governmental organisations, students, and academics.

Unequal access to AI tools is a concern, as the literature "has indicated a digital divide where students from low-income backgrounds may have limited access to AI-enabled educational resources" (Roshanaei et al., 2023). According to estimates by the experts at JISC, a UK agency focused on digital technology in tertiary education, the monthly costs of an AI toolkit that would potentially give a student a significant advantage would cost over 900£ per year (JISC, 2023A). These costs can be prohibitive for many students in economically advanced countries and for most students in other world regions. In a similar survey of UK higher education students carried out in 2022/23, one in two respondents cited poor WIFI connection and one in three respondents cited mobile data costs as a difficulty in the use of digital technologies in learning (JISC, 2023B).

As some exemplary excerpts from recently published articles confirm, the issue of equitable access to new technologies is a high priority in the educational realm. "Ensuring equitable access to personalised learning opportunities is essential. Some students may face barriers to access, such as limited internet connectivity or access to devices, which could exacerbate existing achievement gaps." (Kamalov et al., 2023) "Group-based inequalities may widen because of varying levels of engagement with generative AI tools. For instance, a study revealed that female students report using ChatGPT less frequently than their male counterparts" (Capraro et al., 2024). It is important for universities to pool resources and to engage a broad range of contributors, as "implementing personalised learning often requires significant investments in technology, infrastructure, and continuing professional development" (Kamalov et al., 2023).

On the other hand, the development of AI ecosystems for education does not necessarily entail the type of investments upfronted by big technology companies that develop AI tools for commercial aims. For instance, "relatively smaller language models, which are significantly less expensive to train and deploy, can be effective in education-related generative tasks" (Bulathwela et al., 2024). Also, AI systems can scale at low cost (Kamalov et al., 2023), which means that investment in appropriate educational AI ecosystems can have a large return on investment (ROI) by providing enhanced learning experiences across geographic and socioeconomic barriers.

No-Regret Move 2: Enable equal access to AI ecosystems

To provide equal access to AI-powered collaborative learning systems, investments in digital infrastructure are essential. To facilitate mixed learning styles, this involves the creation of smart classrooms, reliable internet access, and the supply of end-user devices like laptops and tablets. Educational institutions need to create a strong AI ecosystem that supports interactive and collaborative learning experiences by utilising local, national, and international financing. Furthermore, putting in place thorough digital literacy initiatives for teachers and students will optimise the advantages of these tools and guarantee that everyone involved is prepared to take part in AI-powered collaborative learning.

Universities should use an integrated strategic platform with a strong Learning Management System (LMS) like Moodle or Canvas that enables AI-driven tools and individualised learning experiences to successfully implement the essential elements of AI-enhanced collaborative learning. All students must have dependable connectivity and accessibility, which requires investments in high-speed internet infrastructure and the availability of end-user devices. These infrastructure upgrades can be made possible through collaborations with telecom providers, national and local governments, and other organisations. Furthermore, the integration of smart classroom technologies - like the Blue Initiative of the Education University of Hong Kong - should be prioritised to improve collaborative learning and real-time engagement. Using UNESCO-provided frameworks, comprehensive digital literacy programmes for educators and students will guarantee that all parties involved are prepared to use AI. Such collaborative learning platforms require the essential components at regional, organisational, public, and personal levels, including funding initiatives, smart classrooms, Internet connectivity, end-user devices and digital literacy programmes.

Worldwide, there is an increasing inclination towards investing in digital infrastructure development, capacity building, innovative teaching methods, and funding initiatives that support AI-enhanced collaborative learning. Examples of these efforts are detailed in the sections below:

a. **Global Investment in Education and Infrastructure**
   The World Bank stresses that equal access to AI-enhanced education requires investments in digital infrastructure. Research has indicated that these kinds of expenditures are essential for closing the digital gap and improving cooperative education. (World Bank, 2021). For instance, the implementation of AI technologies that support collaborative learning has been made possible by the World Bank's projects in several nations, such as the "Digital Economy for Africa" initiative, which has greatly increased internet connectivity in schools (World Bank, 2021).

b. **Blended Learning and Smart Classrooms**
   Blended learning environments which integrate online digital media with conventional classroom techniques are installed to improve collaborative learning by enabling students to engage in both virtual and real-world settings (U.S. Department of Education, 2020). The Blue Initiative at the Education University of Hong Kong (EduHK) exemplifies efforts in Asia to enhance collaborative learning through blended learning environments. This initiative integrates online digital media with conventional classroom techniques, improving student engagement and collaboration in both virtual and real-world settings (EduHK, 2021). For Example, research from the U.S. Department of Education demonstrates that AI-enabled blended learning environments enhance student cooperation and academic achievement (U.S. Department of Education, 2020). The Singaporean government's "Smart Nation Initiative" aims to employ technology to enhance people's lives by making large expenditures in infrastructure and educational technology. The programme encourages the development of collaborative learning environments using AI tools in blended classroom (Government of Singapore, 2021).

c. **Smart Classrooms**
   Smart classrooms, outfitted with AI-powered instructional software, provide interactive and cooperative learning environments. Real-time feedback, peer cooperation, and group problem-solving exercises are all supported by these technologies (World Bank, 2021). For instance, studies show that by offering a dynamic and engaging learning environment, smart classrooms improve collaborative learning (EdTech Magazine, 2021).

d. **Digital Infrastructure Investments**
   The adoption of AI tools in education has been made possible by the nation's investments in smart classrooms throughout the nation. These tools facilitate group projects and real-time engagement, which promotes collaborative learning (South Korea Ministry of Education, 2020). As an illustration, according to the South Korea Ministry of Education, these expenditures have enhanced learning results and raised student engagement, especially in collaborative environments where students may easily collaborate while utilising AI-driven tools (South Korea Ministry of Education, 2020). All pupils will receive devices as part of Finland's broad plan to incorporate digital tools into teaching, and all schools will have high-speed internet. AI tools are employed in Finnish schools to facilitate group projects, peer tutoring, and conversations (OECD, 2021). As an example, according to the OECD, students' participation in interactive and project-based learning activities has improved collaborative learning thanks to these digital technologies (OECD, 2021).

e. **Regional and International Funding Initiatives**
   Significant funding is available for initiatives aiming at creating digital infrastructure and educational technology

through the European Commission's Horizon Europe programme. This includes AI-powered tools that improve group communication and coordination among students to improve collaborative learning (European Commission, 2020). To give any example, by guaranteeing that AI tools are available to all students, these programmes help to promote equitable opportunities for cooperative learning throughout Europe (European Commission, 2020). The Education Strategy of Asia-Pacific Economic Cooperation (APEC) assists member economies in creating digital literacy initiatives and ICT infrastructure. Funding for AI-enabled collaborative learning environments is part of this (APEC, 2021). For instance, by encouraging collaborative learning through AI-powered platforms, APEC efforts have enhanced educational outcomes in member economies (APEC, 2021).

f. **Digital Literacy Programmes**
With the help of UNESCO's global project on digital literacy, educators and students will be able to use AI and digital tools more successfully. According to UNESCO (2021), these initiatives have demonstrated efficacy in augmenting academic achievements and equipping learners for the digital economy. As an illustration, consider the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), a component of the Digital India initiative in India that has taught millions of rural residents' digital literacy and greatly increased their capacity to engage in the digital economy (Government of India, 2021).

No-Regret Move 3: Strengthen governance through guidelines and standards

In an era defined by technological advancements, universities must harness the power of AI to improve collaborative learning environments to enhance the learning experience. To achieve this universities should set up a strategic plan of governance for a comprehensive approach to integrating AI technologies, skill development, ethical guidelines, transparency, and democratic engagement. By navigating the complexities of AI implementation, universities can enhance educational experience while maintaining a balance between innovation and regulation. The future of higher education depends on their ability to adapt and lead in this transformative landscape. Below are some key actions:

a. **Establish strategic bodies, form committees overseeing AI integration in cooperative learning environments**
Strategic bodies are crucial for effective AI integration in higher education. Universities should establish committees dedicated to overseeing the implementation of AI-powered ecosystems in collaborative learning environments. As has been noted, the task of universities consists of "ensuring AI systems do not perpetuate or amplify biases, protecting the privacy and security of individuals, ensuring the reliability and safety of AI systems, and making AI decisions explainable to humans. The goal of responsible AI is to create AI technologies that serve humanity positively, align with societal values and norms, and contribute to sustainable development" (Kurtz et al., 2024).

b. **Prepare guidelines for AI use and promote transparency**
Establishing clear guidelines and promoting transparency are essential for the responsible use of AI. Universities should draft ethical and functional guidelines, drawing inspiration from existing frameworks such as those at The Northeastern University of London, Ulster University and the University of Edinburgh. Transparency in AI-driven processes can enhance accountability and trust. As Chan (2023) notes, "establishing clear policies around AI use, including ethical guidelines and legal responsibilities, will help students and staff navigate these complex issues."

c. **Foster a balanced approach, encourage democratic engagement in AI initiatives whilst avoiding overregulation**
A balanced approach to AI integration is necessary, encouraging democratic engagement while avoiding overregulation. Universities should use AI tools to facilitate co-design and participation, ensuring diverse voices are included in AI policy making. As is emphasised by George and Wooden (2023), "the shift toward AI-integrated systems will be a considerable change requiring effective communication, stakeholder engagement, and continuous monitoring to ensure that the transition is smooth and beneficial for all parties involved". Furthermore, this will enhance accountability, build trust, and streamline administrative processes, contributing to more efficient and rational operations including privacy issues.

Summary

Appropriate AI ecosystems in universities can responsibly and responsively enhance the learning experience of students by transforming it into a hybrid (human+machine) learning process where human intellectual abilities and brain power are complemented by machines. The assessment logic and analytics of the intelligent machine can be more powerful, efficient, and better presentable than that of humans. Human involvement, on the other hand, validates the process to ensure its trustworthiness and reflects on its results to assess them correctly. At the same time, the university governance aims to provide sufficient AI resources and seeks for collaboration with other universities, industry, and ecosystem infrastructure providers. They also ensure the legal requirements and ethical implications of AI ecosystem data and business workflows and formulate guidelines and standards to the end-users. In this respect, it is important that people have equal access to digital infrastructures which are financed by public funds. In addition, R&D and innovation funding should be utilised for capacity building of teachers, technical and administrative staff, and university management. Internationalisation is equally important in the process of developing AI innovation ecosystem in universities, to encompass various global communities and to incorporate the shared vision and collective wisdom. The power of AI, if implemented strategically and cautiously, can be well harnessed to enhance collaborative learning and thereby improve the educational process for the benefit of students, faculty and all the stakeholders involved in higher education.

References

Asia-Pacific Economic Cooperation (APEC). (2021). *APEC education strategy*. Asia-Pacific Economic Cooperation (APEC). https://www.apec.org/docs/default-source/groups/hrd/2018/apec-educationstrategy-final.pdf

Bulathwela, S., Pérez-Ortiz, M., Holloway, C., Cukurova, M., & Shawe-Taylor, J. (2024). Artificial Intelligence Alone Will Not Democratise Education: On Educational Inequality, Techno-Solutionism and Inclusive Tools. *Sustainability, 16*(2), 781.

Capraro, V., Lentsch, A., Acemoglu, D., Akgun, S., Akhmedova, A., Bilancini, E., ... & Viale, R. (2024). The impact of generative artificial intelligence on socioeconomic inequalities and policy making. *PNAS Nexus, 3*(6).

Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education*, *20*(1), 38. https://doi.org/10.1186/s41239-023-00408-3

EdTech Magazine. (2021). *How smart classrooms are redefining education*. EdTech Magazine. https://edtechmagazine.com/k12/article/2021/03/how-smart-classrooms-are-redefining-education

European Commission. (2020). *Digital education action plan*. European Commission. https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

European Commission. (2020). *Horizon Europe*. European Commission. https://ec.europa.eu/programmes/horizon2020/

George, B., & Wooden, O. (2023). Managing the Strategic Transformation of Higher Education through Artificial Intelligence. *Administrative Sciences*, *13*(9), 196. https://doi.org/10.3390/admsci13090196
Government of India. (2021). *Digital India*. Government of India. https://www.digitalindia.gov.in/

Government of Singapore. (2021). *Smart nation initiative.* Government of Singapore. https://www.smartnation.gov.sg/

Holt, M. (2018). *Collaborative Learning as Democratic Practice. A History*. CCCC/NCTE Studies in Writing and Rhetoric.

Hsu, Y. C., Verma, H., Mauri, A., Nourbakhsh, I., & Bozzon, A. (2022). Empowering local communities using artificial intelligence. *Patterns, 3*(3). https://www.cell.com/patterns/pdf/S2666-3899(22)00022-8.pdf

Igbokwe, I. C. (2023). Application of artificial intelligence (AI) in educational management. *International Journal of Scientific and Research Publications, 13*(3), 300-307. https://www.ijsrp.org/research-paper-0323.php?rp=P13512782

Jeong, H., Hmelo-Silver, C. E., & Jo, K. (2019). Ten years of computer-supported collaborative learning: A meta-analysis of CSCL in STEM education during 2005–2014. *Educational Research Review, 28*, 100284.

JISC. (2023A). *AI in tertiary education. A summary of the current state of play*. https://www.jisc.ac.uk/reports/artificial-intelligence-in-tertiary-education

JISC. (2023B). *Student digital experience insights survey 2022/23: UK higher education (HE) survey findings*. Jisc data analytics. https://digitalinsights.jisc.ac.uk/reports-and-briefings/our-reports/2022-23-uk-higher-education-students-digital-experience-insights-survey-findings/

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New era of artificial intelligence in education: Towards a sustainable multifaceted revolution. *Sustainability, 15*(16), 12451.

Kurtz, G., Amzalag, M., Shaked, N., Zaguri, Y., Kohen-Vacs, D., Gal, E., Zailer, G., & Barak-Medina, E. (2024). Strategies for Integrating Generative AI into Higher Education: Navigating Challenges and Leveraging Opportunities. *Education Sciences*, *14*(5), 503. https://doi.org/10.3390/educsci14050503

Lee, S.. (2023). AI Toolkit for Educators, EIT InnoEnergy Master School Teachers Conference 2023. https://paradoxlearning.com/wp-content/uploads/2023/09/AI-Toolkit-for-Educators_v3.pdf

Lotfian, M., Ingensand, J., & Brovelli, M. A. (2021). The partnership of citizen science and machine learning: benefits, risks, and future challenges for engagement, data collection, and data quality. *Sustainability, 13*(14), 8087. https://www.mdpi.com/2071-1050/13/14/8087

Miao, F., Holmes, W., Huang, R., & Zhang, H. (2021). *AI and education: Guidance for policymakers*. UNESCO. https://doi.org/10.54675/PCSP7350

Organisation for Economic Co-operation and Development (OECD). (2021). *Education at a glance*. Organisation for Economic Co-operation and Development (OECD) https://www.oecd.org/education/education-at-a-glance/

Roshanaei, M., Olivares, H., & Lopez, R. R. (2023). Harnessing AI to Foster Equity in Education: Opportunities, Challenges, and Emerging Strategies. *Journal of Intelligent Learning Systems and Applications*, *15*(04), 123-143.

South Korea Ministry of Education. (2020). *Annual report*. South Korea Ministry of Education. https://english.moe.go.kr/

The Education University of Hong Kong (EduHK). (2021). *Blended Learning for University Enhancement (BLUE) Initiative*. The Education University of Hong Kong. https://lt.eduhk.hk/teaching/blended-learning-for-university-enhancement-blue-initiative/

The Northeastern University of London. *AI Strategy*. The Northeastern University of London. https://www.nulondon.ac.uk/academic-handbook/strategies/ai/ai-strategy/

U.S. Department of Education. (2020). *Blended learning impact study*. U.S. Department of Education. https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Ulster University. *Guidance for students*. Ulster University. https://www.ulster.ac.uk/learningenhancement/cqe/strategies/ai/guidance-for-students

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2021). *Digital literacy global initiative*. UNESCO. https://en.unesco.org/themes/ict-education/digital-literacy

University of Edinburgh. AI guidance for staff and students. University of Edinburg. https://www.ed.ac.uk/bayes/ai-guidance-for-staff-and-students

World Bank. (2021). *Digital development*. World Bank. https://www.worldbank.org/en/topic/digitaldevelopment

AI-Driven Development of Teaching and Learning in Asia and European Higher Education

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Introduction

The integration of artificial intelligence (AI) in higher education varies across Asia and Europe due to historical, cultural, social, and economic influences. In Europe, the educational approach is more flexible and student-centred, aiming to develop students' abilities and interests. AI-based methodologies face challenges like privacy concerns and algorithmic bias, potentially impacting underprivileged students and widening the digital divide. The use of ChatGPT is a pressing issue, with mixed attitudes towards its potential to enhance self-efficacy and motivation (Hadi Mogavi et al., 2024). In Asia, the educational system is more structured and teacher-centred, emphasising academic and disciplinary achievement. The integration of AI into teacher-centred instruction offers advantages such as personalised learning experiences, enhanced classroom management, and reduced teacher workload (Hashem et al., 2023; Zhang & Zhang, 2024). However, the relationship between teachers and students is likely to become increasingly fraught (Jain, 2023). In the European system, assessment methods often involve a combination of formative and summative examinations, which are crucial for evaluating student performance and improving learning outcomes. Formative assessments offer continuous feedback, helping students identify areas for improvement. Studies show a positive correlation between formative and summative performance, ensuring effective learning outcomes (Ha et al., 2023).

In contrast, the Asian system relies to a significant extent on high-stakes examinations. Final examinations can increase stress and lead to academic misconduct (French et al., 2023). Innovative assessment methods, like e-assessment and proficiency-based assessments, can improve learning outcomes and cognitive skills (Crisp et al., 2016). AI-based adaptive testing can improve high-stakes examination precision and accuracy. A meta-analysis showed that AI-supported adaptive learning systems improved cognitive learning outcomes (Wang et al., 2024). However, challenges persist regarding reliability, explainability, and potential bias, which could compromise test results and erode trust in AI-assisted assessment (Aloisi, 2023). Addressing these issues is crucial to ensure the reliability of AI-based systems, which must be held to the same standard as traditional ones (Matayoshi et al., 2021).

The European educational system places significant emphasis on holistic development, encompassing not only academic pursuits but also the cultivation of extracurricular abilities and social competencies. In addition, the Asian education system places a significant emphasis on academic excellence, with a corresponding provision of remedial education to enhance academic performance. The cultural context exerts a significant influence on both educational systems. In Europe, the educational paradigm is characterised by an emphasis on individualism and creativity. In contrast, in Asia, the educational paradigm is shaped by an emphasis on collectivism, respect for authority and hard work. AI-driven role-play simulations can enhance children's emotional intelligence by providing an immersive environment. These simulations help children recognise, comprehend, and regulate emotions (Jarczewska-Gerc & Gogolewska, 2015), fostering deeper relationships and interpersonal skills. The article proposes a methodology for developing AI in higher education, aiming to create a dynamic learning experience across Asia and Europe's education systems, thereby nurturing emotional intelligence effectively.

The Status Quo

Educational systems in Asia and Europe differ significantly due to cultural, historical, economic, and governmental factors (Bentaquet et al. n. d.). These differences can be categorised into educational philosophy, cultural attitudes, assessment and examinations, and curriculum structure. In Asia, rote learning and memorisation are prevalent, influenced by Confucius' teachings on discipline and authority. AI has the potential to revolutionise learning and memorisation through innovative methodologies and tools. AI can enhance memory retention by reinforcing visual learning material and improving the balance between consolidation and generalisation processes. It can also challenge traditional rote learning methodologies in educational assessment by generating high-quality original content and facilitating procedural learning by identifying instances of learners transitioning from procedural to memory-based approaches (Chouteau et al., 2024).

In contrast, European education is student-centred, focusing on critical thinking, creativity, and independent learning. This is influenced by the embedded cultures of European societies, leading to standardised exams and a preference for collaborative learning. AI tools have been used to enhance collaborative learning by bridging perception gaps, clarifying goals, and promoting deeper understanding. This approach fosters critical thinking and creativity, especially when educators moderate discussions (Sako, 2024). AI technology also facilitates personalised learning, optimising student engagement and comprehension (Gondo & Mbaiwa, 2022; Harsening Al. Pdf, n.d.).

In Asian countries, the educational system is centralised, with the government responsible for policy formulation, curriculum decisions, and resource allocation. AI-powered adaptive learning systems can personalise education and cater to individual student needs, improving learning outcomes in STEM subjects (Yannier et al., 2024). AI technologies like ChatGPT enable interactive learning materials, while mixed reality smart glasses provide real-time insights into student learning and behaviour, enhancing student learning outcomes across various abilities (Singhai et al., 2024).

In contrast, European countries like Germany, Hungary, and the Netherlands have a decentralised approach, focusing on a comprehensive curriculum including STEM subjects, humanities, arts, and physical education. These countries prioritise STEM subjects to cultivate a skilled workforce, enhance global competitiveness, and address complex issues.

Japan uses 大学入学共通テスト, or "Daigaku Nyūgaku Kyōtsū Tesuto," as a university entrance exam. South Korea uses the College Scholastic Ability Test (CSAT) or "Suneung" (수능). The examination is a national requirement for those seeking admission to universities. Indonesia conducts a national university entrance examination, known as Seleksi Bersama Perguruan Tinggi Negeri (SBMPTN). In Thailand, the entrance examination is called the Thai University Central Admission System (TCAS). In contrast, various university pathways are applied in European countries. The aforementioned descriptions can be summarised in Table 1.

Table 1. Differences in education systems in Asia and Europe

		Asia	*Europe*
1.	*Educational Philosophy and Approach*	*Teacher-centred*	*Student-centred*
2.	*Cultural Attitudes toward Education*	*Emphasis on achievement and success*	*Holistic development and critical thinking*
3.	*Assessment and Examinations*	*Rigorous standardised testing*	*Holistic assessment*
4.	*Curriculum Structure*	*Prioritisation of core subjects and standardised testing to ensure academic achievement and competitiveness*	*A broad, balanced education that promotes critical thinking, creativity, and cultural diversity*

The Drivers of Change

In the present article, we propose drivers of change to the European education system based on the differences between that system and the Asian education system. To achieve this, we emphasise three points.

Driver of Change 1
Digital Literacy is proposed to address the gaps in the education system in Asia. AI can improve digital literacy in developing Asian countries by creating personalised learning environments. A study in Japan used AI-enhanced active reading tasks to identify learning behaviours and challenges. An AI literacy taxonomy can inform curriculum development and integrate AI in educational contexts, promoting inclusive digital education and bridging the digital divide in Asia (Toyokawa et al., 2023; Shiri, 2024).

Driver of Change 2
The contrasting cultural, policy and educational structures in the two continents justify the proposal of *Education with Automation*. Automation in education offers personalised learning experiences and improved efficiency, allowing educators to focus on complex tasks. This integration could lead to new academic disciplines and courses, equipping students with necessary skills for an AI-centric future labour market (Nykonenko, 2023; Holland & Davies, 2020).

Driver of Change 3
Improving the quality of learning in both countries is *Digital Realities*. AI-generated digital reality enhances virtual environments by creating 3D models using satellite, aerial, and terrestrial images (Guren, 2008). It also simulates autonomous behaviours in virtual characters, such as AI-based animals in virtual islands. These changes are explained through scenarios, facilitating their implementation and providing immersive and interactive experiences (Turan & Cetin, 2019).

The three proposed driver of changes will be elucidated through the delineation of scenarios, thereby facilitating their implementation.

The Four Scenarios

Scenario 1: Equitable tech-driven learning ecosystem (high equity, tech-centred)

The Potential and Perils of AI in Education. AI has the potential to provide equal access to technology and resources for all students, regardless of their background. However, its effectiveness depends on the availability of necessary infrastructure, such as internet access and technological devices (GilPress, 2024). AI can also be used in the absence of comprehensive infrastructure, such as using AI-based technology. Smartphones are increasingly accessible, and AI can be applied in the form of lightweight mobile applications that do not require constant internet connection. These applications can facilitate personalised training or educational content (Aponso et al., 2024; Gui et al., 2024; Kokoç & Göktaş 2024; Obeso et al., 2023). AI can improve student outcomes, retention, and graduation rates by fostering an inclusive and adaptive learning environment. However, high reliance on AI (Lancaster et al, 2021) can lead to risks such as overdependence on intelligent systems and challenges with assessment systems. To maximise the benefits of AI, teacher digital competence is crucial. To address infrastructure difficulties in Asia and improve the learning process in Europe, AI can be integrated into an offline learning platform that can monitor student progress and adapt content to individual learning requirements (He et al., 2024; Liu, 2023).

Scenario 2: Ethically empowered human-centred learning (high equity, human-centred)

The Synergistic Power of AI and AR in Education. The second scenario proposes an educational approach that prioritises individual needs, potential, and well-being, ensuring ethical technology use. This involves using virtual and augmented reality (AR) technologies for immersive learning experiences, such as science lab simulations and space exploration, tailored to individual interests. AI and AR are revolutionising learning experiences, but it's crucial to foster essential soft skills like critical thinking, problem-solving, and creativity (Voogt et al., 2013). As AI becomes a prominent feature in Learning Management Systems (LMS), ethical considerations must be carefully considered. Ensuring responsible AI usage benefits all stakeholders, including students, educators, and academic institutions. Transparency and user consent are essential for trust and ethical implementation in educational settings. AI and AR have a symbiotic relationship,so the convergence of AI and AR offers promising prospects for educational advancement, such as through the following:

Enabling natural and intuitive interactions. The integration of AI into AR devices allows for a more natural and intuitive response to user actions, enhancing the learning experience. Real-time contextual information provides a key aspect, personalising AR experiences and enriching the user's environment.

Serving as a powerful tool for immersive learning. The advent of AR has garnered significant interest from educators, as it enables the superimposition of virtual data onto the tangible world, thereby fostering a dynamic and engaging learning environment (Garzón, 2021).

Improving education outcomes. Research shows that AR has a positive impact on learning, improving outcomes across various disciplines like science, engineering, and social studies, according to extensive studies (Akçayır & Akçayır, 2017).

Increasing motivation. AR can boost student motivation by providing an engaging and interactive learning (Arici et al., 2019; Bacca et al., 2018; Ibáñez et al., 2020). The use of AR tools in content creation can significantly improve learning outcomes, surpassing passive consumption. This suggests that AR tools can facilitate deeper learning experiences.

Providing opportunities for theoretically grounded AR-enhanced learning. The efficacy of AR in the field of education can be attributed to two principal learning theories. The first is Situated Learning. AR aligns with situated learning theory, stating that learning occurs within a specific context and is influenced by interactions with people, places, and objects (Bourne, 2005). It allows learners to immerse themselves in a simulated environment, facilitating knowledge transfer to real-world contexts (Dede, 2009). Additionally, Constructivism emphasises individual role in meaning construction through experiences and knowledge (Dede, 2008). AR facilitates constructivist learning by placing learners in authentic contexts, allowing them to actively construct knowledge through engagement with their environment and peers.

In conclusion, the convergence of AI and AR has the potential to revolutionise education by enhancing personalisation and immersive experiences. This can foster critical thinking, problem-solving, creativity, and deep understanding. As these technologies evolve, their combined capabilities will transform our learning and interaction with the world.

Scenario 3: Exclusive tech-driven learning paradigm (low equity, tech-centred)

The Potential and Challenges of AI-Powered LMS. The third scenario involves an educational model that heavily uses digital technology to support learning processes. The integration of AI into LMS is revolutionising education delivery, but it raises concerns about privacy, safety, and cost. Compliance with data protection regulations like GDPR and FERPA (European Union 2016; Department of Education 2009) is crucial, and AI algorithms must be bias-free and inclusive (Minn, 2022). The development and maintenance of AI-powered LMS features can be costly, influenced by factors like AI functionalities complexity, student data size, and maintenance requirements. A cost-benefit analysis is essential to calculate the potential return on investment. AI can automate grading tasks, provide personalised feedback, and ensure consistent application of rubrics and assessment criteria (Baker, 2021), potentially reducing grading bias and enhancing assessment effectiveness (Farzana, 2023). AI can also revolutionise assessment design by creating Personalised Assessments or Adaptive Assessments, which align with individual students' learning styles and provide a comprehensive evaluation of their knowledge and abilities (Murtaza et al., 2022). However, AI-based assessments must be used alongside traditional methods to fully explore student understanding and critical thinking skills (Wang et al, 2020). AI-LMS faces challenges due to inadequate infrastructure, especially in regions with limited technology. Solutions include optimising and compressing files, using low-resolution videos or lighter formats, providing offline features, and setting up local servers in community centres or schools.

Scenario 4: Selective human-focused learning assistance (low equity, human-centred)

The Potential of AI and AR to Enhance Learning Flow. This section highlights the potential of AI and AR and the HY-DE model (Pietrzyk et al., 2015) to support student engagement and the flow of learning (Dominek, 2021a). AI is crucial in identifying students needing help, aligning with Intelligent Tutoring Systems and adaptive learning. AI-powered AR tools and the HY-DE model (Dani 2014) offer opportunities for integrating AI into classroom curriculums. The flow-based pedagogical model (Dominek, 2022) suggests that AI-powered tools can improve learning outcomes, motivation, and skill development.

Research related to the potential of AI ad AR to enhance learning flow was conducted in the academic year 2021/2022 as part of a classroom experiment, where the AR software and the HY-DE model were implemented to measure their added value in facilitating students' individual flow states during class and in developing their vocabulary acquisition in ESP classes for law enforcement. The classroom research was conducted with the participation of study and control groups (n=33). In the control group, the teaching material was supported by traditional methods and without the involvement of technical devices (n=10). In study group 1, the AR software was used (n=11), while in study group 2, the AR software was supplemented with the application of the HY-DE model as a methodology to improve students' vocabulary knowledge and maintain their individual flow states during class (n=12).

The study explores the impact of traditional or internet-based solutions on students' flow state in English of Specific Purposes (ESP) teaching. It hypothesises that digital devices improve vocabulary acquisition and student involvement. The research uses self-constructed knowledge level tests and the Flow State Questionnaire (Magyaródi et al. 2013) to measure students' vocabulary knowledge and flow state. Results show that AR-supported groups achieve a deep flow state (over 80%) during the AR application phase, while AR & HY-DE model-supported students achieve the highest levels of merging with the experience and challenge-skill balance (Table 2-3).

Table 2. The students' flow state results of the 1st measurement *Source: own database*

	n	Average	Percentage	Standard dev.	Group
• *Challenge-skill balance*	*12*	*46,92*	*46,92*	*46,92*	*Study Group 1*
• *Merging with the experience*	*12*	*36,42*	*36,42*	*36,42*	*Study Group 1*
• *Challenge-skill balance*	*11*	*45,82*	*45,82*	*45,82*	*Study Group 2*
• *Merging with the experience*	*11*	*37,00*	*37,00*	*37,00*	*Study Group 2*
• *Challenge-skill balance*	*10*	*36,18*	*36,18*	*36,18*	*Control Group*
• *Merging with the experience*	*10*	*20,09*	*20,09*	*20,09*	*Control Group*

Table 3. The students' flow state results of the 2nd measurement *Source: own database*

	n	Average	Percentage	Standard dev.	Group
• *Challenge-skill balance*	*13*	*49,38*	*89,78*	*4,17*	*Study Group 1*
• *Merging with the experience*	*13*	*38,77*	*86,16*	*5,26*	*Study Group 1*
• *Challenge-skill balance*	*8*	*47,88*	*87,05*	*5,11*	*Study Group 2*
• *Merging with the experience*	*8*	*39,25*	*87,22*	*2,92*	*Study Group 2*
• *Challenge-skill balance*	*10*	*39,05*	*71,81*	*12,93*	*Control Group*
• *Merging with the experience*	*10*	*27,06*	*61,33*	*9,38t*	*Control Group*

This case study suggests that AI and AR can improve learning flow, but further research is needed to understand the specific contributions of the HY-DE model and the long-term benefits of AR-supported learning on knowledge retention and skill development. The low variation in the study groups may be due to the simplicity of tasks, which made knowledge acquisition challenging. Future research should focus on using tools with less simple tasks to provide students with experience and challenge in solving tasks.

The No-Regret Moves

No-Regret Move 1: Implement an AI-driven early intervention system

In accordance with the third scenario, in particular, an AI-powered LMS has the potential to significantly influence the future of education. This paradigm places significant emphasis on the utilisation of technology and AI in the learning environment, presenting both considerable opportunities and notable challenges. Implementing AI-based early intervention systems in education is a proactive strategy that ensures students get the support they need before they fall behind. This approach harnesses the power of AI to identify at-risk students (Okoye et al., 2024), provide timely intervention and ultimately improve educational outcomes. Such systems are designed to detect learning difficulties early, provide personalised support, and promote fair opportunities for success.

Key Evidence for No-Regret Move 1
Action Statement: Develop and implement an AI system to identify at-risk students early and provide timely support and resources. The key components of this LMS, designed with AI, are as follows:

1. ***Data collection and integration.*** The LMS collects academic performance data, behavioural data, and social-emotional data, monitoring engagement metrics and student well-being through surveys, feedback forms, and behavioural observations, and integrates these data to improve student outcomes.

2. ***Predictive analytics and risk assessment.*** The app uses machine learning to analyse data and predict students at risk of falling behind. It includes risk indicators like declining grades, absenteeism, low engagement, and social-emotional challenges, and early warning systems for timely intervention.

3. ***Personalised intervention strategies.*** The LMS application offers a Support Plan tailored to each student's needs, including additional guidance and resources. Real-time feedback and adjustments ensure effectiveness, while AI-based engagement tools recommend interactive learning resources that match students' learning styles and preferences.

4. ***Teacher and staff support***. The application will aid professionals in AI system interpretation and intervention implementation, providing training for educators, decision support systems for informed resource allocation, and collaboration platforms for educators, counsellors, and parents to support students' learning journeys. The status quo is based on reliance on traditional, reactive methods of identifying and supporting students at risk; inconsistent and delayed interventions. The stages in implementing it are:

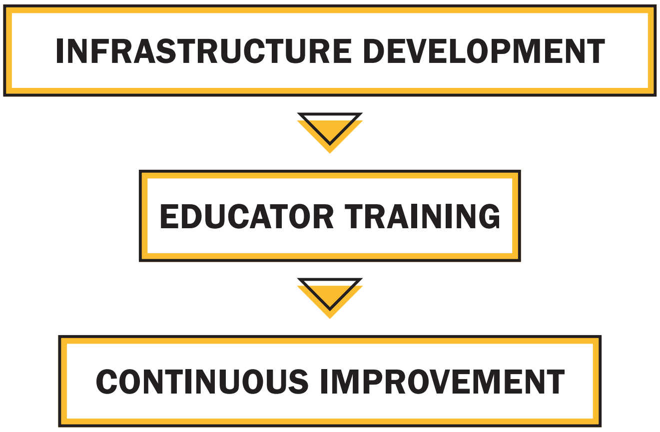


Figure 1. Stages of implementation of an AI powered LMS

The AI platform will be used to collect and integrate academic, behavioural, and socio-emotional data, enabling personalised intervention planning. A comprehensive training programme will be implemented, and continuous professional development will be necessary. Regular updates will increase accuracy and efficiency, benefiting personalised support, student retention, and success rates, resulting in an effective, equitable educational environment.

No-Regret Move 2: Implement an AI-enhanced wisdom development programme

In light of scenarios 1 and 2, it is imperative to adopt an educational approach that prioritises the individual's needs, potential and well-being at the core of the learning process. This approach must be complemented by the use of technologies and tools that adhere to ethical principles, are straightforward to navigate and permit offline use. The integration of AI in education is a strategic approach to enhance students' wisdom development. This programme promotes critical thinking, ethical reasoning, emotional intelligence, and holistic understanding, preparing students for real-world challenges and promoting intellectual growth and personal and societal well-being.

Key Evidence for No-Regret Move 2
Action Statement: Develop and integrate an AI system to facilitate and enhance wisdom-based education, with a focus on critical thinking, ethical reasoning and holistic development.

The AI Ethics in Education Guidelines aim to educate educators on the use of AI in teaching. Once the EU AI law becomes legally binding, institutions can rely on high-risk AI systems' certification. Education authorities should verify compliance, focus on ethical concerns, and comply with data protection regulations while ensuring compliance with teaching, learning, and assessment.

To develop an AI that provides and enhances soft skills (wisdom), an LMS application must be designed with the following features:

1. ***AI-driven personalised learning paths.*** The app uses adaptive learning to customise educational content based on student needs, strengths, and growth areas, dynamically adjusting curriculum based on real-time data and evolving standards.

2. ***Critical thinking and problem solving***. The app uses AI to present real-world problems requiring critical thinking and decision-making, with interactive scenarios and simulations. Socratic Method AI tutors encourage deep thinking and reasoned arguments.

3. ***Ethical reasoning and moral development.*** AI ethics modules are essential for students' ethical reasoning and moral development. They provide interactive, personalised learning experiences, helping students navigate complex ethical dilemmas and understand different perspectives. Integrating AI ethics modules into the curriculum equips students with skills to make ethical decisions in personal and professional life, with personalised feedback enhancing understanding.

4. ***Emotional intelligence and social skills.*** AI is being used to analyse students' emotional responses, providing feedback and strategies for emotional regulation and empathy, and to practice and refine social skills through AI-driven role-playing scenarios.

5. ***Interdisciplinary and holistic learning.*** AI systems are being implemented in education to design and manage interdisciplinary projects, encouraging students to apply knowledge from multiple disciplines to solve complex problems. These systems can provide holistic assessments for academic performance, social, emotional, and ethical development, offering a comprehensive view of student growth. Traditional curriculums focus on knowledge acquisition, with AI-enhanced modules and scenarios designed to be interactive and adaptable to individual student needs (Figure 1).

The post-action state involves an AI-enabled curriculum that promotes critical thinking, ethical reasoning, and holistic student development through personalised learning experiences. This approach prepares students for complex real-world challenges and fosters wisdom, ethics, and emotional intelligence, providing a balanced approach to education that benefits students in all aspects of life.

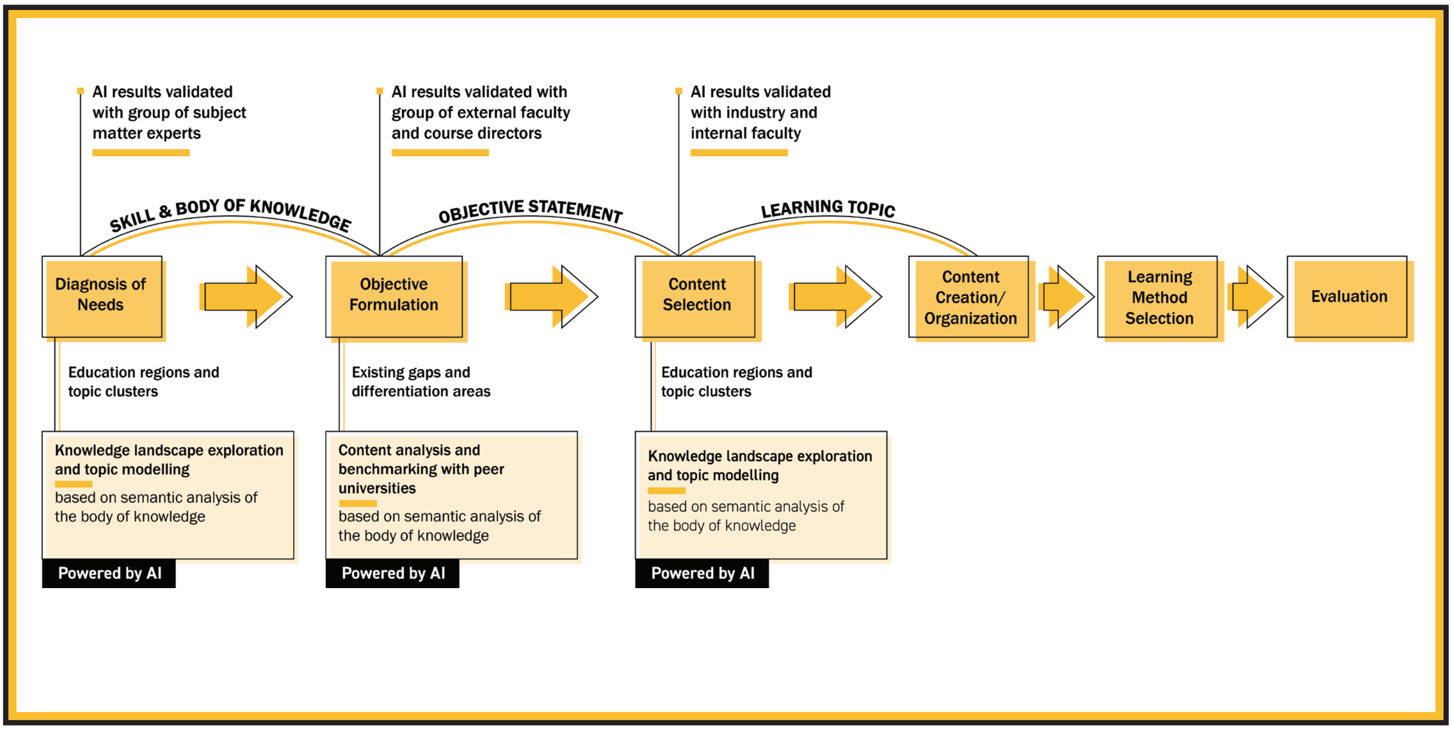


Figure 2. AI-driven framework for curriculum development (Padovano & Cardamone, 2024)

No-Regret Move 3: Implement AI-driven adaptive assessment system

Based on scenarios 1 and 4, The AI-driven adaptive assessment system enhances learning outcomes by adjusting assessments based on individual student performance in real-time, identifying learning gaps, and supporting personalised instruction. It visualises students' levels from course objectives, promoting desired skills and knowledge achievement.

Key Evidence for No-Regret Move 3

Action Statement: Develop and deploy an AI-powered adaptive assessment system to provide personalised, real-time assessment and feedback to students (Figure 2).

The COVID-19 pandemic has led to a shift to online learning platforms like Zoom, Google Classroom, and Microsoft Teams, allowing students to manage their study time more independently. Schools have been exploring alternative assessment methods like assignments and projects (Modirkhorasani & Hoseinpour, 2024), as exams have been postponed or cancelled. A study on anatomy learning found that 91.8% of students found recorded sessions beneficial, but 8.2% felt they could not replace face-to-face demonstrations. Although there was no significant difference in written examinations between face-to-face and online methods, there was a significant difference in written examinations in online units compared to face-to-face units (Potu et al., 2022). AI-powered assessments can adjust learning materials based on individual student needs and performance, providing targeted instruction and instant feedback. This allows for timely interventions and adjustments, enhancing learning outcomes. The integrated AI-assisted assessment matrix outlines the conceptual framework for the learning process, providing real-time, personalised feedback, ensuring accurate measurement of individual student progress and competencies. This increased accuracy and immediacy enable timely intervention and personalised learning pathways, leading to improved educational outcomes through tailored feedback and support.

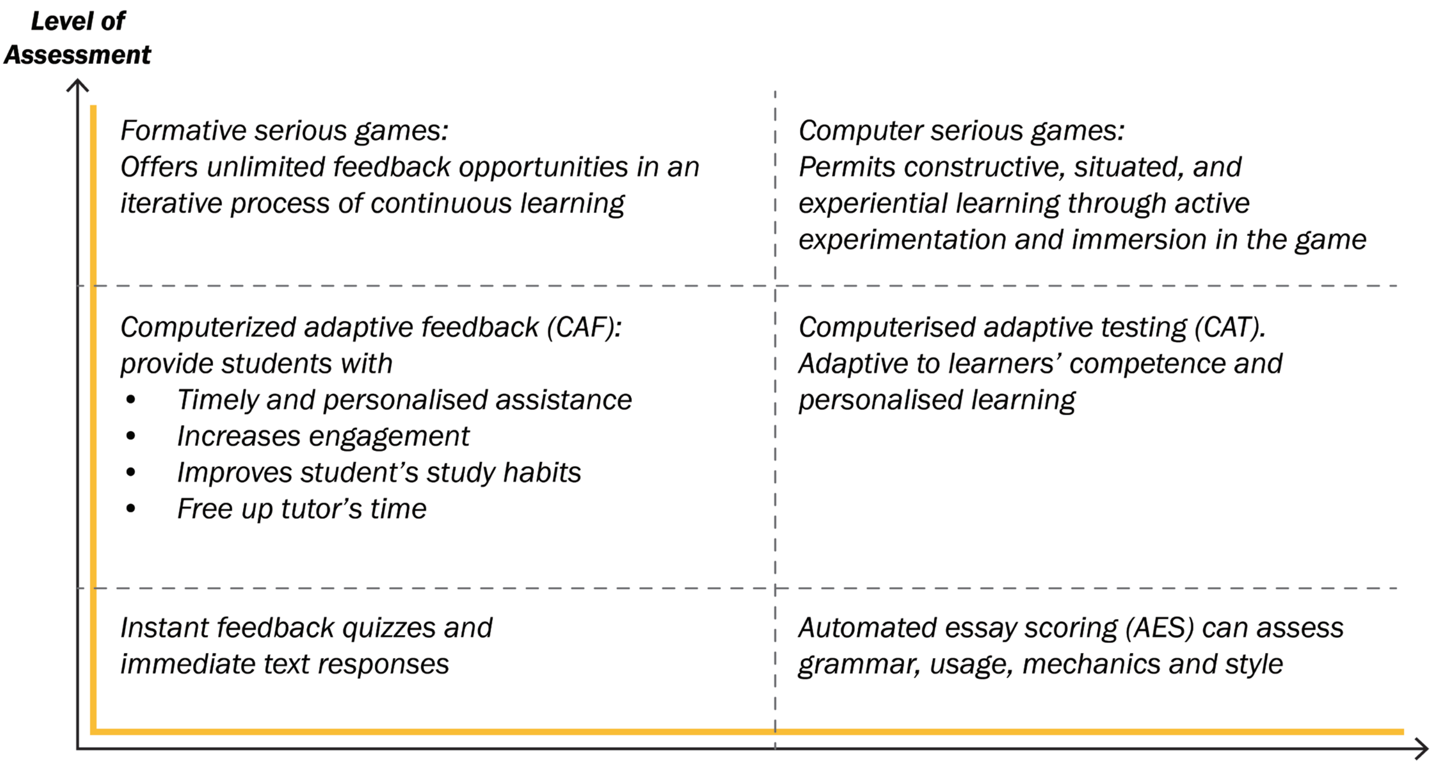


Figure 3. Integrated AI-assisted assessment matrix for the learning process (Kolade et al., 2023)

The Flow-based pedagogical model, based on positive psychology (Seligman & Csikszentmihalyi, 2001), can enhance teaching and learning in education. This model emphasises students' emotional responses to learning situations and aligns with the "PERMA" model, which focuses on pleasure, engagement, relationships, meaning, and achievements. The flow experience requires self-direction, purposeful activity, focus, and feedback. AI-based tools can create a flow-based pedagogical model (Figure 3) that incorporates creativity, flexible thinking, and humour in education. However, challenges like privacy, equity, and teacher training must be addressed to fully realise the potential of AI in education. Collaboration between educators, technologists, and policymakers is crucial for shaping the future of AI-driven education (Seligman, 2011).

Conclusion

The integration of AI in LMS has the potential to revolutionise teaching and learning. By personalising learning experiences, providing instant feedback and automating administrative tasks, AI has the potential to enhance the effectiveness, efficiency and engagement of the educational process. Nevertheless, it is essential to take into account the existing challenges, such as data privacy and potential bias, in order to guarantee that the advantages of AI can be fully realised in a fair and responsible manner.

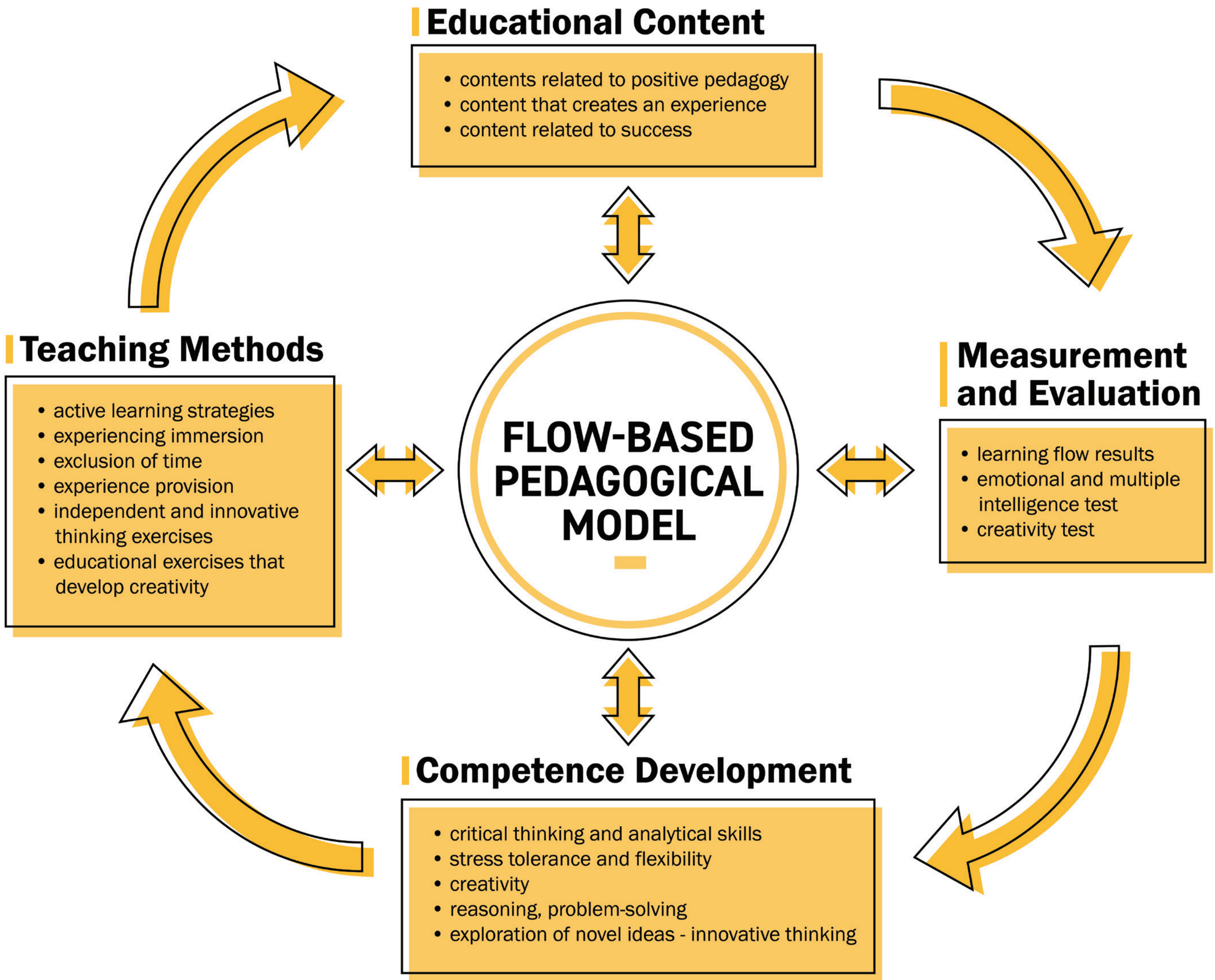


Figure 4. Flow-based pedagogical model (Dominek, 2022)

References

Nykonenko, A. (2023). *The Impact of AI on Startups*. https://doi.org/ https://orcid.org/0000-0002-9442-1601

Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review*, *20*, 1–11. https://doi.org/10.1016/j.edurev.2016.11.002

Aloisi, C. (2023). The future of standardised assessment: Validity and trust in algorithms for assessment and scoring. *European Journal of Education*, *58*(1), 98–110. https://doi.org/https://doi.org/10.1111/ejed.12542

Aponso, S., Tan, Y. T. N., Jain, S., & Oh, C. C. (2024). Gamification of dermatoscopy education using a smartphone mobile platform: A pilot study. *JAAD International*, *16*, 91–96. https://doi.org/10.1016/j.jdin.2024.03.008

Arici, F., Yildirim, P., Caliklar, Ş., & Yilmaz, R. M. (2019). Research trends in the use of augmented reality in science education: Content and bibliometric mapping analysis. *Computers & Education*, *142*, 103647. https://doi.org/https://doi.org/10.1016/j.compedu.2019.103647

Bacca, J., Baldiris, S., Fabregat, R., & Kinshuk. (2018). Insights Into the Factors Influencing Student Motivation in Augmented Reality Learning Experiences in Vocational Education and Training. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.01486

Baker, R. S. (2021). Artificial Intelligence in Education: Bringing It All Together. In S. Vincent-Lancrin (Ed.), *OECD Digital Education Outlook 2021* (pp. 43-57). OECD. https://doi.org/10.1787/589b283f-en

Bourne, J. (2005). Subject Learning in the Primary Curriculum. In J. Bourne, M. Briggs, P. Murphy & M. Selinger (Eds.), *Subject Learning in the Primary Curriculum: Issues in English, Science and Mathematics*. Routledge. https://doi.org/10.4324/9780203990247

Chouteau, S., Lemaire, B., Thevenot, C., Dewi, J., & Mazens, K. (2024). Learning basic arithmetic: A comparison between rote and procedural learning based on an artificial sequence. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *50*(3), 418–434. https://doi.org/10.1037/xlm0001241

Comas-Forgas, R., Lancaster, T., Calvo-sastre, A., & Sureda-negre, J. (2021). Exam cheating and academic integrity breaches during the COVID-19 pandemic : An analysis of internet search activity in Spain. *Heliyon 7*(10). https://doi.org/10.1016/j.heliyon.2021.e08233

Crisp, G., Guàrdia, L., & Hillier, M. (2016). Using e-Assessment to enhance student learning and evidence learning outcomes. *International Journal of Educational Technology in Higher Education*, *13*(1), 16–18. https://doi.org/10.1186/s41239-016-0020-3

Dede, C. (2008). Theoretical Perspectives Influencing the Use of Information Technology in Teaching and Learning. In J. Voogt & G. Knezek (Eds.), *International Handbook of Information Technology in Primary and Secondary Education* (pp. 43–62). Springer US. https://doi.org/10.1007/978-0-387-73315-9_3

Dede, C. (2009). Immersive Interfaces for Engagement and Learning. *Science*, *323*(5910), 66–69. https://doi.org/10.1126/science.1167311

Dominek, D. L. (2021a). A flow mint a pozitív pszichológia jelenléte az oktatásban. *Eruditio-Educatio*, *16.*(4), 72–82. https://doi.org/10.36007/eruedu.2021.4.72-82

Dominek, D. L. (2021b). Creativity in higher education through the flow channel. *Belvedere Meridionale*, *33*(4), 5–12. https://doi.org/10.14232/belv.2021.4.1

Dominek, D. L. (2022). On a Flow-based pedagogical model. The emergence of experience and creativity in education. *Eruditio-Educatio*, *17.*(3), 072–081. https://doi.org/10.36007/eruedu.2022.3.072-081

Farzana, T. (2023). standard measurement in online learning: a rubric as a focus on teaching-learning practices to move up quality education. *EIKI Journal of Effective Teaching Methods*, *1*(3). https://doi.org/10.59652/jetm.v1i3.37

French, S., Dickerson, A., & Mulder, R. A. (2023). A review of the benefits and drawbacks of high-stakes final examinations in higher education. *Higher Education*. https://doi.org/10.1007/s10734-023-01148-z

Garzón, J. (2021). An Overview of Twenty-Five Years of Augmented Reality in Education. *Multimodal Technologies and Interaction*, *5*(7), 37. https://doi.org/10.3390/mti5070037
GilPress, (2024). *How Many People Own Smartphones? (2024-2029)*. Whatsisthebigdata. https://whatsthebigdata.com/smartphone-stats/#google_vignette

Gondo, R., & Mbaiwa, J. E. (2022). Agriculture. In M. Khayesi & F.M. Wegulo (Eds.), *The Palgrave Handbook of Urban Development Planning in Africa* (pp. 75–103). https://doi.org/10.1007/978-3-031-06089-2_4

Gui, M., Gerosa, T., Argentin, G., & Losi, L. (2023). Mobile media education as a tool to reduce problematic smartphone use: Results of a randomised impact evaluation. *Computers & Education*, *194*, 104705. https://doi.org/10.1016/j.compedu.2022.104705

Ha, C., Ahmed, U., Khasminsky, M., Salib, M., & Andey, T. (2023). Correlative and Comparative Study Assesing Use of a Mock Examination in a Pharmaceutical Calculations Course. *American Journal of Pharmaceutical Education*, *87*(1), 8654.

Hadi Mogavi, R., Deng, C., Kim, J. J., Zhou, P., Kwon, Y. D., Hosny Saleh Metwally, A., Tlili, A., Bassanelli, S., Bucchiarone, A., Gujar, S., Nacke, L. E., & Hui, P. (2024). ChatGPT in education: A blessing or a curse? A qualitative study exploring early adopters' utilization and perceptions. *Computers in Human Behavior: Artificial Humans*, *2*(1), 100027. https://doi.org/10.1016/j.chbah.2023.100027 *Harsening AI.pdf*. (n.d.).

Hashem, R., Ali, N., El Zein, F., Fidalgo, P., & Abu Khurma, O. (2023). AI to the rescue: Exploring the potential of ChatGPT as a teacher ally for workload relief and burnout prevention. *Research and Practice in Technology Enhanced Learning*, *19*, 023. https://doi.org/10.58459/rptel.2024.19023

He, Q., Chen, H., & Mo, X. (2024). Practical application of interactive AI technology based on visual analysis in professional system of physical education in universities. *Heliyon*, *10*(3), e24627. https://doi.org/10.1016/j.heliyon.2024.e24627

Holland, I., & Davies, J. A. (2020). Automation in the Life Science Research Laboratory. *Frontiers in Bioengineering and Biotechnology*, *8*(November), 1–18. https://doi.org/10.3389/fbioe.2020.571777

Ibáñez, M. B., Uriarte Portillo, A., Zatarain Cabada, R., & Barrón, M. L. (2020). Impact of augmented reality technology on academic achievement and motivation of students from public and private Mexican schools. A case study in a middle-school geometry course. *Computers & Education*, *145*, 103734. https://doi.org/10.1016/j.compedu.2019.103734

Jain, R. (2023). The Impact of Artificial Intelligence on Business: Opportunities and Challenges. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4407114

Jarczewska-Gerc, E., & Gorgolewska, A. (2015). Imagine the emotion: the use of mental simulations in supporting the development of emotional skills of preschool children. *Early Child Development and Care*, *185*(8), 1268–1282. https://doi.org/10.1080/03004430.2014.990898

Kokoç, M., & Göktaş, Y. (2024). How smartphone addiction disrupts the positive relationship between self-regulation, self-efficacy and student engagement in distance education. *Revista de Psicodidáctica (English Ed.)*, 500151. https://doi.org/10.1016/j.psicoe.2024.500151

Kolade, O., Owoseni, A., & Egbetokun, A. (2024). Is AI changing learning and assessment as we know it? Evidence from a ChatGPT experiment and a conceptual framework. *Heliyon*, *10*(4), e25953. https://doi.org/10.1016/j.heliyon.2024.e25953

Liu, T. (2023). AI proctoring for offline examinations with 2-Longitudinal-Stream Convolutional Neural Networks. *Computers and Education: Artificial Intelligence*, *4*, 100115. https://doi.org/10.1016/j.caeai.2022.100115

Matayoshi, J., Cosyn, E., & Uzun, H. (2021). Are We There Yet? Evaluating the Effectiveness of a Recurrent Neural Network-Based Stopping Algorithm for an Adaptive Assessment. *International Journal of Artificial Intelligence in Education*, *31*(2), 304–336. https://doi.org/10.1007/s40593-021-00240-8

Minn, S. (2022). Computers and Education : Artificial Intelligence AI-assisted knowledge assessment techniques for adaptive learning environments. *Computers and Education: Artificial Intelligence, 3*. https://doi.org/10.1016/j.caeai.2022.100050

Modirkhorasani, A., & Hoseinpour, P. (2024). Decentralized exam timetabling: A solution for conducting exams during pandemics. *Socio-Economic Planning Sciences*, *92*, 101802. https://doi.org/10.1016/j.seps.2024.101802

Murtaza, M., Ahmed, Y., Shamsi, J. A., Sherwani, F., & Usman, M. (2022). AI-Based Personalized E-Learning Systems: Issues, Challenges, and Solutions. *IEEE Access*, *10*, 81323–81342. https://doi.org/10.1109/ACCESS.2022.3193938

Obeso, M., Pérez-Pérez, M., García-Piqueres, G., & Serrano-Bedia, A.-M. (2023). Enhancing students' learning outcomes through smartphones: A case study of using instagram in higher management education. *The International Journal of Management Education*, *21*(3), 100885. https://doi.org/10.1016/j.ijme.2023.100885

Okoye, K., Nganji, J. T., Escamilla, J., & Hosseini, S. (2024). Machine learning model (RG-DMML) and ensemble algorithm for prediction of students' retention and graduation in education. *Computers and Education: Artificial Intelligence*, *6*, 100205. https://doi.org/10.1016/j.caeai.2024.100205

Padovano, A., & Cardamone, M. (2024). *Computers and Education : Artificial Intelligence Towards human-AI collaboration in the competency-based curriculum development process : The case of industrial engineering and management education*. *7*(June).

Pietrzyk, M., Madej, L., Rauch, L., & Szeliga, D. (2015). Increase Model Predictive Capabilities by Multiscale Modeling. In *Computational Materials Engineering* (pp. 209–253). Elsevier. https://doi.org/10.1016/B978-0-12-416707-0.00005-3

Potu, B. K., Atwa, H., Nasr El-Din, W. A., Othman, M. A., Sarwani, N. A., Fatima, A., Deifalla, A., & Fadel, R. A. (2022). Learning anatomy before and during COVID-19 pandemic: Students' perceptions and exam performance. *Morphologie*, *106*(354), 188–194. https://doi.org/10.1016/j.morpho.2021.07.003

Sako, T. (2024). Enhancing Critical Thinking through AI-Assisted Collaborative Task-Based Learning : A Case Study of Prospective Teachers in Japan. *Journal of English Language Teaching and Linguistics, 9*(2), 157–170. http://dx.doi.org/10.21462/jeltl.v9.i2.1319

Seligman, M. E. P. (2011). *Flourish: A visionary new understanding of happiness and well-being*.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, *55*(1), 5–14. https://doi.org/10.1037/0003-066X.55.1.5

Shiri, A. (2024). Artificial intelligence literacy: a proposed faceted taxonomy. *Digital Library Perspectives*. https://doi.org/10.1108/DLP-04-2024-0067

Toyokawa, Y., Horikoshi, I., Majumdar, R., & Ogata, H. (2023). Challenges and opportunities of AI in inclusive education: a case study of data-enhanced active reading in Japan. *Smart Learning Environments*, *10*(1), 67. https://doi.org/10.1186/s40561-023-00286-2

Turan, E., & Çetin, G. (2019). Using artificial intelligence for modeling of the realistic animal behaviors in a virtual island. *Computer Standards & Interfaces*, *66*, 103361. https://doi.org/10.1016/j.csi.2019.103361

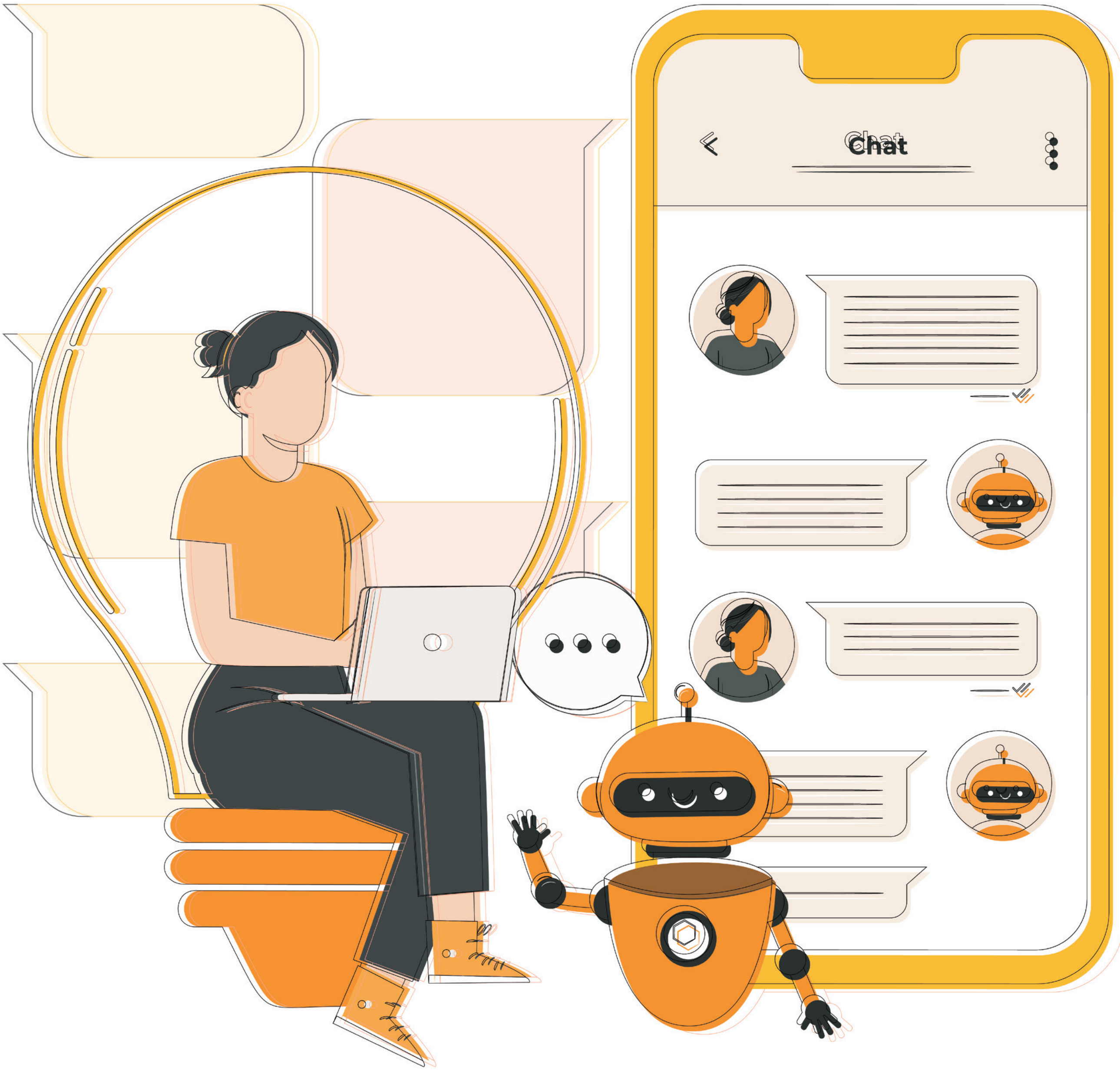
Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of Computer Assisted Learning*, *29*(5), 403–413. https://doi.org/10.1111/jcal.12029

Wang, W., Song, L., Wang, T., Gao, P., & Xiong, J. (2020). A Note on the Relationship of the Shannon Entropy Procedure and the Jensen–Shannon Divergence in Cognitive Diagnostic Computerized Adaptive Testing. *SAGE Open*, *10*(1), 215824401989904. https://doi.org/10.1177/2158244019899046

Wang, X., Huang, R. "Tammy," Sommer, M., Pei, B., Shidfar, P., Rehman, M. S., Ritzhaupt, A. D., & Martin, F. (2024). The Efficacy of Artificial Intelligence-Enabled Adaptive Learning Systems From 2010 to 2022 on Learner Outcomes: A Meta-Analysis. *Journal of Educational Computing Research*, 07356331241240459. https://doi.org/10.1177/07356331241240459

Yannier, N., Hudson, S. E., Chang, H., & Koedinger, K. R. (2024). AI Adaptivity in a Mixed-Reality System Improves Learning. *International Journal of Artificial Intelligence in Education*, *0123456789*. https://doi.org/10.1007/s40593-023-00388-5

Zhang, J., & Zhang, Z. (2024). <scp>AI</scp> in teacher education: Unlocking new dimensions in teaching support, inclusive learning, and digital literacy. *Journal of Computer Assisted Learning*, *40*(4), 1871–1885. https://doi.org/10.1111/jcal.12988



The Role of Personalised AI in Education: Challenges & Opportunities

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Introduction

What will be the future of education? Will computers/robots replace human teachers? How will universities adjust to the changing realities? While these questions have been debated and discussed for a long time, the unprecedented growth of technology and rapid improvement in artificial intelligence (AI) algorithms have enhanced the urgency to address them. Indeed, the field of education has a long tradition of incorporating technology and personalised AI has the potential to revolutionise it; however, the recent advances in AI offer a different challenge as they threaten to shake the foundation of the learning environment by automating curriculum design, content delivery, and performance evaluation. Facing unparalleled situations, institutes of education must be prepared to maintain their relevance by employing technology to ensure maximum benefit to all the stakeholders, i.e., students, teachers, and society. Situated within the broader context of AI in education, this study focuses on the use of personalised AI in education and its impact on the entire education system. The case for using personalised AI in education is based on the appeal of the student-centred learning approach. Although the benefits of the student-centred learning approach are well recognised (Wright, 2011; Kaput, 2018), numerous education institutes still follow the teacher-centred approach due to the operational challenges associated with the student-centred approach (Hirumi, 2002). Personalised AI in education, with its potential to navigate operation challenges and offer authentic student-centred learning, presents unparalleled opportunities for enhancing learning outcomes, accessibility, tailored learning experiences and educational equity. However, the increased role of AI in education is not completely risk-free. The questions regarding the role of human agency and human values, data privacy, and the purpose of education and learning in an AI-driven age are being asked and fiercely debated (van der Vorst & Jelicic, 2019; Laak & Aru, 2024]. This paper explores the multifaceted role of universities in harnessing AI to advance educational equity via personalised knowledge and learning while addressing the inherent challenges that such an integration presents.

Mindful of both opportunities and risks, this study seeks to conceptualise and analyse the landscape of higher education in 2060. The analysis is based on the following two dimensions: the orientation of future technology growth (technology-centred vs. human-centred) and the access to technology (high equity vs. low equity)).

Currently, the integration of AI in education varies significantly across geographical and economic divides. While some institutions have successfully leveraged AI to provide personalised learning pathways and real-time feedback (Luckin & Holmes, 2016; Roll & Wylie, 2016; Zawacki-Richter et al., 2019; Chen et al., 2020), others grapple with basic digital infrastructure, limiting their ability to benefit from these advancements. This disparity in AI adoption exacerbates existing inequalities in educational access and quality. Indeed, a more equitable AI would be preferred, and there is a growing push towards it. The future is uncertain, and this paper takes into account both possibilities: 1. Every education institute across the geographies and demographics has equal access to AI tools; 2. AI tools are concentrated in the hands of a select few. Further, since the debate on human-centred vs. technology-centred development of AI is ongoing, this study considers a future where AI development is: 1. Technology Focused; 2. Human focused. The four possible scenarios under these two dimensions are illustrated in figure 1. By analysing the four scenarios, “Technology for All” and “AI for Good”, “Transcendence” and “Avengers”, the paper investigates different approaches to AI integration and their implications. It concludes by suggesting the moves that educational institutes should consider in order to stay relevant and provide high quality education (Deschênes, 2020).

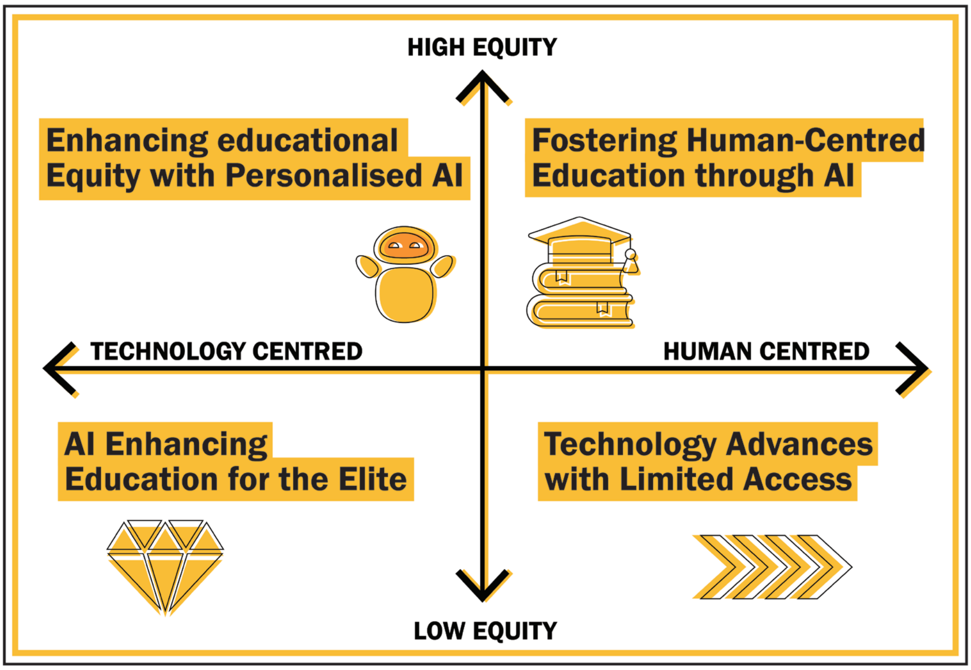

Figure 1: The drivers of change and four scenarios

Status Quo

Current state in education
AI has been making significant inroads into the educational sector, with varying degrees of adoption and implementation across different regions and institutions. Currently, AI applications in education range from intelligent tutoring systems and adaptive learning platforms to automated grading tools and chatbots for student support (Luckin & Holmes, 2016; Zawacki-Richter et al., 2019).

Personalised learning and AI
Personalised learning, a pedagogical approach that tailors education to individual student needs, has gained significant traction in recent years. AI has emerged as a powerful tool to facilitate this approach, offering the potential to analyse vast amounts of data to create individualised learning pathways feedback (Roll & Wylie, 2016; Chen et al., 2020), .

Current implementations of AI for personalisation in education include adaptive learning systems that adjust content difficulty based on student performance, recommendation systems that suggest relevant learning resources, and intelligent tutoring systems that provide one-on-one guidance (Al-Zahrani & Alasmari, 2024). These technologies aim to enhance student engagement, improve learning outcomes, and provide more equitable access to quality education.

Emerging trends
There is a growing interest in AI-powered educational tools across the globe. Educational institutions, policymakers, and EdTech companies are increasingly recognising the potential of AI to transform learning experiences and improve educational outcomes (Zawacki-Richter et al., 2019; Chen et al., 2020).
Simultaneously, there is an increasing focus on ethical considerations and data privacy in the implementation of AI in education. Concerns about algorithmic bias, data security, and the potential misuse of student information have led to calls for more robust governance frameworks and ethical guidelines for AI in education (Holmes et al., 2022; Jobin et al., 2019).

Stakeholder perspectives
Students are increasingly exposed to AI-powered learning tools, with many benefiting from more personalised and adaptive learning experiences. However, there are concerns about potential over-reliance on technology and the impact on social skills development (Holmes et al., 2019; Dymnicki et al., 2013).

Teachers are adapting to new roles as facilitators and mentors, with AI taking over some routine tasks like grading and basic content delivery. While this shift allows for more meaningful interactions with students, it also requires new skills and ongoing professional development (Gašević et al., 2023; Bransford et al., 1999).

Educational institutions are grappling with the challenges and opportunities presented by AI. Many are investing in AI infrastructure and exploring ways to integrate these technologies into their curricula and administrative processes. However, they also face challenges related to cost, implementation, and ensuring equitable access for all students (Carvalho et al., 2022; Kuleto et al., 2021).

Methodology

This study employed a collaborative and iterative approach to explore the role of personalised AI in education, with a focus on challenges and opportunities in the year 2060. The research process was structured around the ASEFInnoLab5 project, which ran from May 2 to June 27, 2024.

The research process was divided into several phases:

1. **Conceptual Development:** We engaged in discussions on critical aspects of AI in education, including:
    - AI Governance
    - Advancing AI in Education
    - AI for Sustainable Development
    - AI Innovation Ecosystem in 2060

2. **Scenario Planning:** Based on our discussions, we developed four distinct scenarios for the future of personalised AI in education. These scenarios were constructed along two axes: the orientation of future technology growth (technology-centred vs human-centred) and access to technology (high equity vs low equity)

3. **Strategic Analysis:** We identified and analysed potential moves for managing uncertainties in the implementation of AI in education.

4. **Critical Review:** We conducted a thorough examination of potential weaknesses in our scenarios and strategic recommendations.

5. **Peer Review:** Our initial findings were presented in a two-minute presentation to other project participants, allowing for peer feedback and further refinement of our ideas.

6. **Paper Development:** Following the presentation, we began the process of writing this paper, synthesising our discussions, scenario planning, and strategic analysis into a cohesive narrative.

The Four Scenarios

Scenario 1: Enhancing educational equity with personalised AI (high equity, tech-centred)

The "Technology for All" scenario promises to create a true student–centred learning environment through personalised AI systems, tailored learning pathways and equal access to resources (Samuel, 2023). However, being technology-centred, this scenario envisages a world where the technology will not only deliver education but also decide the pedagogy and learning outcomes. This dominance of technology may relegate crucial human values, such as the emotional well-being of students and larger societal welfare, to the background (Samuel 2023; Bengio, 2023). As AI systems operate in increasingly isolated frameworks, the valuable human skills of cooperation, teamwork, and peer learning could be undermined.

As AI systems become capable of generating and processing vast amounts of information, the emphasis may shift from rote memorisation to critical thinking, problem-solving, and the ability to navigate and synthesise information in an AI-saturated environment (Critch & Russell, 2023).

Impact on Stakeholders

- *Students.* AI-powered adaptive learning platforms act as personalised companions that constantly evolve with each student's learning curve (Al-Zahrani & Alasmari, 2024). This not only enhances understanding and retention but also empowers learners by providing them with control over their educational journey, offering transparent insights into their progress and intellectual growth (Holmes et al., 2019). Nevertheless, the enhanced learning will come at the cost of probable social exclusion, apathy to human values, and lack of social skills to work in team environment.
- *Teachers.* While AI takes on tasks like content delivery and assessment, teachers may shift their focus towards mentorship, facilitating complex discussions, and nurturing critical thinking and creativity in students (Holmes et al., 2019; Gašević et al., 2023; Bransford et al., 1999). This transition allows educators to leverage their expertise in areas where AI falls short, ultimately enriching the educational experience [13]. At the same time, the prevalence of AI may lead to lesser employment opportunities to humans in the education sector.
- *Universities.* With universal access to super intelligent AI systems and minimal differentiation in the AI tools used, traditional universities could face intense competition from independent online learning platforms. This competition could further diminish the role of universities as critical environments for fostering human values and social interactions. If left unchecked, the pervasive use of personalised AI in education poses an extreme or catastrophic risk not only to the educational landscape but also to society as a whole, as it could lead to a devaluation of human educators and the essential interpersonal skills they foster. To compete with alternative models of education delivery and reap the long-term advantages, educational institutions will have to integrate AI technologies in their ecosystem and encourage faculty members to engage in critical thinking and research activities.

Scenario 2: Fostering human-centric education through AI (high equity, human-centred)

In the "AI for Good" scenario, the development of personalised AI is guided by a strong ethical framework that prioritises human well-being, inclusivity, and social responsibility (Floridi et al., 2018). AI systems are not merely tools for knowledge acquisition but are designed to uphold and reinforce ethical and legal standards, ensuring transparency, fairness, and accountability in their development and deployment (Hagendorff, 2020). This approach emphasises the importance of data privacy, algorithmic bias mitigation, and the protection of intellectual property rights to ensure equitable access and use of educational content (Jobin et al., 2019; Bearman et al., 2023; Fjeld et al., 2020).

Moreover, the "AI for Good" scenario recognises the importance of human-AI collaboration in education. AI systems are envisioned as partners, not replacements, for human educators, working together to create a more engaging, effective, and inclusive learning environment (Prahani et al., 2022; Floridi et al., 2021). By embracing ethical principles and fostering human-AI collaboration, the "AI for Good" scenario offers a promising vision for the future of education, where technology serves as a powerful tool for empowering learners and promoting equitable access to knowledge.

This collaboration leverages the strengths of both humans and AI, with AI providing personalised learning, while human educators focusing on fostering critical thinking, creativity, and emotional intelligence (Holmes et al., 2019).

Impact on Stakeholders

- *Students.* In this scenario, students not only enjoy the benefits of student – centred learning offered by AI-powered tools but also learn to appreciate human values and social concerns (Kopp & Thomsen, 2023; Dymnicki et al., 2013).

- *Teachers.* AI systems alleviate the burden of routine tasks such as grading, content delivery, and administrative duties, allowing educators to dedicate more time and energy to engaging directly with students (Chen et al., 2020). This shift enables teachers to focus on fostering critical thinking, creativity, and emotional intelligence, ultimately leading to a more profound and meaningful educational experience (Holmes et al., 2019). Additionally, teachers play a vital role in providing feedback to AI developers, ensuring that the tools are effective, ethically aligned, and responsive to the evolving needs of learners (Du Boulay, 2016).

- *Universities.* With the availability of high-quality technology to everyone, universities will be tasked with investing in cutting edge research and promoting high quality researchers. Further, the successful implementation of AI requires careful planning, investment in infrastructure, and the development of comprehensive policies to address issues such as data privacy, algorithmic bias, and the responsible use of AI in educational settings (Carvalho et al., 2022). While the initial investment and staff training may be substantial, the long-term benefits include increased student engagement, improved learning outcomes, and a more inclusive and accessible educational environment (Zawacki-Richter et al., 2019).

Scenario 3: AI enhancing education for the elite (low equity, human-centred)

In this rather dystopian scenario termed “Avengers,” AI development is driven by human-centric goals, but it is distinctly marked by its service to an elite group with abundant resources, leading to a consolidation of high-quality education among those with the resources to access advanced AI technologies. This selective distribution of AI benefits creates a technological aristocracy, where significant disparities in access and educational quality not only persist but are exacerbated (Bengio, 2023; Mittelstadt, 2019; UNESCO, 2021; Kuleto et al., 2021).

The role of personalised AI in this particular case study becomes that of a social divider, where the perceived upper social classes reap and leverage all the benefits from the advancements in AI technology while other societal groups are shunned from progress and unable to afford or follow the tidal waves of innovation and technological prowess (Crawford, 2021).

Impact on Stakeholders

- *Students.* The disparity in AI benefits creates a pronounced divide. Students from affluent backgrounds receive highly personalised and efficient AI-driven education, enhancing their learning experiences and outcomes. In contrast, those from less privileged backgrounds struggle with basic digital access and educational resources, widening the educational and societal gap.

- *Teachers.* In elite educational settings, teachers might transition to roles that are more about curating AI-driven content and less about direct instruction, while teachers in underserved areas continue to grapple with limited tech support and access, impacting their ability to deliver quality education.

- *Universities.* High-profile institutions that can invest in cutting-edge AI systems will further cement their status as prestigious education centres, attracting wealthier students and more funding. Institutions serving lower-income students may fall further behind unless significant investments are made to bridge this technological divide.

Scenario 4: Technology advances with limited access (low equity, tech-centred)

In the "Transcendence" scenario, AI development is hyper-focused on technological advancements, with benefits disproportionately available to those with the means to access and leverage these technologies. This creates a landscape where knowledge becomes a commodified asset controlled by corporate interests, heightening existing social and economic divides. In a world characterised by this scenario, technology becomes a profitable asset, with no regard to human values, emotions, necessities or ethical considerations.

Impact on Stakeholders

- *Students.* Although students from affluent backgrounds or those attending high-profile institutions have access to advanced personalised AI systems that act as comprehensive educational tools, greatly enhancing their learning potential, they are not cognizant of human values and ethical considerations. In contrast, most students face significant barriers to access these technologies, resulting in unequal educational opportunities and outcomes.

- *Teachers.* Teachers are increasingly required to integrate expensive AI tools into their teaching and face extreme pressure to keep their jobs. On the other hand, while teachers in less affluent areas might struggle with basic digital infrastructure, they relish the job security.

- *Universities.* Elite universities that can afford to invest in state-of-the-art AI technologies benefit from enhanced reputations and attract more students and funding. However, they will have to ensure they are able to differentiate from alternate education providers (e.g., online platforms). In a scenario where the growth of technology is concentrated in the hands of corporations, those corporations may launch alternate educational platforms and completely alter the learning space.

Having discussed multiple scenarios, the next section proposes a few no-regret moves that can equip education institutes to face any possible scenario.

No-Regret Moves

The uncertainties involved in predicting which of the scenarios will unfold make it imperative for educational institutes to start investing in strategic choices that have the potential to pay off in any scenario. We outline four such no-regret moves below:

No-Regret Move 1: Robust data privacy laws and ethical standards

The increasing use of AI in education, exemplified by tools like Knewton's adaptive learning platform[1] and Carnegie Learning's MATHia software[2], has raised significant concerns about data privacy, misuse of personal information, and algorithmic bias (Wang et al., 2021; Kuleto et al., 2021). These concerns are particularly relevant in both the "Technology for All" and "AI for Good" scenarios, where the collection and analysis of vast amounts of student data are essential for personalisation and optimisation of learning experiences. The potential for misuse of this data, either through unintentional biases in algorithms like those found in some facial recognition software, or deliberate exploitation, necessitates robust safeguards (Holmes et al., 2022).

In order to provide the highest quality of the education in collaboration with technology, the education institutes must ensure that AI-powered educational systems are designed to safeguard the privacy and security of personal data utilised (Wachter & Mittelstadt, 2019). It also encompasses the establishment of ethical standards to guide the development and implementation of AI, ensuring responsible use, bias mitigation, and the promotion of equity. This could involve the formation of AI ethics committees, the incorporation of ethics into AI-related curricula, and the development of assessment tools to evaluate the ethical implications of AI applications in education.

In the context of personalised AI, moves towards data privacy and ethics would ensure that the exchanged knowledge between the individual and the AI assistant would not be blindly processed but would rather follow strict ethical guidelines, ensuring human decency and unbiased learning.

No-Regret Move 2: Investment in AI educational infrastructure

This move involves substantial investment in the digital infrastructure necessary to support AI educational tools across all educational institutions. Ensuring that every institute has the necessary hardware, high-speed internet, and access to cloud services means that AI can be used effectively in any educational setting. This foundational step is crucial to truly democratise education through technology, allowing students from all backgrounds to benefit from personalised AI learning tools.

Evidence from various global educational technology initiatives underscores the critical role of digital infrastructure in the effective implementation and equitable reach of AI-powered education. Regions with robust digital infrastructure, such as Scandinavian countries, consistently demonstrate significant improvements in educational outcomes when integrating AI

[1] https://www.wiley.com/en-us/education/alta
[2] https://www.carnegielearning.com/solutions/math/mathia/

tools, highlighting the direct correlation between technological investment and educational success (Namoun & Alshanqiti, 2020; Brasca et al., 2022).

The integration of such AI tools and infrastructure would greatly assist the formulation of "regional" educational assistants, with access to different hubs of knowledge, information and educational material.

No-Regret Move 3: Investment in digital literacy programmes

This strategic initiative aims to increase digital literacy among students and teachers. It is important that teachers are able to effectively use AI to maximise the benefits of personalised learning (Chen et al., 2020). By implementing regular training sessions, universities should aim to ensure that educators are able to integrate AI tools into their teaching methodologies.

Numerous studies have demonstrated a strong correlation between higher levels of digital literacy and the ability to effectively use and benefit from digital tools and services (Hwang et al., 2020; Outeda, 2024; Martin, 2008). In educational contexts, digitally literate teachers and students are more adept at integrating technology in ways that enhance learning outcomes and foster critical thinking skills [6]. This is particularly relevant in the context of AI in education, where digital literacy is a prerequisite for both utilising AI tools and understanding their implications (Pedro et al., 2019).

It is more than evident that, striving for digital literacy would enhance the skills, competencies and capabilities of individuals in terms of learning, "learning to learn" and critical thinking, hence improving the flow of knowledge between human and AI. Such initiatives are highly important to cultivate an education-centric culture that encourages a harmonious collaboration between humans and AI tools, mitigating potential dangers.

No-Regret Move 4: Explainable AI

The EU ethics guidelines on trustworthy AI[3] consider explainability an essential characteristic of trustworthy AI. Explainable AI aims to make the decision-making processes of AI systems transparent and understandable to humans. This is crucial for:

- Trust and Adoption: Users are more likely to trust and adopt AI systems that they can understand and verify (G.E.M.R Team, 2023).
- Error Correction: Understanding how decisions are made helps in identifying and correcting errors in AI systems.
- Regulatory Compliance: Increasingly, regulations require AI systems to explain their decisions, especially in critical areas like healthcare and finance.
- Addressing the "Clever Hans" problem (Anders et al., 2022): To ensure that the decisions of AI are robust and not based on spurious correlation or noisy data.

The proposed actions for Explainable AI are highly important when dealing with personalised AI, given that the predictions of the models and assistants are tailored to each individual. Hence, since each individual is characterised by a spectrum of beliefs, opinions and perceptions of knowledge, the decisions of personalised AI should be thoroughly explained, to mitigate problems with bias, false predictions and mishandling of information.

The Challenges

While the integration of personalised AI in education presents transformative opportunities, it is essential to acknowledge and mitigate the associated risks. This section outlines critical challenges that could arise from the deployment of AI in educational settings. These risks include issues of collective wisdom, individual and communal usage of AI, knowledge authenticity, technology-driven inequalities, and the need for robust governance.

Loss of Collective Wisdom. As AI becomes more ingrained in the educational process, there's a risk that collective human knowledge and traditional methods of communal learning may be undervalued or lost. This could result in a lack of diverse intellectual perspectives that are crucial for a well-rounded educational experience. Such a scenario could lead to a diminishing appreciation for the deep, often unquantifiable insights that come from human experience and cultural knowledge, which AI might not fully replicate or appreciate.

Individualism vs. Community. The capacity of humans to use personalised AI benevolently raises concerns about fostering individualism at the expense of community and collaboration. While personalised AI can tailor learning to individual needs, it might also reduce opportunities for collaborative learning that fosters social skills and empathy, elements crucial for societal cohesion.

Challenges to Knowledge and Higher Concepts. Personalised AI might challenge the very nature of knowledge itself, particularly when dealing with complex, higher-order concepts. The interpretation and understanding of complex ideas could become overly reliant on AI's algorithms, which might not always account for the nuances and interdisciplinary approaches necessary in higher education.

Technology Costs and Creation of Elites. The deployment of sophisticated AI tools can be costly, potentially leading to a stratification where only affluent institutions or individuals can afford these advanced technologies. This risk could exacerbate educational inequalities, creating a new elite class that has exclusive access to the best AI-driven education, while others lag behind.

[3] https://ai.bsa.org/wp-content/uploads/2019/09/AIHLEG_EthicsGuidelinesforTrustworthyAI-ENpdf.pdf

Government and Institutional Roles. The disparity in access to AI tools might compel governments or universities to intervene more aggressively to close gaps in educational achievement. This challenge is particularly daunting for weaker governmental systems that may lack the resources or political will to implement such measures effectively.

Conclusion

This paper has explored the impact of personalised AI on students, teachers and education institutes. The discussion revealed a world where AI can either democratise education or deepen existing divides, depending on its application and governance. Four distinct scenarios—**Technology for All, AI for Good, Avengers, and Transcendence**—were examined, each depicting varied futures shaped by the interplay between technological advancement and human-centric values. lead the way in creating a more inclusive, equitable, and innovative future for all learners. In conclusion, the integration of personalised AI in education presents a transformative opportunity to revolutionise learning and address long-standing educational inequities. By tailoring instruction to individual needs, AI can empower learners of all backgrounds to reach their full potential. However, this potential can only be realised through a thoughtful and ethical approach that prioritises human values, data privacy, and equitable access. The integration of personalised AI in education presents a transformative opportunity to address long-standing educational inequities and revolutionise learning. However, this potential can only be realised through a thoughtful, ethical approach that prioritises human values, data privacy, and equitable access. By embracing the no-regret moves outlined in this paper, educational institutions can navigate the complexities of AI integration and create a more inclusive, equitable, and innovative future for all learners.

References

Al-Zahrani, A.M., & Alasmari, T.M. (2024). Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications. *Humanities and. Social Sciences Communications, 11*, pp. 1-12. https://doi.org/10.1057/s41599-024-03432-4

Anders, C.J., Weber, L., Neumann, D., Samek, W., Müller, L., Lapuschkin, S. (2022). Finding and removing Clever Hans: Using explanation methods to debug and improve deep models. *Information Fusion, 77*, pp. 261-295. https://doi.org/10.1016/j.inffus.2021.07.015

Bearman, M., Ryan, J., & Ajjawi, R. (2023). Discourses of artificial intelligence in higher education: A critical literature review. *Higher Education, 86*, pp. 369-385. https://doi.org/10.1007/s10734-022-00937-2

Bengio, Y. (2023). AI and catastrophic risk. *Journal of Democracy, 34*(4), pp. 111-121. https://www.journalofdemocracy.org/ai-and-catastrophic-risk/

Brasca, C., Krishnan, C., Marya, V., Owen, K., Sirois, J., & Ziade, S. (2022). *How technology is shaping learning in higher education*. McKinsey & Co. https://www.mckinsey.com/industries/education/our-insights/how-technology-is-shaping-learning-in-higher-education

Bransford, J.D., Brown, A.L., & Cocking, R.R. (1999). *How People Learn: Brain, Mind, Experience, and School*. National Academy Press.

Carvalho, L., Martinez-Maldonado, R., Tsai, Y., Markauskaite, L., De Laat. Maarten. (2022). How can we design for learning in an AI world? *Computers and Education: Artificial Intelligence, 3.* 100053. https://doi.org/10.1016/j.caeai.2022.100053

Chen, L., Chen, P. & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access, 8*, pp. 75264-75278.

Crawford, K. (2021). *The Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*. Yale University Press.

Critch, A., & Russell, S. *TASRA: a taxonomy and analysis of societal-scale risks from AI*. arXiv. https://arxiv.org/abs/2306.06924

Deschênes, M. Recommender systems to support learners' agency in a learning context: a systematic review. *International Journal of Education Technology in Higher Education*, 17(1) p. 50. https://doi.org/10.1186/s41239-020-00219-w

Du Boulay, B. (2016). Artificial intelligence as an effective classroom assistant. *IEEE Intelligent Systems, 31*(6), pp. 76-81.

Dymnicki, A., Sambolt, M., & Kidron, Y. (2013). *Improving college and career readiness by incorporating social and emotional learning*. College and Career Readiness and Success Center.

Fjeld, J., Achten, N., Hilligoss, H., Nagy, A., & Srikumar, M. (2020). *Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-Based Approaches to Principles for AI*. Berkman Klein Center. http://dx.doi.org/10.2139/ssrn.3518482

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., Luetge, C., Madelin, R., Pagallo, U., Rossi, F., Schafer, B., Valcke, P., Vayena, E. (2018). AI4People—an ethical framework for a good AI society: opportunities, risks, principles, and recommendations. *Minds & Machines, 28*, pp. 689-707. https://doi.org/10.1007/s11023-018-9482-5

Floridi, L., Cowls, J., King, T.C., & Taddeo, M. (2021). How to design AI for social good: Seven essential factors. In L. Floridi (Ed.), *Ethics, Governance, and Policies in Artificial Intelligence*, pp. 125-151.

Gašević, D., Siemens, G., & Sadiq, S. (2023). Empowering learners for the age of artificial intelligence. *Computers and Education: Artificial. Intelligence, 4*, p. 100130. https://doi.org/10.1016/j.caeai.2023.100130

Global Education Monitoring Report Team, (2023). *Global education monitoring report summary, 2023: Technology in education: a tool on whose terms?* UNESCO.

Hagendorff, T. (2020). The ethics of AI ethics: An evaluation of guidelines. *Minds & Machines, 30*(1), pp. 99-120.

Hirumi, A. (2002). Student-centred, technology-rich learning environments (SCenTRLE): Operationalizing constructivist approaches to teaching and learning. *Journal of Technology and Teacher Education, 10*(4), pp. 497-537.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*, Center for Curriculum Redesign.

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S.B., Santos, O.C., Rodrigo, M.T., Cukurova, M., Bittencourt, I.I., & Koedinger, K.R. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education, 32*, pp. 504-526. https://doi.org/10.1007/s40593-021-00239-1

Hwang,G., Xie, H., Wah, B.W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artifical Intelligence, 1*, p. 100001.

Jobin, A., Ienca, M. & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence 1*, pp. 389–399. https://doi.org/10.1038/s42256-019-0088-2

Kaput, K. (2018). *Evidence for Student-Centered Learning*. Education Evolving.

Kopp, W., & Thomsen, B.S. (2023). *How AI can accelerate students' holistic development and make teaching more fulfilling*. World Economic Forum.

Kuleto, V., Ilić, M., Dumangiu, M., Ranković, .M, Martins, O.M.D., Păun, D., & Mihoreanu, L. (2021). Exploring Opportunities and Challenges of Artificial Intelligence and Machine Learning in Higher Education Institutions. *Sustainability*, *13*(18). 10424. https://doi.org/10.3390/su131810424

Laak, K. & Aru, J. (2024). *AI and personalized learning: Bridging the gap with modern educational goals*. arXiv. https://arxiv.org/abs/2404.02798

Luckin, R. (2018). *Machine Learning and Human Intelligence: The Future of Education for the 21st Century*. UCL IOE Press.

Luckin, R., Holmes,W., Griffiths, M. & Forcier, L.B. (2016). Intelligence Unleashed: An Argument for AI in Education. https://www.pearson.com/corporate/about-pearson/what-we-do/innovation/smarter-digital-tools/intelligence-unleashed.html

Mittelstadt, B. (2019). Principles alone cannot guarantee ethical AI. *Nature Machine Intelligence, 1*(11), pp. 501-507.

Namoun, A., & Alshanqiti, A. (2021). Predicting student performance using data mining and learning analytics techniques: A systematic literature review. *Applied Sciences, 11*(1), p. 237.

Outeda, C.C. (2024). European Education Area and Digital Education Action Plan (2021–2027): One More Step Towards the Europeanisation of Education Policy. In D.R. Troitiño (Ed.), *E-Governance in the European Union: Strategies, Tools, and Implementation*, pp. 187-206. https://link.springer.com/book/10.1007/978-3-031-56045-3

Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). *Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000366994

Prahani, B. K., Rizki, I. A., Jatmiko, B., Suprapto, N., & Tan, A. (2022). Artificial Intelligence in Education Research During The Last Ten Years: A Review and Bibliometric Study. *International Journal of Emerging Technologies in Learning (iJET)*, *17*(08), pp. 169–188. https://doi.org/10.3991/ijet.v17i08.29833

Roll, I. & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education., 26*, pp. 582-599. https://doi.org/10.1007/s40593-016-0110-3

Samuel, J. (2023). Response to the March 2023 'Pause Giant AI Experiments: An Open Letter' by Yoshua Bengio, signed by Stuart Russell, Elon Musk, Steve Wozniak, Yuval Noah Harari and others…. http://dx.doi.org/10.2139/ssrn.4412516

UNESCO. (2021). *Recommendation on the Ethics of Artificial Intelligence.* UNESCO.

van der Vorst, T., & Jelicic, N. (2019). Artificial Intelligence in Education: *Can AI Bring the Full Potential of Personalized Learning to Education?.* 30th European Conference of the International Telecommunications Society (ITS): "Towards a Connected and Automated Society", Helsinki.

Wachter, S., & Mittelstadt, B. (2019). A right to reasonable inferences: re-thinking data protection law in the age of big data and AI. *Columbia Business Law Review*, p. 494.

Wang, Y.L, Liu, C, & Tu, Y. (2021). Factors affecting the adoption of AI-based applications in higher education. *Educational Technology & Society, 24*(3), pp. 116-129.

Wright, G.B. (2011). Student-centered learning in higher education. *International Journal of Teaching and Learning in Higher Education, 23*(1), pp. 92-97.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators? *International Journal of Education Technology in Higher Education, 16*(1), pp. 1-27. https://doi.org/10.1186/s41239-019-0171-0

Shaping Tomorrow's Curriculum by AI: A Vision for 2060 in Higher Education

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Introduction

The explosion of artificial intelligence (AI) technologies in the last few years caught the university sphere completely unprepared. Initial reactions were hasty, often omitting consideration of the potential impact of AI or even a basic collection of good practices. Nevertheless, in recent years, universities have begun to realise the new opportunities. The use of AI in higher education has jumped enormously in the past few years, which can already be seen in the significant increase in publications on this topic from 2021 to 2022, especially in China (Crompton & Burke, 2023). Given these antecedents, it seems especially justified to consider the role of universities in AI innovation ecosystems, even with a seemingly distant time horizon such as 2060.

This position paper explores the potential scenarios of the next generation for the impact of AI on higher education curricula. Our vision is guided by two primary drivers: Human-Centred vs. Technology-Centred approaches and High vs. Low Equity in Technology access. Based on these aspects, four scenarios emerge. "AI Ubiquity: Democratising Technology in Education" (Technology-Centred and High Equity), "Ethical AI: Transforming Education for All" (Human-Centred and High Equity), "Community Guardians: Human-Centred Learning in an Unequal Tech World " (Human-Centred and Low Equity), and "Elite AI: The Divide of Technology-Driven Education" (Technology-Centred and Low Equity) offer diverse visions of the future, each with unique challenges and opportunities. This paper also proposes actionable, low risk "no-regret moves" to help navigate these scenarios and ensure a positive trajectory for AI in education.

The Status Quo

The current state of AI integration in higher education varies widely across different regions and institutions. Overall, stakeholders in higher education generally have positive attitudes toward AI, recognising its potential to enhance learning and administrative processes (Al-Zahrani & Alasmari, 2024). In technologically advanced and resource-rich environments, universities are beginning to incorporate AI-driven tools for personalised learning, administrative automation, and advanced research. Examples include AI tutors, digital twins, and sophisticated data analytics to enhance student outcomes. However, there is a significant disparity in access and implementation, particularly in regions with limited resources.

In many parts of Asia and Europe, linguistic and cultural diversity presents a unique challenge for AI deployment. The lack of standardised AI frameworks and the potential for biased algorithms further complicate the landscape. Moreover, concerns about data privacy, ethical use of AI, and the digital divide underscore the need for thoughtful, inclusive policies. Despite these challenges, there is a growing recognition of the transformative potential of AI in education, driving efforts to bridge gaps and ensure equitable access to technology.

As we consider the current state of AI integration in higher education, it becomes evident that significant disparities in access and implementation mark the landscape. While some regions and institutions in high-income countries are pioneering advanced AI-driven educational tools, others with lower incomes face considerable challenges. Meta-research on AI literature in higher education reflects this situation (Crompton & Burke, 2023).

This varied backdrop of existing conditions sets the stage for potential future scenarios. By examining these scenarios, we can better understand the possible trajectories for AI in higher education and identify strategic actions to navigate the complexities ahead. The following section presents four distinct scenarios—each reflecting different combinations of technology access and human-centred approaches—to envision how AI might shape three main domains of the educational landscape: curriculum, assessment, and pedagogy.

The Four Scenarios

Scenario 1: AI Ubiquity: Democratising technology in education

The first scenario called "AI Ubiquity: Democratising Technology in Education" could be a situation where the demands from the business world, particularly from technology companies, play a decisive role in shaping curricula at universities. As the primary beneficiaries of a well-trained workforce and AI-aware customers, these stakeholders advocate for curricula emphasising AI literacy, advanced tech skills, and practical applications of AI technologies. This demand-driven approach ensures educational institutions produce graduates capable of meeting the future job market's needs.

Ensuring that training and curricula are accessible to a wide audience is a shared interest among educational institutions, industry players, and society at large. This inclusivity is essential for fostering a diverse and skilled workforce. Massive Open Online Courses (MOOCs) continue to evolve, with AI enhancing their effectiveness and reach. These courses offer flexible, scalable, and cost-effective education to millions of students globally, breaking down geographical and socio-economic barriers. AI-driven platforms provide customised learning experiences and adaptive assessment methods, enhancing the effectiveness of educational outcomes (Ahmad et al., 2022). These platforms identify strengths and weaknesses, offering tailored resources and exercises to optimise learning outcomes. In this tech-centred educational landscape, students enjoy a high degree of freedom in their learning journey. AI facilitates self-directed learning, allowing students to progress at their own pace and explore areas of interest in depth. AI systems create personalised learning paths based on students' performances, interests, and career goals. This personalised approach ensures that each student receives the support they need to succeed.

While the integration of AI in education offers numerous benefits, one notable drawback is the limited availability of personal guidance. The reliance on AI for personalised learning reduces the need for human advisors, leading to a more impersonal educational experience. AI chatbots and virtual assistants provide automated support and answer students' queries. Although efficient, these systems lack the nuanced understanding and empathy provided by human advisors. To compensate for the lack of personal advice, educational frameworks encourage peer-to-peer learning and mentoring. Students collaborate and support each other, fostering a community of learners.

Scenario 2: Ethical AI: Transforming education for all

In the second approach, titled "Ethical AI: Transforming Education for All", we envision a future where AI development is human-centred and ensures high equity. In this scenario, personalised learning powered by AI profoundly transforms university curriculum development, emphasising inclusivity, ethical considerations, and holistic student development. AI tools assist faculty in designing curriculum content. These tools analyse vast amounts of data from various sources, including academic research, job market trends, and student performance metrics, to recommend relevant topics and materials. This collaborative approach ensures that curricula are both cutting-edge and grounded in real-world applications.

Each student has a digital twin—an AI-driven virtual replica that tracks their academic journey, learning preferences, and progress. This digital twin plays a crucial role in curriculum execution by helping to tailor educational content, providing personalised recommendations, and offering real-time feedback. The digital twin adjusts learning modules based on the student's performance and engagement, ensuring a customised and effective learning experience. Traditional exams are replaced by continuous assessment models. AI systems provide real-time, compassionate feedback through digital twins, focusing on growth and learning rather than punitive measures. This continuous feedback loop helps students stay on track and address learning challenges promptly. Evaluation metrics include not only academic performance but also engagement, collaboration, and personal development. Digital twins provide comprehensive data that allows for a nuanced understanding of each student's progress, ensuring a fair and comprehensive evaluation process.

Professors transition from traditional lecturing roles to facilitators and mentors. They use insights from AI and digital twins to provide personalised guidance and support to students. Professors focus on fostering critical thinking, creativity, and ethical awareness, complementing the technical instruction provided by AI. Continuous professional development is very important for faculty to stay updated with AI advancements and effectively integrate AI tools into their teaching practices. Universities provide ongoing training and support to help educators navigate the evolving educational landscape.

Scenario 3: Community Guardians: Human-centred learning in an unequal tech world

In a scenario characterised by low equity and a human-centred approach to curriculum development, numerous universities face significant challenges regarding infrastructure, technological capabilities, and the digital skills development of both teachers and students. The emphasis remains on preserving academic integrity and fostering human connections in education. In this environment, university curricula prioritise local and contextually relevant content, optimising the resources and ensuring that students receive an education tailored to their immediate surroundings and needs. This approach fosters a deep connection between students and their communities, enhancing the relevance and applicability of their learning.

Pedagogical strategies shift towards community-based and peer learning models. AI still plays a supportive role in these models by identifying and matching local expertise with educational needs. This promotes hands-on and interactive learning without heavy reliance on advanced digital tools, thereby mitigating the impact of low technological access. AI-curated static knowledge resources and materials become key components of the learning process, ensuring that all students have access to high-quality educational content despite technological disparities.

Teachers play a pivotal role as facilitators and guides. In this human-centred approach, the focus is on equipping teachers with the skills and knowledge to effectively use less AI-powered tools. This empowers teachers to deliver personalised and impactful education, even in the absence of advanced technology. Educators also emphasise the development of critical thinking, creativity, and ethical awareness among students. By fostering these skills, teachers prepare students to navigate complex societal challenges and contribute meaningfully to their communities. The peer-to-peer knowledge exchange remains irreplaceable in education, with teachers acting as mentors and role models for their students.

Assessment methods employ some kind of AI tools to monitor student progress continuously. These tools provide actionable human insights and timely interventions, allowing for personalised support. The focus is on continuous and formative assessments rather than high-stakes examinations. AI-driven analytics offer a nuanced understanding of each student's strengths and areas for improvement, helping educators tailor their instruction to meet individual needs. This approach ensures that all students receive the support they need to succeed, despite the limitations in technological infrastructure.

Scenario 4:
Elite AI: The divide of technology-driven education

In a tech-centred and low-equity setting, the integration of AI into education and curriculum development primarily benefits those who already have access to advanced technology. However, for those without access, the benefits of AI will be limited or not available at all. AI-intensive and thus more efficient education is market-based, and as a result its access is limited for many students. For those who cannot afford it, what remains is less effective education and less sophisticated curricula.

The focus on technological advancement might lead to a technocentric pedagogy, where AI and tech-based tools dominate teaching methods. Faculty in wealthy institutions may integrate AI tools to enhance learning experiences, making education more interactive and data-driven for a subset of students. Universities emphasise highly specialised AI and tech-driven courses tailored for students with advanced skills and access to resources. Elite programmes might focus on cutting-edge AI technologies, catering to students who already have a strong foundation in computational science and data analytics. Wealthier students may have access to personalised AI-driven learning and assessment tools that adapt to their needs, further enhancing their learning outcomes. In contrast, students from under-resourced backgrounds might have limited access to such tools, reinforcing educational inequalities.

Teaching staff at elite universities could increasingly be seen as facilitators of AI tools rather than traditional instructors. They spend more time curating digital content or overseeing AI-driven systems than engaging in personalised, student-centred teaching. In contrast, educators at less privileged institutions might struggle to keep up with the fast-paced demands of AI-driven pedagogy due to a lack of institutional support and resources. In the pursuit of technological progress, non-technical disciplines like the humanities or social sciences receive less attention and funding. As a result, some universities downplay the importance of ethical, cultural, and social considerations in the development and deployment of AI.

Assessments increasingly rely on AI to automate grading, evaluate performance, and even predict students' future success. While this could streamline administrative work, it would likely benefit students who are already proficient in using AI tools and digital platforms, leaving behind those without the skills or access to this technology. Over-reliance on AI in teaching might diminish the focus on critical thinking, creativity, and humanistic approaches to learning. As AI handles more of the information processing, students might be trained primarily in how to interact with these systems, rather than in how to critically evaluate and challenge, or innovate beyond them.

The universities themselves could become increasingly segregated, with wealthy institutions thriving in an AI-driven environment and poorer institutions being left behind. Universities may become stratified, with AI benefitting a small elite while excluding the majority of students. The education system, once seen as a pathway to upward mobility, may become a battleground where access to AI-driven technologies determines one's prospects, exacerbating social and economic divides. This future scenario paints a picture of a university system that mirrors societal inequities, where access to AI's benefits becomes a dividing line between privileged and marginalised populations.

The No-Regret Moves

As we navigate the rapidly evolving landscape of AI in education, certain strategic actions can be taken now that will yield benefits regardless of how future scenarios unfold. These 'no-regret moves' are foundational steps that address current challenges while preparing institutions for various potential futures. By implementing these strategies, educational institutions can ensure they remain adaptable, ethically sound, and focused on equitable access and quality education. These moves include developing robust ethical guidelines, investing in low-barrier AI technologies, and enhancing digital infrastructure to support diverse learning environments.

No-Regret Move 1:
Glocalisation of AI technologies

Develop and enhance the 'glocalisation' of AI technologies to reduce language and cultural barriers, making AI accessible and relevant across diverse contexts. This approach adapts AI solutions to local languages, dialects, and cultural practices, ensuring broad usability and acceptance. Since Asia is home to over 2,300 languages, and Europe has around 286 languages, addressing this linguistic diversity is crucial for effective AI deployment (Language diversity in Asia: A linguistic mosaic, 2024).

Moreover, the global AI in education market sise is projected to reach USD 20.1 billion by 2027, growing at a CAGR of 40.4% from 2020 to 2027. This growth highlights the importance and high developing potential of localised versions of AI solutions (Global Market Estimates, 2024). Another effect of glocalisation on AI solutions as technological solutions is their standardisation, which also positively affects the trust and reliability of AI technologies (Soley, R. M., 2014).

No-Regret Move 2: Contextualisation of AI technologies

The integration of AI into university systems offers significant potential for enhancing learning, research, and administration. However, for AI technologies to have a meaningful and lasting impact, they must be contextualised to reflect the situation of their use and its user, local environments, educational goals, and cultural nuances.

This no-regret move involves adapting AI applications to the unique characteristics of specific tasks and usage, ensuring they align with local educational standards and societal values. Such contextualisation goes beyond the technical deployment of AI, addressing deeper concerns about relevance, accessibility, and cultural sensitivity. Tailoring AI technologies in this manner ensures that the tools built for education are highly functional by use-case tailoring and pedagogically effective.

For instance, AI systems used in universities in diverse regions may need to incorporate local educational practices and personal cultural references to be truly effective. This approach is supported by evidence indicating that when learning content is culturally relevant and contextually adapted, students engage more deeply and achieve better outcomes. Culturally relevant educational content, designed with local contexts in mind, fosters a sense of belonging and understanding and thus also contributes to student success (Byrd, 2016). These positive effects are also available through new common contexts embedded in the curriculum. This provides a solution for different cases, such as when there is high heterogeneity among students (Wyatt, 2015). Thus, the contextualisation of AI technologies is a critical step in ensuring that their implementation in universities meets the diverse needs of students and educators, enhancing both engagement and learning outcomes.

No-Regret Move 3: Establishment of ethical AI frameworks

Develop and enforce ethical guidelines for using AI and digital twins in education. This ensures transparency, accountability, and fairness in AI-driven personalised learning, preventing biases and protecting student data. Ethical AI use will always be crucial to maintaining trust and equity in educational environments. The report of the AI Now Institute highlights that "AI systems can perpetuate and even exacerbate existing inequalities due to biased data and algorithms" (AI Now Institute, 2019). This underscores the importance of ethical guidelines to audit and mitigate bias in AI-driven educational tools.

"Increasing transparency in AI decision-making processes is crucial to foster public trust and understanding" (The Royal Society, 2017). Ethical guidelines mandating transparency can help build trust in AI-driven educational tools by ensuring that decision-making processes are clear and understandable.
The GDPR outlines that "organisations must implement robust mechanisms for accountability and provide individuals with the right to explanation regarding automated decisions" (European Union, 2016). Adopting similar accountability standards in educational AI systems ensures that any harm caused by AI is promptly addressed, protecting students' interests. A report from UNESCO notes that "AI in education should be designed with inclusivity and equity in mind to ensure fair educational outcomes for all students" (UNESCO, 2021). Ethical guidelines can help ensure that AI systems are implemented in a way that promotes fairness and reduces disparities.

No-Regret Move 4: Development of low-entry AI

Development and dissemination of affordable and easily accessible AI solutions. The development of AI services in such a way that it is easier to communicate with them, that they are cheaper, and that their services can essentially be accessed as a public utility lays the foundation for large-scale and intensive access. As a second step, the standardisation of basic AI services can be implemented, giving users greater security and improving competition in the provision of services.

Regions in Europe and Asia have very differentiated access to New Technologies even today. Providing resources and support to those who may lack access, bridging the digital divide, and ensuring that the benefits of AI-driven personalised learning are available to everyone, promotes inclusivity and equity.

Summary

This position paper explores the future integration of AI in higher education by 2060, examining various potential scenarios shaped by the interplay of equity and whether AI approaches are human-centred or technology-centred in the future. It highlights universities' significant role in AI innovation ecosystems and the varying impacts these scenarios may have on curriculum development.

Addressing the challenges and opportunities presented by these scenarios, the paper proposes four practical and low risk no-regret moves. These include the glocalisation and contextualisation of AI technologies to overcome linguistic and cultural barriers, the establishment of ethical AI frameworks to ensure fairness and transparency, the development of affordable and accessible AI solutions to bridge the digital divide, and the implementation of high-quality data standards for AI training to prevent biases and ensure accurate assessments.

By adopting these measures, universities can effectively navigate the complexities of AI integration, fostering an educational environment that promotes equity, ethical use, and inclusivity. These proactive strategies aim to enhance the educational and academic landscape, ensuring that AI benefits all students and prepares them for a future where technology is integral to their learning and development. The recommendations provided in this paper serve as a roadmap for universities to harness the potential of AI while addressing current challenges and ensuring a positive trajectory for AI in education.

References

Ahmad, I., Sharma, S., Singh, R., Gehlot, A., Priyadarshi, N., & Twala, B. (2022). MOOC 5.0: A roadmap to the future of learning. *Sustainability*, 14(18), 11199. https://doi.org/10.3390/su141811199
AI Now Institute. (2019, April 1). *Discriminating systems: Gender, race, and power in AI.* https://ainowinstitute.org/publication/discriminating-systems-gender-race-and-power-in-ai-2

Al-Zahrani, M. A., & Alasmari, A. A. (2024). Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications. *Educational Technology Research and Development*. https://www.nature.com/articles/s41599-024-03432-4

Byrd, C. M. (2016). Does culturally relevant teaching work? An examination from student perspectives. *Sage Open*, 6(3), 1-10. https://doi.org/10.1177/2158244016660744

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *Educational Technology Research and Development*, 71(3), 455–472. https://doi.org/10.1186/s41239-023-00392-8

European Union. (2016). General Data Protection Regulation (GDPR). https://gdpr-info.eu/

Global Market Estimates. (2024, June 24). *AI in education market analysis: Size & forecasts*. Global Market Estimates Research & Consultants. https://www.globalmarketestimates.com/market-report/ai-in-education-market-3891

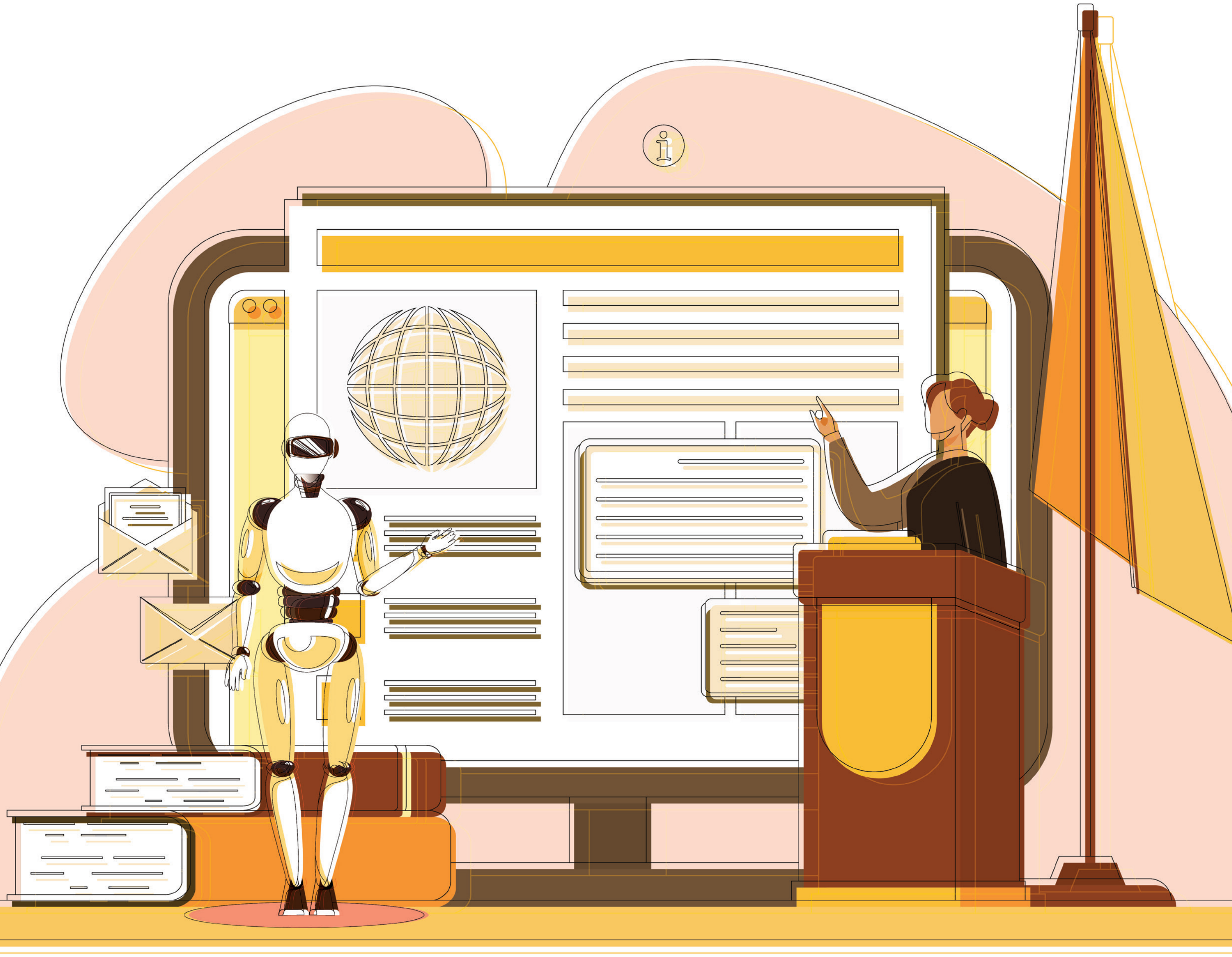
Shih, D. (2024, May 6). *Language diversity in Asia: A linguistic mosaic.* The Deeping. https://www.thedeeping.eu/2024/05/02/language-diversity-in-asia-a-linguistic-mosaic/

Soley, R. M. (2014). Glocalization: Market cultivation and the future of standards. In *Concept-oriented research and development in information technology* (pp. 183-194). https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118753972.ch13

The Royal Society. (2017). *Machine learning: The power and promise of computers that learn by example*. https://royalsociety.org/~/media/policy/projects/machine-learning/publications/machine-learning-report.pdf

UNESCO. (2021). *Artificial intelligence in education: Challenges and opportunities for sustainable development*. https://unesdoc.unesco.org/ark:/48223/pf0000366994

Wyatt, T. (2015). Understanding the process of contextualization. *Multicultural Learning and Teaching*, 10(1), 111–132. https://www.degruyter.com/document/doi/10.1515/mlt-2013-0026/html



Personalised Bot Education Agents

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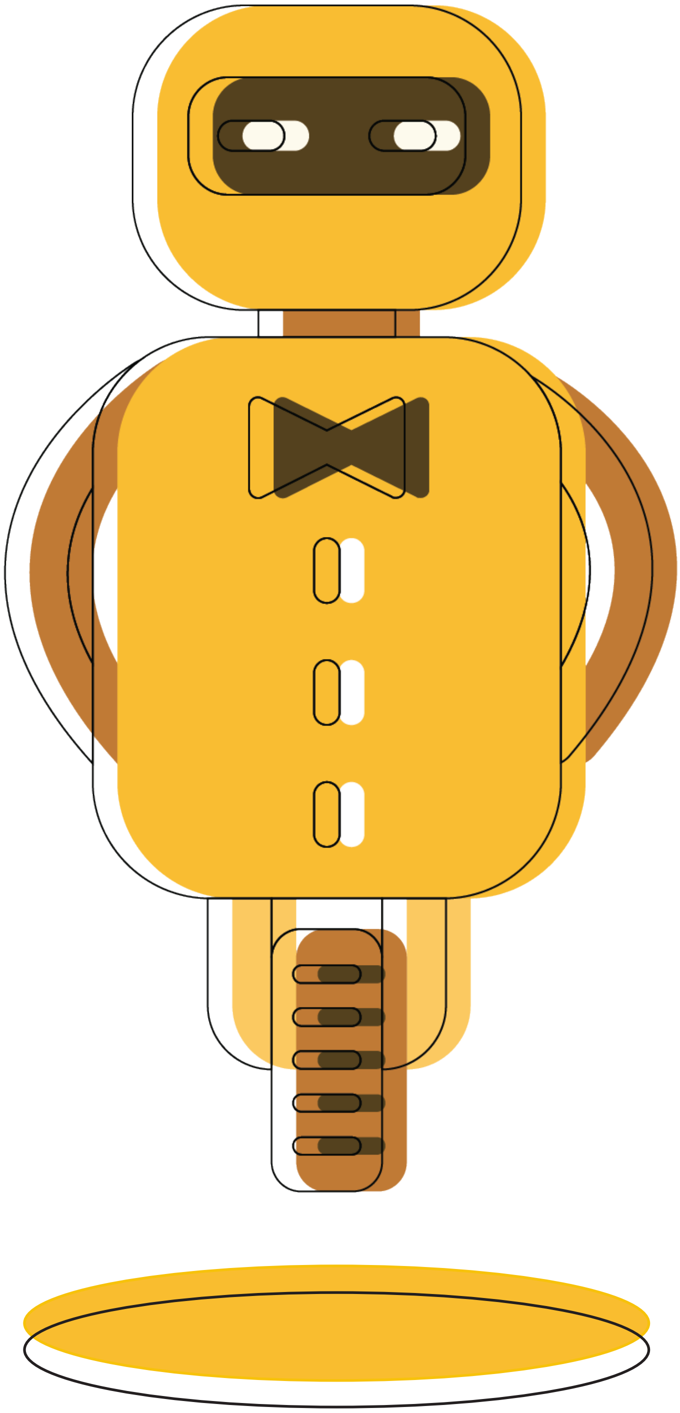
Introduction

The integration of artificial intelligence (AI) in the education process is rapidly transforming the landscape of the learning and teaching process in the universities. Among the emerging technologies, AI arguing agents—software designed to engage in debates and present counter arguments—hold significant potential for enhancing critical thinking skills in university classrooms. These AI tools can act as devil's advocates, challenging students to critically evaluate information, including combating deepfakes.

However, the deployment of innovative AI tools in educational settings brings forth a variety of scenarios, each with distinct implications for equity and the nature of student engagement. This position paper explores four potential scenarios of AI-arguing agents in university classrooms, categorised by varying levels of equity and whether the approach is human-centred or tech-centred. By examining these scenarios, we aim to understand the potential benefits and challenges of the development of Personalised Bot Education Agents (PBEA) in fostering an inclusive and effective educational environment.



The Status Quo

Currently, universities are at varying stages of integrating AI technologies into their educational frameworks. The primary applications of AI in higher education include administrative tasks, such as scheduling and grading, as well as personalised learning platforms that offer tailored content to individual students. While some institutions are experimenting with more interactive AI tools, the widespread use of advanced AI arguing agents, designed to enhance critical thinking and argumentation skills, is still in its infancy in both Asia and Europe. Traditional classroom settings, led by human instructors, remain the norm, with critical thinking and debate skills developed through direct peer and instructor interactions. This human-centred approach provides personalised and contextual feedback but also faces challenges in scalability and the potential for inherent biases.

Equity in access to educational resources continues to be a significant concern within the current educational landscape. Disparities in technology access, funding, and support services mean that not all students have equal opportunities to benefit from existing digital educational tools. These inequities can particularly hinder the development of critical thinking among underprivileged student populations. As universities consider the adoption of AI-arguing agents, there is a pressing need to address these disparities to ensure that all students can benefit equitably from the advancements in AI technology. This context sets the stage for exploring various scenarios of PBEA AI tools integration and examining the potential benefits and challenges to foster an inclusive and effective educational environment.

The Drivers of Change

There are two drivers of change that will be used in this paper: 1) human-centred vs technology-centred AI, and 2) equity in technology access (high vs low), as illustrated below:

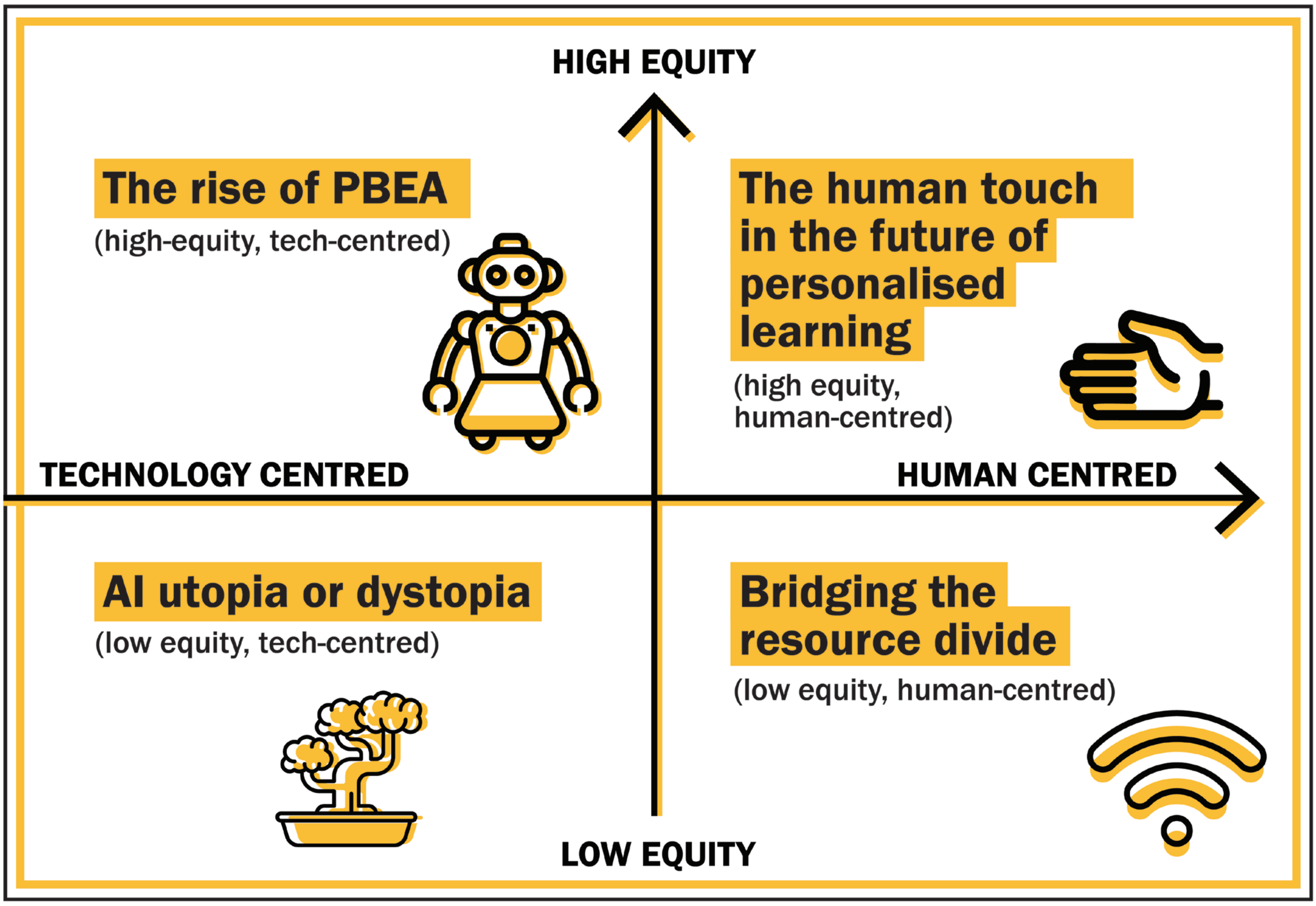


Figure 1. The two drivers of change and the four scenarios

Based on these, we explored our subtheme in four scenarios to be discussed in the following section.

The Four Scenarios

Scenario 1: The human touch in the future of personalised learning

In the near future, where equity is high but tech-centredness is low, universities are harnessing the power of advanced technologies to create smarter classrooms, where the learning experience is tailored to each student. However, in this vision of education, it's not AI that fills the role of personalised tutor—it's the educators themselves. Armed with sophisticated tools and insights, teachers step into a more dynamic role, acting as human Personalised Education Agents (PEA) to guide their students through individualised learning journeys.

Picture a classroom where every educator adapts to the unique learning styles of their students, providing real-time, personalised feedback that helps each individual grow. These teachers are more than just instructors—they are mentors, coaches, and facilitators, helping students build critical thinking skills and navigate the complexities of modern information. The streamlined use of technology allows educators to swiftly assess student performance, offering feedback that is both timely and tailored to individual needs. This interaction fosters a more engaged and responsive learning environment, where students feel seen and supported in their academic journey.

The impact is clear: students benefit from faster assessments and personalised development plans, while educators have the tools to provide more constructive, targeted feedback. In this future, it is not AI but educators themselves who hold the key to unlocking students' potential, using technology as a tool to elevate—not replace—the vital human connection at the heart of learning.

Scenario 2: The rise of PBEA

In the year 2060 in a scenario, where equity is high and tech-centredness is high as well, the landscape of education is undergoing a profound transformation, driven by the rapid rise of AI-powered learning tools. Among these innovations is the PBEA AI technology, a cutting-edge platform designed to reshape how students learn, how teachers teach, and how institutions assess performance. The ambitious goal behind PBEA AI is clear: to revolutionise critical thinking, ensure the achievement of learning objectives, and explore the societal impacts of AI within the education process.

The journey begins with a vision—one where students no longer rely solely on traditional methods to cultivate their critical thinking skills. Instead, they engage with AI tools that challenge their perspectives, pushing them to think deeper and analyse more rigorously. PBEA AI provides real-time feedback, offering students personalised development plans that evolve with their progress. Whether it's a single assignment or the entirety of a semester, students receive guidance tailored to their unique learning paths. This, in turn, helps prepare them for their professional careers, equipping them with the skills they need to thrive in a rapidly changing world.

For educators, PBEA AI offers something equally transformative. It not only tracks student progress but also evaluates the performance of faculty, providing constructive, consistent feedback that enhances teaching methods. As universities and colleges across the globe integrate this technology, the focus shifts from simple knowledge transfer to a more dynamic, interactive learning experience.

As PBEA AI becomes more widespread, the benefits are undeniable. Not only does it enhance curricula and streamline the achievement of academic goals, but it also becomes an essential tool in the development of critical thinking—an increasingly vital skill in the AI-driven world.

Scenario 3: Bridging the resource divide

In this scenario, where equity is low and tech-centredness is low, universities are bustling with innovation, committed to the principles of human-centred education.

At the heart of this divide is unequal access to resources. Some students, bolstered by high-speed internet, advanced learning tools, and enriching extracurricular activities, soar. Their critical thinking skills sharpen, and their capacity to navigate complex information grows. They engage confidently in debates, their arguments well-reasoned and supported by a wealth of credible sources, like mentors and applications that help build their soft skills (low tech versions of PBEA AI). Meanwhile, their peers, often from underfunded backgrounds, struggle. Lacking access to the same tools and mentorship programmes, they find it harder to keep pace. The skills gap, once a whisper, now becomes a visible chasm.

As the semester progresses, the consequences of this disparity extend far beyond the classroom. Those with fewer resources become increasingly vulnerable to misinformation.
For educators, the challenge becomes insurmountable. With classrooms increasingly divided between the resource-rich and resource-poor, teachers struggle to meet the diverse needs of their students. Once strong teacher-student relationships begin to fray, the sense of community that once defined these learning environments starts to erode.

As this growing inequity threatens to undermine human-centred education, universities are forced to confront a stark reality: without equal access to resources, the promise of inclusive, transformative learning cannot be fulfilled.

Scenario 4: AI utopia or dystopia

In the 2060, where human equity is low but tech-centredness is high, the world of AI has surpassed our wildest dreams. Universities are leading the charge, developing AI that can solve global problems like never before. However, this technological utopia has a dark side – a stark divide between those who benefit from AI's advancements and those who are left behind.
This disparity is rooted in the uneven distribution of resources. While well-funded institutions in wealthy nations thrive, many universities, especially those in developing countries, struggle to keep pace. They lack the financial funds to compete with tech giants like Google or Amazon, whose vast resources and market dominance often steer AI research towards commercially viable applications rather than socially impactful ones. This phenomenon echoes the "digital divide" of the early 21st century.

This unequal access to AI's transformative power is not just a matter of technological infrastructure, but also of political and economic influence. Those with the deepest pockets often have the loudest voices in shaping AI policy and development. This can lead to a scenario where AI is primarily used to enhance the lives of the privileged, exacerbating existing inequalities. Think of AI-powered self-driving cars that cater to the wealthy, while public transportation systems remain neglected, or AI-driven financial algorithms that prioritise the profits of hedge funds over the needs of small businesses and individuals.
In this dystopian future, PBEA AI technology becomes a tool of exclusion rather than inclusion. PBEA AI educational tools may offer personalised learning experiences, but only to those who can afford the latest gadgets and high-speed internet connections. The result is a world where the benefits of PBEA AI technology are concentrated in the hands of a privileged few, while the rest of society is left to grapple with outdated technologies and widening inequality.

The gap between the AI-haves and have-nots grows, and resentment and disillusionment fester, potentially leading to social upheaval and political instability. History has shown that technological revolutions can either empower the masses or exacerbate existing inequalities, and the trajectory of PBEA AI technology in 2060 seems to be leaning towards the latter.

The No-Regret Moves

No-Regret Move 1: Establish an AI Education Fund

There is already an academic and macroeconomic demand to establish an AI Education Fund under the governance of ASEF and incorporate it in the selected jurisdiction with consideration of academic, cross-border economic and political advantages and challenges. The main goal of the Fund is to establish and maintain a financial management framework for development and implementation of PBEA AI tools in universities worldwide. The sources of funds would be contributions and grants from international non-government organisations (NGOs), academic institutions and EU programmes and they would range from 100 million to 1 billion USD per annum.

The performance results of this new fund would be measured mainly with long-term qualitative and quantitative performance and return measures instead of traditional short-term return ratios (ROE, ROA, ROI). KPIs assessment framework will be determined and based exclusively on sustainable growth measures such as CAGR, EoY, EVA, and TSR to support long-term development and distribution of AI Educational tools and long-term economic returns for contributors and investors.

Accordingly, the Long-term Strategic plan for the Fund will be developed and its implementation will be agreed upon among all dedicated investors, contributors, international agencies and academic institutions involved.

Key Evidence for No-Regret Move 1

- There are various EU funds allocated for long-term investments into AI tools development (European Parliament, 2024).

- ROE, ROA, and ROI ratios are short-term quantitative measures and cannot be used as KPIs for performance assessment of such funds (FasterCapital, n.d.).

- Long-term operational, academic, and financial return qualitative goals of contributors and academic institutions should be considered instead and accordingly prioritised versus short-term quantitative measures (Burgos et al., 2023; da Silva et al., 2023).

No-Regret Move 2: Implement adaptive learning technologies

Implementing PBEA AI tools in the classroom is a strategic move to enhance educational outcomes, foster a more inclusive learning environment.

Key Evidence for No-Regret Move 2

- Adaptive learning tools provide teachers with real-time data on student performance, enabling more informed and timely educational interventions. This data-driven approach helps identify and address individual learning gaps, ensuring that each student receives the support they need to succeed (Gligorea et al., 2023; Jadán-Guerrero et al., 2024).

- Studies have shown that adaptive learning technologies can maintain students in a state of optimal learning flow by adjusting the difficulty of tasks to match their skills, thereby preventing boredom and reducing anxiety. This balance is crucial for sustaining motivation and promoting effective learning (Delgado et al., 2020).

- PBEA AI tools as a technology will emerge as an innovative solution to overcome several educational barriers by offering speech recognition technology, text-to-speech conversion technology that enable students with disabilities to communicate smoothly. A survey conducted with the participation of 66 teachers and 112 parents in two developing countries, Ecuador and Guatemala, revealed opportunities to improve students' education by identifying possible solutions in adapting resources and encouraging inclusion through the application of AI. A recurring challenge in both countries is the lack of adequate infrastructure, specialised tools, inclusive methodologies, and software to facilitate the learning process in educational institutions (Jadán-Guerrero et al., 2024).

- The adaptive education system in the e-learning platform was built in response to the fact that the learning process is different for each learner. To provide adaptive e-learning services and learning materials specifically designed for adaptive learning, AI techniques may be useful for several reasons, including their ability to expand and imitate human reasoning and decision-making processes (teaching-learning models) and minimise sources of uncertainty to achieve effective teaching-learning contexts. This learning capability ensures the improvement of the learner and the system throughout the lifelong learning mechanism (Colchester et al., 2017).

- Concepts and uses of AI, and assessing the functionality of adaptive tools, provide evaluative input regarding their use by American school teachers, and highlight the importance of additional research on the issue. It can be seen that this tool is a valid media choice to complement teaching, especially regarding adaptive learning. They offer students more inclusive opportunities: they maximise learning by adapting instruction to meet students' needs, and help students become more responsible for their own schools. As for teachers, their testimonials highlight the benefits of dedicating more class time to students' weakest areas (Delgado et al., 2020).

- AI can build and evaluate adaptive learning systems where the basic approach of spiking neural networks as well as artificial neural networks is adopted (Al-Fayyadh et al., 2021).

No-Regret Move 3: Create an AI ethics framework

By establishing a robust data governance framework that prioritises ethical considerations, schools can create a safe and transparent environment for the use of PBEA AI tools. This approach not only protects student privacy and fosters trust but also ensures that PBEA AI tools in education are aligned with the best interests of students.

There must be a framework that provides a set of ethical principles that education must implement, including how to manage risk, how to incorporate human decision-making into AI, and how to minimise bias in data sets.

Key Evidence for No-Regret Move 3

- The use of AI in digital technology (DT) is spreading profound socio-technical transformation.

- Governments and AI experts have supported the key principles of AI but lacked direction on the level of implementation.

- The implications of clarity, accountability, fairness, and autonomy (in the cognitive domain), and privacy (in the information domain) are the ones most discussed in the sample in this paper (Ashok, Madan, Joha, & Sivarajah, 2022; Schiff, 2022).

No-Regret Move 4: Establish a university consortium for PBEA AI tools development

The university consortium is a national partnership that brings together AI capabilities globally to drive research and accelerate scientific breakthroughs in the fields of AI and high-performance computing (HPC). The programme aims to help government leaders make plans for developing and implementing PBEA AI tools to advance AI in the education process. Consortium members will collaborate to facilitate innovation and build AI skills development in the education process in universities to nurture the AI generation in the next 20 - 30 years.

Key Evidence for No-Regret Move 4

- The consortium model directly counters the resource limitations faced by many universities, especially those in developing nations. A study by the World Bank (2020) found that limited funding and infrastructure hinder AI research and development in many African countries. By pooling financial and technical resources, a global consortium could level the playing field, enabling universities in Indonesia, for example, to collaborate with institutions in the United States or Europe, sharing expertise, data, and computational power. This collaborative approach would not only accelerate AI innovation but also ensure that the benefits of AI are distributed more equitably across the globe (World Bank, 2020).

- A university consortium could act as a bulwark against the undue influence of commercial interests in AI development. As highlighted by researchers like Kate Crawford (2021), the profit-driven nature of big tech companies often leads to AI applications that primarily benefit the wealthy and privileged. A consortium, driven by a shared commitment to social impact, could prioritise research agendas that address the needs of marginalised communities. For instance, Indonesian universities within the consortium could focus on developing AI solutions for local challenges like agricultural optimisation or disaster prediction, ensuring that AI technology is tailored to the specific needs of their country (Crawford, 2021).

- A university consortium could play a crucial role in promoting AI literacy and education. As noted in UNESCO's report (2020), the lack of AI skills is a major barrier to equitable participation in the AI revolution. By offering joint training programmes and educational resources, the consortium could empower individuals from diverse backgrounds to understand, utilise, and even shape AI technologies. This would not only bridge the digital divide but also foster a more inclusive and democratic AI ecosystem (UNESCO, 2020).

Several university consortia are actively advancing AI development and research worldwide:

- Thailand A.I. University Consortium: This national partnership focuses on research, scientific breakthroughs in AI and high-performance computing, and AI skills development. (https://th-ai.org/)

- SEC Artificial Intelligence Consortium: This consortium of universities in the Southeastern Conference (SEC) shares educational resources, promotes workshops, and seeks joint partnerships with industry. (https://www.thesecu.com/programs/sec-ai-consortium/)

- AI Africa Consortium: This African consortium aims to shape the future of AI research and application on the continent through collaborative projects and initiatives. (https://aiafrica.ac.za/)

No-Regret Move 5: Train the trainers

Training on how to utilise AI tools (like PBEA AI) for educators is a key to innovating and reaching the 2060 goal.

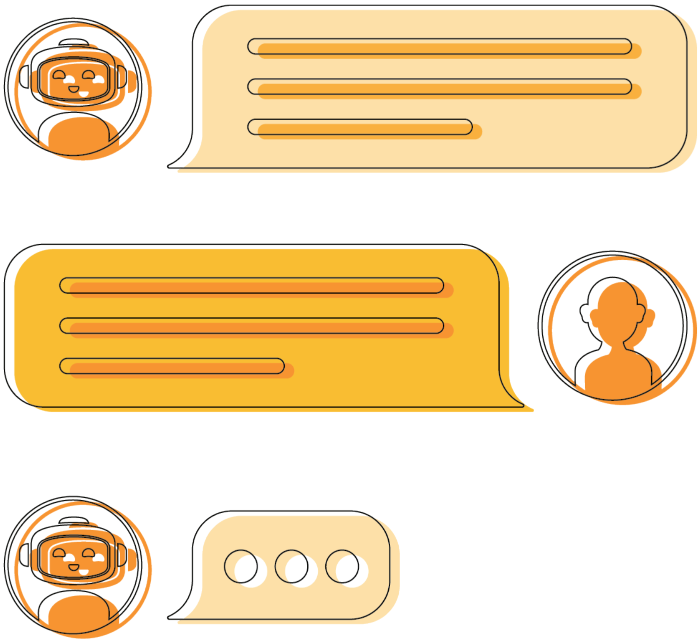
Key Evidence for No-Regret Move 5

- Training educators in AI tools helps them understand how to leverage them to enhance student performance and retention. AI tools (like PBEA AI) will innovate new forms of education by adapting content and instructional methods to individual student needs, thereby optimising learning outcomes (Wilton, Ip, Sharma, & Fan, 2022).

- Through a comprehensive review of literature and case studies, the author shows how AI applications in education can inadvertently lead to privacy breaches, amplify biases, and alter traditional teaching dynamics and why we need to act now (Salloum, 2024).

Summary

The rapid advancement and the integration of AI in education offers transformative potential for enhancing critical thinking, fostering equitable access to educational and financial resources. Integration of AI-arguing agents into education is guided by ethical principles and promotes equity. As universities explore the deployment of AI-arguing agents in classrooms, it is crucial to adopt strategic no-regret moves to ensure successful and equitable AI integration in education. Therefore, a new AI technology should be developed and implemented, which would be Personalised Bot Education Agents (PBEA AI). Development of the PBEA AI tool and its implementation processes will help to bridge gaps in access and resources, foster an inclusive and innovative educational environment, and prepare students for an AI-driven future.



Key Recommendations and Moves:

1. **Implementation of PBEA AI tool for AI literacy and educational process enhancement**
   After the PBEA AI tool is developed it must be subsequently implemented in the adaptive education process to enhance learning outcomes. Universities must attract the long-term international funds and/or grants for licensing and educators training for effective use of PBEA AI tools and improve faculty AI literacy to innovate and achieve their long-term educational goals and course taxonomies.

2. **Robust data governance framework for PBEA AI tool**
   Establish a centralised, well-structured data governance framework and IT architecture for collection and mining of relevant data, as well as subsequently cleaning and secure storage in structured datasets and databases that would prioritise the ethical considerations to protect student privacy, foster trust, and ensure fair and equitable terms for PBEA AI applications and data used.

3. **University consortium for AI research with PBEA AI tool**
   Form an international consortium of universities under Asia Europe Foundation to drive the PBEA AI tool for fostering innovation and skills development in AI research in education for faculty and students. This consortium must foster a collaboration between universities, research institutions, and governments across borders to share knowledge, resources in AI education and research.

4. **Establishment of a long-term academic AI Education Fund**
   Establish an AI Education Fund governed by the Asia-Europe Foundation. It will be funded by international NGOs, academic institutions from university consortia, and EU programmes, focusing on sustainable performance and return measures on financing the development and implementation of AI Education tools (including PBEA AI). The Fund's strategy must consider the sustainable and long-term qualitative and quantitative performance goals and return KPIs.

References

Al-Fayyadh, H. R. D., Ganim Ali, S. A., & Abood, D. B. (2021). Modelling an adaptive learning system using artificial intelligence. *Webology, 19*(1), 01-18.

Ashok, M., Madan, R., Joha, A., & Sivarajah, U. (2022). Ethical framework for Artificial Intelligence and Digital technologies. *International Journal of Information Management, 62*, 102433.

Burgos, D., Cimiano, P., Schmidt, A., & von Wartburg, R. (2023). Qualitative goals in AI investments: Long-term operational, academic, and financial returns. *International Journal of Educational Technology in Higher Education.* https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-023-00408-3

Colchester, K., Hagras, H., Alghazzawi, D., & Aldabbagh, G. (2017). A survey of artificial intelligence techniques employed for adaptive educational systems within e-learning platforms. *Journal of Artificial Intelligence and Soft Computing Research, 7*(1), 47-64.

Crawford, K. (2021). *Atlas of AI.*

da Silva, A. C., & Neves, L. (2023). The prioritisation of long-term goals over short-term quantitative measures in AI investments. *Information, 14*(2), 85. https://www.mdpi.com/2078-2489/14/2/85

Delgado, H. O. K., de Azevedo Fay, A., Sebastiany, M. J., & Silva, A. D. C. (2020*). Artificial intelligence adaptive learning tools: The teaching of English in focus. BELT-Brazilian English Language Teaching Journal, 11*(2), e38749-e38749.

East Ventures. (2022). *Artificial intelligence in Indonesia: The current state and its opportunities.* https://east.vc/news/insights/artificial-intelligence-in-indonesia-the-current-state-and-its-opportunities/

European Parliament. (2024). *EU funds for AI tools development.* https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/762288/EPRS_BRI(2024)762288_EN.pdf

FasterCapital. (n.d.). *Limitations of return on equity and alternative metrics for ROI analysis.* https://fastercapital.com/topics/limitations-of-return-on-equity-and-alternative-metrics-for-roi-analysis.html

Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., & Gorski, H. (2023). *Adaptive learning using artificial intelligence in e-learning: A literature review. Educ. Sci., 13,* 1216. https://doi.org/10.3390/educsci13121216

Jadán-Guerrero, J., Tamayo-Narvaez, K., Méndez, E., & Valenzuela, M. (2024, June). Adaptive learning environments: Integrating artificial intelligence for special education advances. In *International Conference on Human-Computer Interaction* (pp. 86-94). Cham: Springer Nature Switzerland.

SAFEnet. (2022). *Priorities and challenges of Indonesia's Artificial Intelligence National Strategy (Stranas KA).* https://safenet.or.id/2022/05/priorities-and-challenges-of-indonesias-artificial-intelligence-national-strategy-stranas-ka/

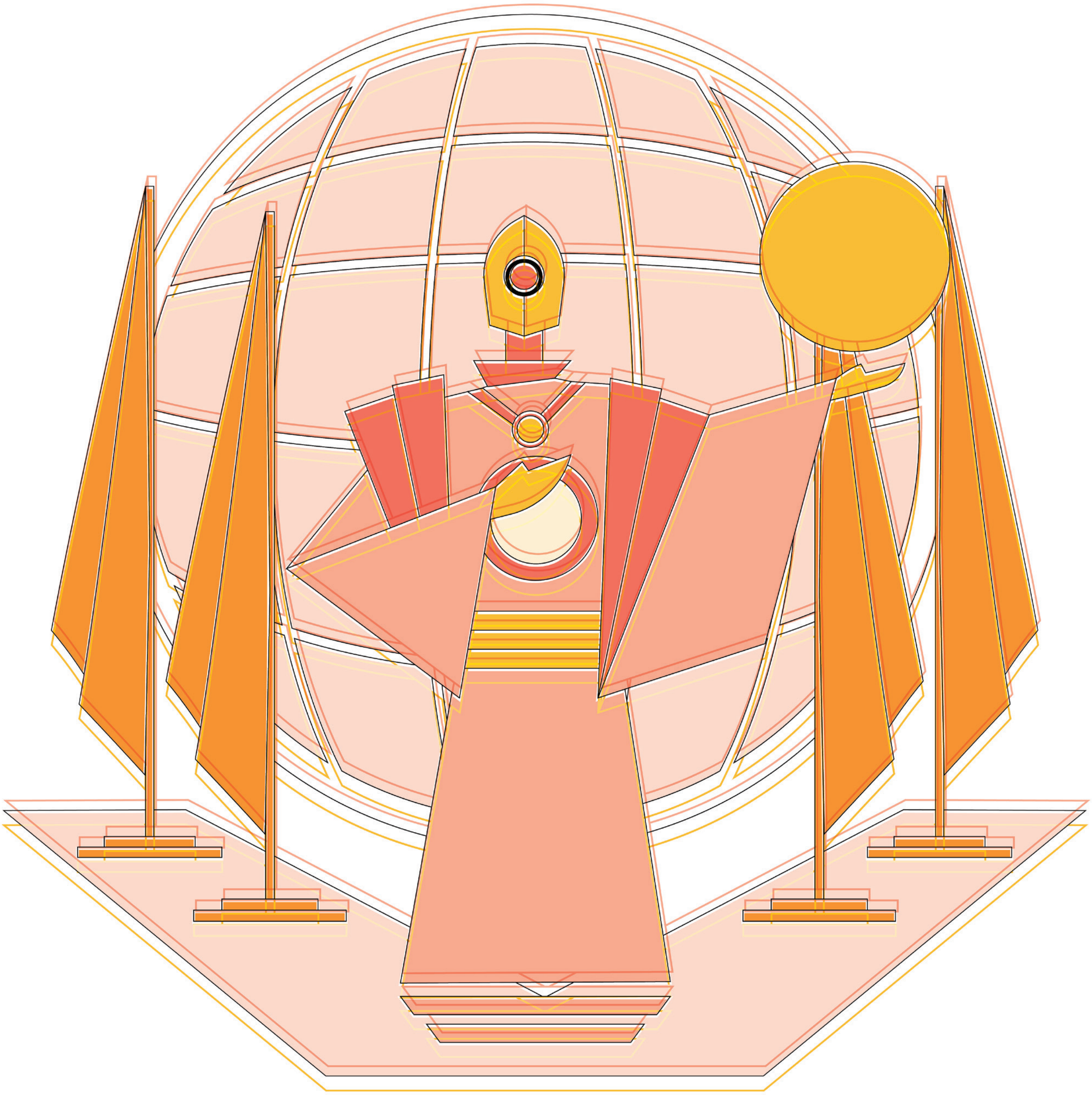
Salloum, S. A. (2024). AI perils in education: Exploring ethical concerns. In A. Al-Marzouqi, S. A. Salloum, M. Al-Saidat, A. Aburayya, & B. Gupta (Eds.), *Artificial intelligence in education: The power and dangers of ChatGPT in the classroom* (pp. 669-675). Springer. https://doi.org/10.1007/978-3-031-52280-2_43

Schiff, D. (2022). Education for AI, not AI for education: The role of education and ethics in national AI policy strategies. *International Journal of Artificial Intelligence in Education, 32*(3), 527-563.

UNESCO. (2020). *Artificial Intelligence and Education.* https://unesdoc.unesco.org/ark:/48223/pf0000375689

Wilton, L., Ip, S., Sharma, M., & Fan, F. (2022). Where is the AI? AI literacy for educators. In M. M. Rodrigo, N. Matsuda, A. I. Cristea, & V. Dimitrova (Eds.), *Artificial intelligence in education. Posters and late breaking results, workshops and tutorials, industry and innovation tracks, practitioners' and doctoral consortium. AIED 2022. Lecture notes in computer science* (pp. 180-188). Springer. https://doi.org/10.1007/978-3-031-11647-6_31

World Bank. (2020). *The Digital Economy for Africa Initiative.* https://www.worldbank.org/en/programs/all-africa-digital-transformation



AI Technology as an Accelerator of Multicultural Skills Development

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Introduction: AI in Education

Fostering multiculturalism amongst graduates is a key lever for higher education institutions (HEIs) worldwide as they work towards achieving Sustainable Development Goal 16, which aims to promote peaceful and inclusive societies for sustainable development. With the emergence of Artificial Intelligence (AI) technology, schools and HEIs must harness its power to accelerate multicultural skills development, by taking a holistic approach and personalising students' journeys.

In order to leverage new technologies for a sustainable, inclusive, and innovative ecosystem, HEIs should analyse the drivers of change for AI in education and their potential impact on soft skills such as multicultural development. In its current form, AI does not prioritise soft skills development. It does not fully understand the abstract role of soft skills in employability, nor does it consider the potential impact of the lack of soft skills development in societal polarisation.

This paper compares a human-centred position versus a technology-centred approach in the development and use of AI for multicultural skills development. It also considers the impacts of high versus low equity in the accessibility of using AI-technology as an accelerator of skills development.

In this document, we presume that on a global scale, HEIs will invest in AI ecosystems with the aim of meeting learners' expectations; maintaining a greater degree of collegiate integrity; and positively contributing to multicultural skills acquisition in line with SDG 16.

We conclude that to meet these objectives, HEIs must develop, invest, and integrate the use of AI in the classroom as well as push for greater accessibility. Maintaining a high level of equity in the use of technology is contingent on adequate governance of the use of AI. Likewise, in providing more open-source AI solutions that are readily accessible, HEIs should ensure that active dialogue with local stakeholders, industry, and university partners is continuously taking place worldwide.

The Status Quo of AI in Multicultural Skills Development

Due to the lack of culturally diverse training data, AI in multicultural skills development is still in its early stages. Most AI systems are trained on data from a few dominant cultures, which may lead to cultural insensitivity or biases in decision-making. When it comes to multicultural skills development, we find AI-powered language learning tools and multicultural training programmes and VR that simulate cross-cultural interactions. To improve business negotiation skills, there are updates taking place to data training that will consider language tone, interpretations of facial expressions and body language.

Large companies such as Facebook still rely on manual treatment of profanity, racism, and slander as only humans can fully understand cultural nuances and their impact on society. Language sensitivity and situation-appropriate vocabulary has not yet been learned by AI. Despite the advances being made, there are still ethical concerns around integrating AI in multicultural development due to bias that could further polarise society, marginalising individuals and ultimately widening the disparity gap due to hurdles in accessibility.

The Drivers of Change and Four Scenarios

After identifying external drivers of change (i.e., human-centred vs technology-centred AI and high equity vs low equity in technology access) and evaluating their impact on soft skill development, specifically multiculturalism, four distinct scenarios present themselves.

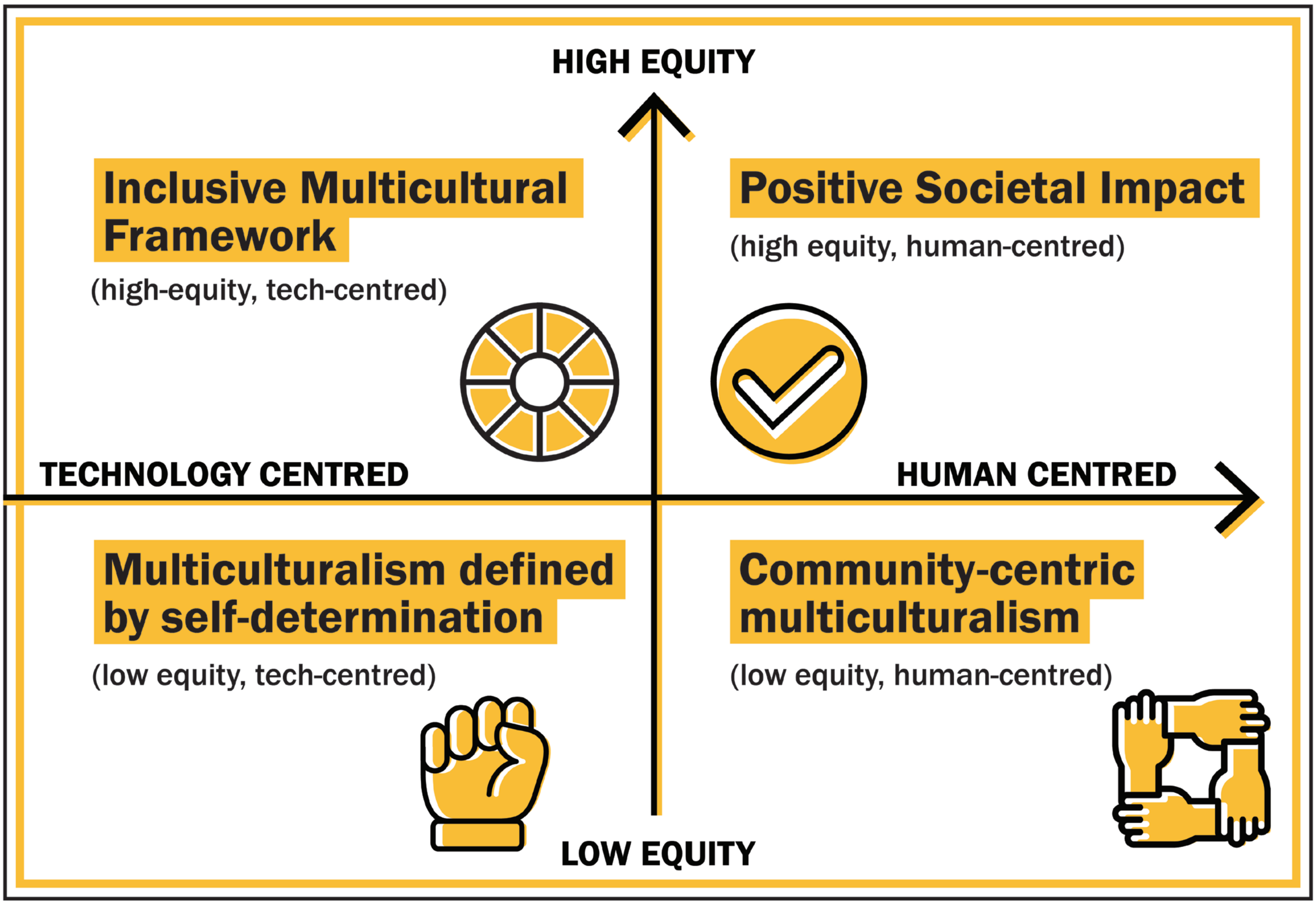


Figure 1. The two drivers of change and the four scenarios

Scenario 1:
Positive Societal Impact
(high equity, human-centred)

Human-centred AI technology that is readily accessible, holds immense promise for personalisation and multicultural development for students, staff, and faculty. As seen in Iceland's partnership with OpenAI, Reinforcement Learning from Human Feedback is improving cultural knowledge and context. Accessibility to human-centred AI tools for multicultural skills development has the potential to make an evolutionary jump in the way we engage and do business globally. Collaborative learning environments, supported by AI, can foster cross-cultural interactions, promoting empathy and understanding.

Moreover, developing cross-cultural skills is part of the life-long education journey. AI tools can consider the background of each individual and allow HEIs to better cater to the needs of students from different cultural backgrounds, tailoring learning materials and teaching styles to suit the diverse cultural norms of students.

Scenario 2:
Inclusive Multicultural Framework
(high-equity, tech-centred)

With the popularity, affordability, and accessibility of technologically advanced AI tools for multiculturalism skills development, individuals can rapidly improve in areas such as foreign language skills, culture appropriate negotiation techniques and improved cultural intelligence. In this scenario, HEIs will most likely shift to AI-achieved micro-credentials.

While these technology-centred AI tools can improve how we address multicultural skills development, there is a risk of falsified knowledge or misinformation due to the machine's inability to understand nuances. Furthermore, social-based AI multicultural tools have the ability create an alternative reality to cultural norms, etiquette, and values.

Scenario 3: Community-centric multiculturalism (low equity, human-centred)

Human-centred AI tools with limited accessibility risk marginalisation, creation of a caste system and therefore a limited multicultural perspective.

As witnessed with Cambridge Analytica and the US presidential elections, human ambition and bias can greatly influence individuals, leading them to adopt a community-centred outlook. In the context of multicultural skills development, this would lead to a narrow approach to cross-cultural communication, development of a global mindset and cultural understanding of ethical and social values. The emergence of a community-centred approach to multicultural skills would have a significant impact on the way international business decisions are made and the emergence of global leadership.

Scenario 4: Multiculturalism defined by self-determination (low equity, tech-centred)

Technology-driven tools for multicultural skills development, which are developed for the minority and only accessible by the minority, would quickly result in an elitism in education and a cultural caste system perpetuated by technology, creating many alternative realities.

By limiting accessibility to AI tools, the fundamentals of multicultural skills would be founded in the beliefs, knowledge, and interpretations of the individuals who can access the technology. AI would not be taught how to truly representative of global diversity. The impact of students graduating with an alternative reality to multiculturalism would have a dangerous impact on the global business market.

Recommendations

No-Regret Move 1: Promote watchdog standards and norms for mass use of AI in education

Allowing access to multicultural skills development with respect to global norms on the use of AI. HEIs should support institutions for peace such as the UN, World Bank, OECD, and others as they lead initiatives that promote standards and norms for the mass use of AI in education. This watchdog support will help HEIs to avoid becoming avenues for multicultural propaganda. The 193 Member States of the United Nations adopted the recommendations on the Ethics of Artificial Intelligence, which was published in November 2021 (UNESCO, 2023).

Despite a human-centred or technology-centred AI tool, HEIs should position themselves as defenders of responsible AI development, including issues of cultural diversity, fairness, and bias in AI. HEIs must also adopt a multi-stakeholder approach, advocating for inclusivity in AI technologies.

- Both Europe and Asia are susceptible to unqualified generative AI, especially soft skills such as multiculturalism. The European Union has categorised education as one of the areas at “high risk” from AI. Thus, regulators need to be as bold as the creators of this technology (UNESCO, 2024). At the moment, there are no regulatory bodies in either zone.

- Globalisation and working across borders are on the rise in both Europe and Asia, and so we need to have a workforce that is apt in multicultural skills.

- The geopolitical situation is impacting HEIs worldwide. HEIs have a responsibility to highlight the impotence and rapid development of soft skills.

No-Regret Move 2: Shift the paradigm for HEIs to guarantee a personalised educational pathway

Investing in AI technology will allow HEIs to ensure personalised learning for all students. Identifying the personal needs of our students and taking into account their pre-university experiential experience will allow HEIs to customise programmes and make recommendations on learning modules that ensure that learning outcomes on multicultural skills development are met.

HEIs should also consider adopting learning material and styles to suit a wide range of cultural norms and values.

- Integrating personalised learning experiences with AI has shown a potential transformative impact on students’ performance and academic achievements (Zia, 2023).

- Students’ expectations in both regions demonstrate the need for personalised education pathways

- Integrating a holistic approach to education and the development of soft skills will foster and strengthen lifelong learning and the creation of relevant micro-credentials for a wide range of learners.

No-Regret Move 3: Work with companies to highlight the importance of experiential learning and digital well-being

Engaging with multinational corporations for multicultural skills from all employees: leadership, operations, research, administration, and more will positively impact the local industry by training students who are highly skilled in multicultural communication and understanding. According to Reeves (2024), investing in experiential learning is investing in the future success of individual employees as well as organisations.

When investing in AI technology for multicultural skills development, companies should provide their input and needs for adequate pedagogical development. This step will lead to quick job market insertion.

It is also important that companies invest in reducing technology-driven bias and avoid alternative realities to multiculturalism that would negatively impact global business. In this sense, the industry-education cooperation must act as a check and balance the use of AI for soft skills development and the societal outcomes viewed through a corporate lenses.

- Most companies are looking for graduates with global readiness and skill sets and are willing to provide recommendations to HEI on relevancy from their perspectives

- Companies are evolving their hiring benefits to include remote working and in the future digital well-being will be another criterion to consider. HEI can kick-start this process by mirroring learning to reflect the new workplace.

- Hiring well-skilled graduates has a positive impact on local industry as it leads to job stability and corporate and regional growth.

No-Regret Move 4: Facilitate open AI modules on multicultural skills development across a university alliance

Creating alliances between HEIs will lead to open registration for AI technologies for multicultural skills development. These cooperations can impact AI development as cross-border research and global industry insights can continuously improve the functioning of AI tools for multicultural development.

International HEI partners, working together, can ensure that AI systems are globally relevant and inclusive. HEI partnerships can emphasise the importance of training AI models on datasets that reflect diverse cultural contexts.

- Many good, reputable HEIs in Europe and Asia can take the lead in implementing a multi-lateral collaboration for these global learners.

- Many HEIs wish to deepen international cooperation to go beyond research and student mobility. Co-development or implementing AI-based multicultural datasets would be an added value for both regions as it fosters greater diversity.

- Many HEIs are developing AI tools for soft skills development. Working within an international alliance can allow for easier access to diverse cultural datasheets and a co-creation of AI tools that have undergone country-specific reinforcement, learning from human feedback, ultimately allowing for a more globally-trained AI.

Summary

This position paper underscores the pivotal role of AI in enhancing multicultural skills development in HEIs, the challenges that lie ahead, and the collaborative efforts needed to overcome them. It serves as a call to action for all stakeholders in the education sector to work together in harnessing the power of AI for the betterment of multicultural education.

In addition to calling on HEIs to use AI for multicultural skills development, this paper aims to contextualise and provide a sense of the use of AI for soft skills development. In other words, employability and positive societal impact must be the overarching vision for HEIs. Attention to digital well-being should also be an integral part of the strategic plan when shifting to AI-based learning.

The potential risks and challenges associated with the use of AI in multicultural skills development are not to be taken lightly. Issues such as societal division, bias amplification, and accessibility-related disparities need to be addressed proactively to ensure that the benefits of AI are equitably distributed.
The paper highlights the critical role of governments and NGOs in regulating the use of AI in multicultural skills development. Using AI technology to train students to thrive in a multicultural context comes with great responsibility and qualitative indicators and skills assessment are essential. This document is a call for policymakers to ensure that AI tools are not only advanced but also accessible to all learners.

Finally, the paper underscores the power of collaboration in overcoming the challenges associated with the use of AI in multicultural skills development. It advocates for the establishment of alliances between HEIs and partnerships with companies to ensure a holistic approach to skills development that includes experiential learning and digital well-being.

Experience and human guidance are needed when developing multicultural skills. Educators have the power to connect the dots between skills, employment, and positive societal transformation. AI is a tool that can be leveraged to help us meet this goal; however, it must be harnessed appropriately and guided by medications during the duration of the student's journey.

References

Reeves, M. (2024). *7 Benefits of Experiential Learning in the Workplace*. Together. https://www.togetherplatform.com/blog/7-benefits-of-experiential-learning-in-the-workplace

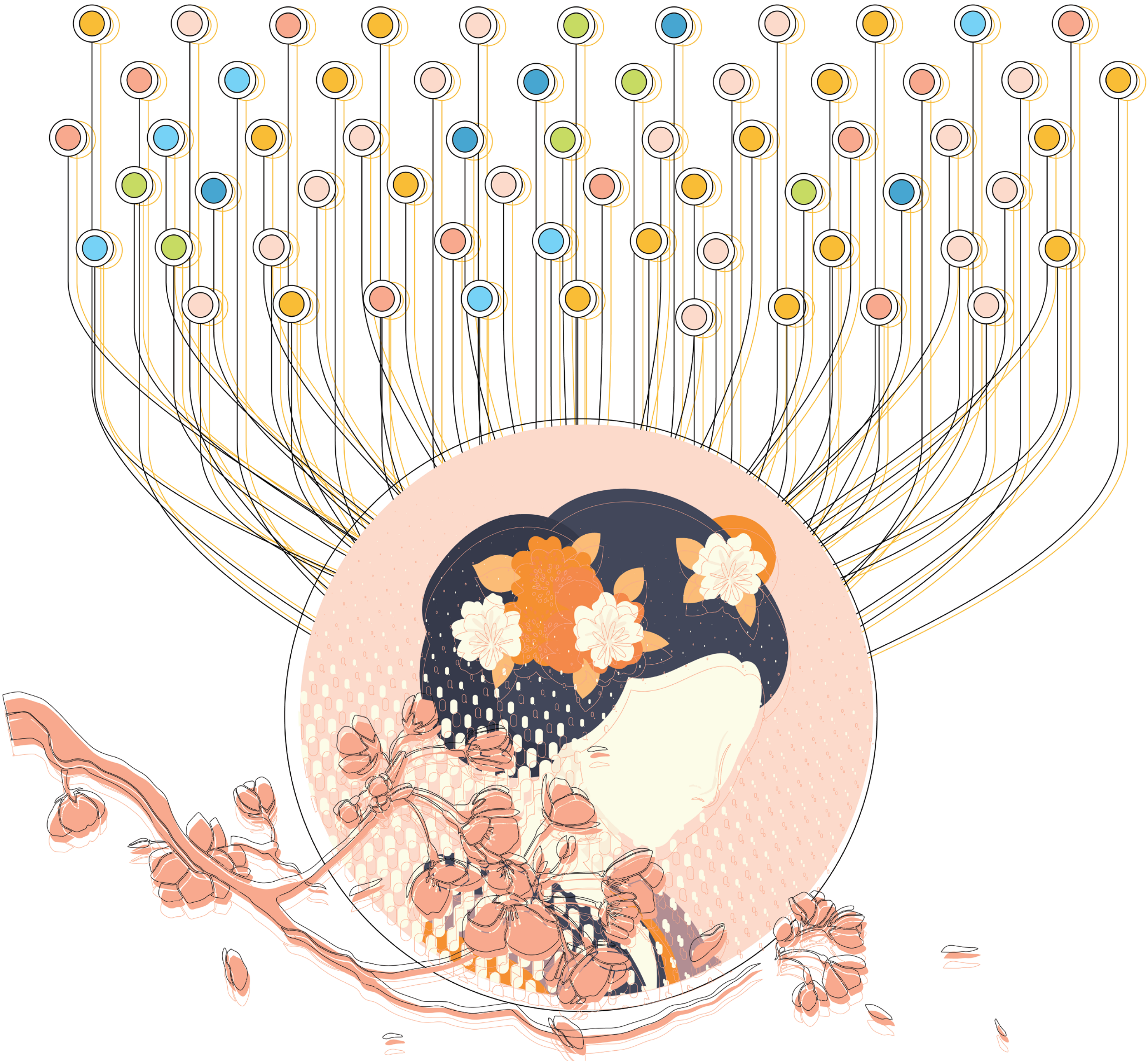
UNESCO. (2023). *Recommendation on the Ethics of Artificial Intelligence*. https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence

UNESCO. (2024). *Use of AI in Education: Deciding the Future We Want*. https://www.unesco.org/en/articles/use-ai-education-deciding-future-we-want

Zia, T. (2023). *Transforming Education: AI-Powered Personalized Learning Revolution*. Technopedia. https://www.techopedia.com/transforming-education-ai-powered-personalized-learning-revolution

Other Consulted Sources

- AI Ethics Lab: https://aiethicslab.com/
- Partnerships on AI: https://partnershiponai.org/
- Algorithmic Justice League (AJL): https://www.ajl.org/
- AI for Good: https://aiforgood.itu.int/



AI in Creativity Stimulation





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Introduction

The convergence of artificial intelligence (AI) and the arts is fundamentally reshaping our understanding of creativity, prompting a re-evaluation of long-held beliefs and methodologies. This intersection raises profound questions about the nature of creative value, the evolving role of human artists, and the ethical implications of AI-generated works. Creativity, long considered a uniquely human trait, is increasingly being augmented and even emulated by AI systems (Boden, 2004). As educational institutions strive to prepare students for a future where creative problem-solving is paramount, the incorporation of AI in creativity education becomes not just beneficial, but essential (Robinson, 2011). AI tools and platforms offer unprecedented opportunities for personalised learning experiences, adaptive feedback, and the exploration of creative possibilities beyond traditional boundaries (Lubart et al., 2019).

This paper explores the different forms of creativity and highlights the impact of psychology on humans. The paper introduces the Flow framework and how it could be leveraged to expand on creative content creation, education methods, learning and competence development and learning measurement. There is a need to understand and apply aspects of stimulation in creative learning process.

The integration of AI in creativity education also raises important questions about the nature of creativity itself and the role of technology in fostering genuine creative skills (Cropley, 2020). The paper develops four scenarios in which creative education can be actualised, balancing the human- and technology-centred approach with high and low equity parameters. This leads to developing short-term no-regret moves, meaningful recommendations that educational institutions, policy makers, and society at large can adopt.

This helps in developing a forecast for the future where the confluence of AI and creative stimulation in Higher Educational Institutions can be realised. By leveraging the flow model and cohesive collaboration between stakeholders, the paper provides targeted recommendations through 2060. By examining both the potential benefits and pitfalls of AI integration, this paper offers insights that can guide educators, policymakers, and developers in harnessing AI to enhance creative education while preserving the essence of human creativity.

Background and Status Quo: Creativity and AI

Rhodes' theory (Rhodes, 1961) identifies 4 areas of creativity: Personality, Process, Press, Product. So, creativity requires the creative person, the process of creation, the external environmental influences and the result. "Creativity is a process whereby the symbolic domain of culture is changed. New songs, new ideas, new machines – this is what creativity is all about" (Csíkszentmihályi, 2008, p. 14). However, creativity is also influenced by thinking skills and personality factors, personality traits, behavioural manifestation or cognitive process (Rhodes, 1961). One of the challenges of the 21st century is to rebuild the cognitive flexibility of millennials and Generation Alpha, which can only be achieved through methodological innovation by teachers. Creative students possess characteristics including childlike curiosity, being full of ideas, being experimental but somewhat forgetful, and being inclined to engage without being given tasks by others. Csíkszentmihályi (2008, p. 15) defines creativity as any action, idea, or product that changes or creates a new field.

Creativity is a continuous process where students generate novel, original, and practical outcomes. Nurturing curiosity in the classroom through innovative tools, methods, and procedures, paired with effective teaching methodologies emphasising creativity and flexibility, can enhance student performance, foster a sense of accomplishment, and elevate motivation levels.

According to positive psychology, learners associate a feeling or emotion with every situation. This can be used by the teacher in the classroom. The state of flow, introduced by psychologist Mihály Csíkszentmihályi (1990), is the experience of total immersion and concentration in each activity. This state is particularly important for creativity and innovation, as it allows individuals to maximise their performance and find creative solutions. It is important for teachers to avoid a lack of motivation in the classroom and to work with teaching methods that can keep students' attention. Positive psychology emphasises the joy inherent in learning and development, self-esteem, the perception of success as a reward, active efforts to improve and the importance of curiosity (Pléh, 2012; Seligman, 2018). Flow can only be achieved if the achievement of such challenges generates new desires (Csíkszentmihályi, 1990; Nakamura & Csíkszentmihályi, 2002). In this way, the learner's performance increases, and he or she can experience a more complex state of consciousness and reach a more advanced level of self-awareness, which is key to the flow experience (Dominek et al., 2023).

According to proponents of positive psychology and flow theory, the focus should be on the positive aspects of life, happiness, self-actualisation and the ability to make the right choices (Seligman & Csíkszentmihályi, 2000; Szondy, 2011). Students thrive in digital environments because they encounter challenges that make them think, solve problems and collaborate, thus developing their competence and creativity (Labancz & Barnucz, 2016). A primary objective of utilising digital content in education is to get students to enter the flow state, a concept supported by the flow-based pedagogical model (Dominek, 2022). This model incorporates creativity, flexible thinking or even humour into users' education, suggesting these elements can aid students enter the flow channel (Figure 1).

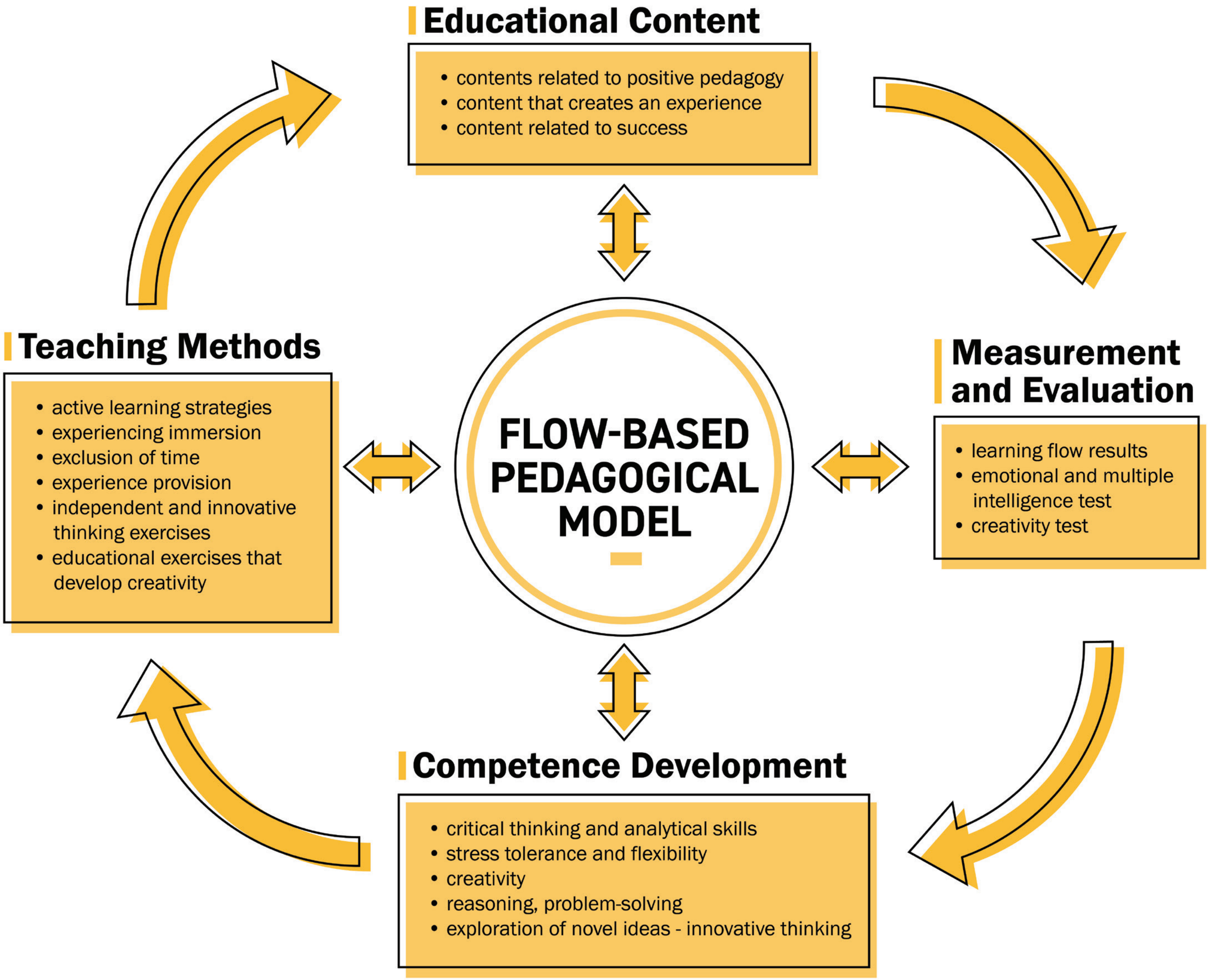


Figure 1. Flow-based pedagogical model (Dominek, 2022)

Glaveanu & Kaufman (2019) stated in the Cambridge Handbook of Creativity that "Creativity is the key to success in almost all areas of life, personal and professional. Creativity can and should be educated." Creativity is now seen not only as an innate talent but a skill that can be developed for all people to thrive in the 21st century (Bereczki & Kárpáti, 2021). What stimulates creativity in other individuals? Unsworth's (2001), Matrix of Creativity Types, rooted in industrial/organisational psychology, categorises creativity into four types based on the context (i.e., open or closed problem) and reason (i.e., a driver for engagement, similar to intrinsic–extrinsic) (Figure 2): responsive creativity, which is externally motivated and focused on closed problems; expected creativity, which allows for some intrinsic motivation while still being influenced by external factors; contributory creativity, driven by personal interest yet confined to specific subjects; and proactive creativity, characterised by self-directed creation based on personal guidelines.

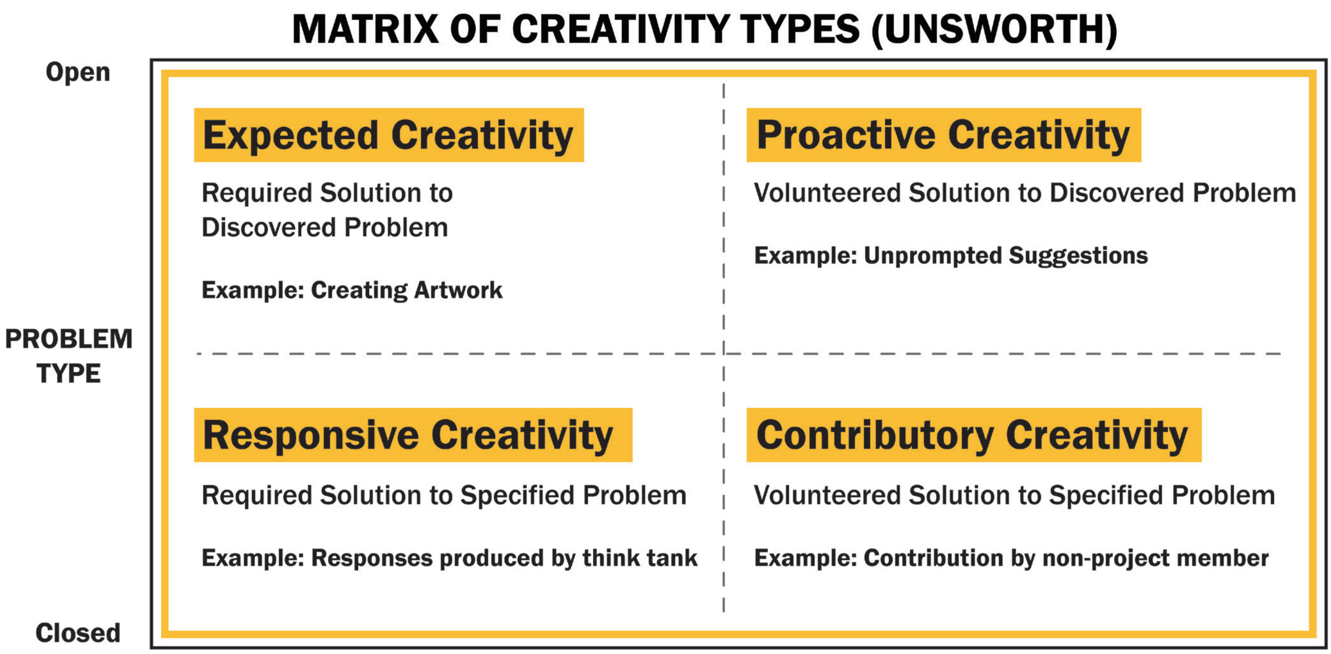


Figure 2. Matrix of creativity types (Unsworth, 2001)

AI and creativity have a bright future together if they work together in a way that augments creative output while respecting moral principles and human values. Vinchon et al. (2023) proposed four fundamental laws aiming to prevent AI from generating harmful content and competing directly with humans. First, AI must not replicate human labour, and transparency is crucial regarding the data used to generate new content. Second, AI should adhere to ethical standards, avoiding the creation of harmful or offensive content. Third, AI should function collaboratively with humans in creative processes, whether as co-creators or supportive tools. Lastly, any content created by AI must clearly indicate its artificial origin. In higher education, such as universities, educators should introduce students to Generative AI tools like Adobe Firefly, DALL-E, and Artbreeder to explore the capabilities and limitations of these tools in ideation, image generation, and creative experimentation.

The study of Kavakoglu et al. (2022) highlighted that AI could serve as a tool for computational creativity in design education, assist in transferring knowledge from students to AI-generated images, facilitate peer-learning between students and AI, be a subject of research, aid in learning, and visualise future implications and integrations. However, experience in data preparation, data refinement, and outcomes organisation is necessary when collaborating between AI and human designers. Adobe research suggested that AI can help with administrative tasks, freeing up human designers' time for creative work (IBM, 2024). Furthermore, the study by Ali et al. (2019) demonstrated that students who understand computational thinking and AI are better at problem-solving and can significantly enhance their creative thinking skills. A key advantage of generative AI for organisations and public institutions lies in its potential to amplify human ingenuity and break down barriers to widespread innovation.

The Four Scenarios

Currently, AI is in its early stages of development, as publicly known. However, its rapid progression suggests it could soon become a valuable support in the education system Fadel et al. (2019). Four future scenarios explore how AI might impact the development and evolution of the creative sector in academia and industry.

Scenario 1: Technology for all! (high-equity, tech-centred)

AI development focuses on technological advancements and enhancements to create efficient, high-functioning systems. Policies and initiatives aim to make these cutting-edge AI technologies accessible to all, reducing the digital divide. Infrastructural and educational investments prioritise accessibility across socio-economic backgrounds. However, the primary goal often prefers optimisation of technological potential over broader deliberations of human well-being (Rivera & Elksne, 2024).

AI is expected to integrate into creative society, enhancing production and innovative thinking while optimising the creative process. These tools promote digital literacy and experimentation in art education. Interdisciplinary collaborations and industrial advancements benefit from open resource sharing. However, AI's advancements in arts – production, documentation, archival, and research – often disregard ethical data sourcing and individual privacy.

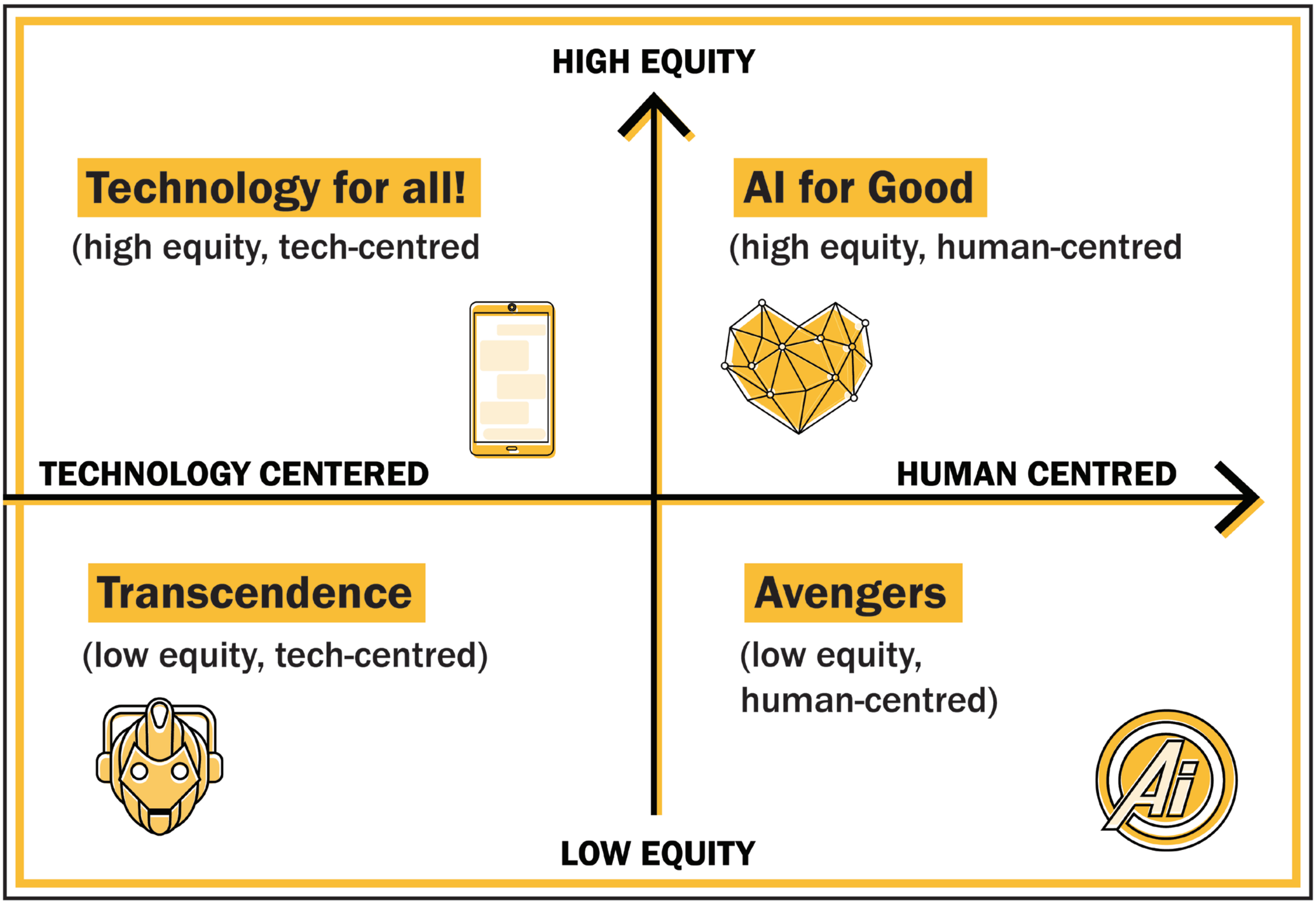


Figure 3. Four scenarios projected on the drivers of change (InnoLab5, 2024)

Scenario 2: AI for good (high equity, human-centred)

AI development prioritises human well-being, ethical considerations, and enhancing human capabilities. Policies ensure equitable access to AI technologies, bridging the digital divide and empowering underserved communities. Investments in education and community engagement promote broad participation in and ensure that all communities benefit from AI advancements. Stakeholder input guides AI system design to address diverse societal needs. The primary goal is solving societal issues, occasionally prioritising societal impact over advancing technology for its own sake (Rivera & Elksne, 2024).

Supportive AI tools enhance idea generation, emphasising ownership, inclusivity, problem-solving, and originality in creative content. They foster cross-disciplinary interactions and promote innovative content using archives, public domain resources, and comprehensive databases. AI integration in academic spaces supports experimentation in content creation, form development, and research. Beyond personal and industrial creativity, AI seeks innovative solutions in community development through the arts. Ethical considerations in data mining and AI development may slow technological advancement due to required notifications and consent from involved parties.

Scenario 3: Avengers (low equity, human-centred)

AI development prioritises human-centred goals but benefits accrue primarily to elite groups with greater access to technology. Significant disparities exist in AI technology access, leaving underserved communities behind. Ethical considerations and human well-being are emphasised, yet mainly for those able to afford advanced AI solutions. Innovations primarily serve the needs and interests of affluent populations, potentially widening social and economic gaps. The primary goal is solving societal issues for those who can afford the solutions (Rivera & Elksne, 2024).

AI development, human-centred yet corporate-driven, enriches resource pools but restricts access behind paywalls or organisational requirements. While enhancing production capabilities, AI exacerbates disadvantages and elitism among marginalised communities lacking technological access. This imbalance in academia leads to unequal knowledge and experimentation capabilities, fostering an elite sector with greater resources. This imbalance also affects industry output. Concerningly, there's a trend of appropriating cultural techniques without proper representation or benefit to indigenous communities.

Scenario 4: Transcendence (low equity, tech-centred)

AI development prioritises technological advancements and optimisation, often neglecting equitable access. Benefits accrue to those with resources and skills to utilise advanced technologies, excluding large segments of the population and exacerbating social and economic inequalities. This focus on benefiting a few creates societal tensions and marginalises those without access to AI advancements (Rivera & Elksne, 2024).

In a future prioritising technological advancement over human integrity, AI may replace artist and designer jobs, potentially reducing uniqueness and diversity in artistic works. The shift towards online learning platforms in universities, driven by cost efficiency, integrates AI in teaching. This streamlined approach limits critical thinking from interpersonal interactions. With AI as a primary solution provider and reduced human intervention, there's less incentive for innovative and unconventional creative solutions, leading to stagnation and homogenisation in visual arts and academia.

AI in Creativity Stimulation: Tactical Recommendations

Regardless of the future development of AI, it holds the potential to boost creativity, for both the creative industry and academia. The flow-based pedagogical model establishes pleasure of discovery through collaboration and problem-solving as key stimulants to creativity. AI has the potential to augment the process if used carefully, but concerns of accessibility and ethicality may develop into a hinderance in acceptance into academic curricula and as an industry tool. The following three suggestions address the issues of accessibility, integration, and ethical resource building.

No-Regret Move 1: Freedom in time and space of using AI

The competitiveness of AI is enhanced by the freedom and opportunities offered by the digital space, supported by the rise in practical usage since the pandemic. The amplification of creative thinking and problem solving in these spaces is the key to entering the flow channel of learning (Labancz & Barnucz, 2016). The current model for many existing commercial generative AI is locked behind paywalls and copyright concerns, limiting integration in academic experimentation spaces. A new model or business model of cooperation between academia and industries could benefit the broader usage of AI across platforms.

In digital art and design, implementing cultural representatives for Europe and Asia is crucial. Promoting Creative Commons (CC) licensing allows artists to specify permissions, enabling broader distribution and collaboration while preserving certain rights. Advocating for open data initiatives encourages accessibility and sharing of data sets, leading to increased innovation and collaboration. Establishing a trustworthy digital art and design archive serves as a valuable resource for artists, educators, and researchers, fostering knowledge-sharing and inspiration.

Furthermore, emphasising special copyright protection in digital art is essential. Copyright laws must adapt to safeguard artists' rights. A private company overseeing these regulations can streamline the process and ensure compliance, upholding integrity and accountability and contributing to a robust and sustainable digital art ecosystem in Europe and Asia.

No-Regret Move 2: Balancing tradition and modernity

Over-reliance on AI and technology can undermine students' critical thinking and problem-solving skills by providing convenient solutions that reduce independent thinking and creativity. Developing these skills involves trying various approaches and learning from mistakes, which AI can facilitate, but with the risk of ultimately limiting persistence and creativity. Educational institutions need to balance technology with traditional methods, using AI as a supportive tool, not a replacement. Educators should encourage active engagement and challenge-solving to foster critical thinking and skill development, ensuring technology complements rather than impedes student progress.

Current teacherless online teaching systems (hybrid) aggravate the problem through reduction of creative thinking. Similarly, contemporary usage of AI poses the same problem by serving as a solution provider, which discourages analytical and creative thinking, a necessity in the creative fields. However, in the future, in a situation where teacherless education may become an optional necessity, to cater for all needs, AI can also be trained as a partner in discussion, to intervene as a conversation and analytical thinking facilitator in situations where classrooms are without tutors (Labadze et al., 2023).

Integrating AI into the ideation process is crucial for fostering innovation and creativity, as it can generate initial ideas, which are then refined by humans. This collaboration enhances the diversity and innovation of solutions, augmenting human creativity through harmonious collaboration. As AI advances, it will provide data-driven insights, accelerate prototyping, and mitigate biases. Balancing AI-generated ideas with human creativity is key to unlocking the full potential of ideation. Justin Ablett addressed his thoughts in the New York Times that "Generative AI can democratise the ability for nearly anyone within an organisation — anyone with an imagination, really — to be part of the creative process, and, at the same time, it allows creative professionals to focus on the work they love and what they're good at" (IBM, 2024).

Integrating AI into art and design education is crucial for preparing students for the evolving creative landscape. Educators can effectively integrate AI by familiarising students with AI tools, developing prompting skills, addressing ethical considerations, integrating AI into the curriculum, and facilitating critiques and reflections. These strategies empower students to harness AI's transformative potential while fostering critical thinking and creative skills essential for the 21st century.

No-Regret Move 3: AI consortium of universities

Creativity thrives on inspiration, and one of the primary resources of aid in ideation can be research of historical data and methodologies (Ishiguro & Okada, 2021). AI has great potential to work as an auxiliary support in this part — not only as a method of research, but also serving as a vast archival pool that can aid in bypassing the confines of spatial boundaries that restrict the development of mindsets based upon the immediate cultural artefacts humans interact with. However, the output of current Generative AI models is limited by web scraping sources and public datasets, leading to output that doesn't provide the diverse insights needed. (World Intellectual Property Organization, 2024).

An Open AI Pool, jointly created and trained by a consortium of universities across the world in collaboration with international institutions such as UNESCO World Heritage could be the answer, providing an ethical and multi-national resource that can be used for the generation of creative content. Acquiring material from consented, open-source and public domain sources of multinational nature, the data the AI would be trained to collect and archive would be varied and representative of all cultures, therefore providing an inclusive resource that can aid in overcoming access barred by physical constraints.

Currently, the opt-out nature of commercially driven AI datamining causes ethical discord in usage. By having an Open AI Pool, moderated by the academia, the voluntary sharing of resources in the form of historical and public domain archives, can aid in addressing the ethical concerns, while uniting content currently safekept across specific institutions — dually forming an archival and guidance tool, a more advanced version of our current digital open archive and academic journal resource. This could also aid in bridging the gap in current Generative AI software providing content that is specifically Euro-centric and aiding in identifying the multifaceted distinctions in culture-based content in both Asian and European cultures (Padilla, 2023).

Existing archival initiatives such as the Internet Archive and British Library's Images Online can serve as examples of what's possible. Utilising institutional data archives to train an AI software system to digitise, archive, and maintain a central system could result in AI that generates varied content due to the wide cultural pool of resources (Tarkowski, 2023; Kahle, 2023).

Universities in Europe and Asia can collaborate with international institutions like UNESCO World Heritage to utilise their resources and expertise. Leveraging their academic image banks and archives globally can enhance the creative process and promote innovation.

The Long-term Vision: Implementation Plan

In a time and space when education can move towards a hybrid model of online and offline classes, the proposed tactical solutions foster creative thinking in online spaces through ethical database sources and teaching aides which aid in archival research. The current hybrid teaching model has been proven to be comparatively ineffective in arts education, with the students not being provided enough stimuli in a course without any human intervention (Mahsan et al., 2023). However, the advancement of AI can serve as providing auxiliary support to classroom teaching, unlocking potentials of interdisciplinary experimentations, and even provide a solution to teacherless hybrid classrooms.

As the current capabilities of AI tools are expected to advance rapidly in the coming years, the development of the suggestions may be possible by year 2030 and implementation between 2040 to 2060 (Davidson, 2024). The primary hurdle in the execution of the suggestions would be obtaining international cooperation and investment, and setting up regulatory frameworks to moderate the implementation. Considering the predicted developments, following is a suggested timeline in which the recommendations could be implemented:

From 2025 to 2030, the Fair Use clause can be re-examined and the integration of a CC license allowing creators to opt in for AI data mining and development. Currently, CC has already initiated public dialogue with creators and developers for re-evaluation of the licences in the context of AI development (Stihler, 2023).

Between 2025 and 2035, a central archival database can be developed under the guidance of a consortium of academic institutions in partnership with a body like UNESCO World Heritage. Collaboration with an impartial central institution can aid in quelling concerns of trust and communication that hinder current explorations of AI as an archival medium, and the unification can serve as a free-for-research generative virtual assistant AI, offering an ethical alternative to text-to-image models (Jaillant & Rees, 2023). From 2025 to 2035, the digitisation of existing content can be initiated in universities, museums, libraries, and archival institutions across Asia and Europe to contribute to the central archival database.

Between 2030 and 2040, a chatbot and virtual assistant AI can be developed to function as conversation partners, personal ideation aids, and replacements for human interaction, particularly in arts academia. While currently, the potential for developing AI Chatbots as Classroom Assistants already exists, the virtual assistant would be specifically trained for the purpose of creativity stimulation (Lindgren, 2024).

From 2036 to 2040, the central archival database AI can be trained through specific university programmes, and from 2041 to 2045, training of the virtual assistant AI can also start in experimental classrooms, initially in theoretical and discursive subjects and later in skill-building online spaces.

Once stabilised, between 2041 and 2060, the central archival database AI can be incorporated into classrooms as a research assistant and an aid in the ideation process. From 2045 to 2060, virtual assistant AI can be integrated into classrooms as a teacher's aide and personal guide for students in online and offline classrooms.

Conclusion

The use of AI in academia raises ethical concerns about data sources and the potential impact on critical thinking in creative fields. While AI enhances accessibility in the arts, it also risks making human-made art obsolete, homogenising content through instant gratification and discouraging unconventional thought. When integrating AI into curricula, arts institutions must address both the critical thinking and ethical challenges, ensuring AI complements diverse learning needs rather than replacing human interaction.

A flow-based pedagogical model emphasises continuous and dynamic learning, through compassion, rule-based decision-making, and community-based decisions for the greater good to foster innovative, engaging, and ethically grounded educational practices. For instance, project-based learning can create flow while tackling ethical challenges, and adaptive learning technologies can offer personalised experiences while adhering to strict data use and privacy guidelines. By 2060, the thoughtful integration of AI in education could significantly support maintenance of the flow state essential for creativity, offering personalised learning, access to rare resources, automatic feedback, and collaborative interdisciplinary environments.

The goal is to empower AI as a tool in creativity stimulation, not to replace artists and designers. Ethically applied, AI can aid ideation, generating text, media, and code, serving as a creative starting point or skillset support. In education, AI can enhance creativity by serving as a conversational support and personal guide for students in teacherless online modes, fostering creative thinking.

References

Ali, S., Payne, B. H., Williams, R., Park, H. W., & Breazeal, C. (2019). *Constructionism, Ethics, and Creativity: Developing Primary and Middle School Artificial Intelligence Education.* International Workshop on Education in Artificial Intelligence K-12 (Eduai'19), 1–4.

Bearman, M., Dracup, M., Garth, B., Johnson, C., & Wearne, E. (2022). Learning to recognise what good practice looks like: how general practice trainees develop evaluative judgement. *Advances in Health Sciences Education, 27*(1), 215–228. https://doi.org/10.1007/s10459-021-10086-3

Bereczki, E. O., & Kárpáti, A. (2021). Technology-enhanced creativity: A multiple case study of digital technology-integration expert teachers' beliefs and practices. *Thinking Skills and Creativity, 39*. https://doi.org/10.1016/j.tsc.2021.100791

Boden, M. A. (2004). *The creative mind: Myths and mechanisms*. Routledge.

Fadel, C., Holmes, W. and Bialik, M. (2019). Artificial intelligence in education: Promises and implications for teaching and learning. Boston: Centre for Curriculum Redesign.

Csíkszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. Harper & Row.

Csíkszentmihályi, M. (2008): *Kreativitás. A flow és a felfedezés, avagy a találékonyság pszichológiája*. Akadémiai Kiadó, Budapest.

Cropley, A. J. (2020). Creativity: A social approach. *Roeper Review, 42*(3), 187-198.

Davidson, T. (2024, January 23). *What a compute-centric framework says about AI takeoff speeds—AI Alignment Forum*. AI Alignment Forum. https://www.alignmentforum.org/posts/Gc9FGtdXhK9sCSEYu/what-a-compute-centric-framework-says-about-ai-takeoff

Dominek, D. L. (2022). On a Flow-based pedagogical model. The emergence of experience and creativity in education. *Eruditio-Educatio, 17*(3), 72–81. https://doi.org/10.36007/eruedu.2022.3.072-081

Dominek, D. L., Barnucz, N., Uricska, E., & Christián, L. (2023). Experiences of digital education from the students' perspective. *Informacios Tarsadalom, 23*(2), 9–24. https://doi.org/10.22503/INFTARS.XXIII.2023.2.1

Glaveanu, V. P., & Kaufman, J. C. (2019). Creativity. In *The Cambridge Handbook of Creativity* (pp. 9–26). Cambridge University Press. Gombrich, E. H. (1972). The Visual Image. *Scientific American, 227*(3), 82–97. https://www.jstor.org/stable/pdf/24927430.pdf

Greenfield, P. M. (2009). Technology and informal education: What is taught, what is learned. *Science, 323*, 69–71. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=2009012915

Hayles, N. K. (2007). Hyper and Deep Attention: The Generational Divide in Cognitive Modes. *Profession, 2007*(1), 187–199. https://doi.org/10.1632/prof.2007.2007.1.187

IBM. (2024). *How Can A.I. Help Creatives Be More ... Creative?* The New York Times. https://www.nytimes.com/paidpost/ibm/how-can-ai-help-creatives-be-more-creative.html?cpv_ap_id=50670771&utm_campaign=hp&tbs_nyt=2024-june-nytnative_hp

Ishiguro, C., & Okada, T. (2021). How Does Art Viewing Inspires Creativity? *The Journal of Creative Behavior, 55*(2), 489–500. https://doi.org/10.1002/jocb.469

InnoLab5. (2024). InnoLab5 Handout Drivers of Change: Four Scenarios. Jaillant, L., & Rees, A. (2023). Applying AI to digital archives: trust, collaboration and shared professional ethics. *Digital Scholarship in the Humanities, 38*(2), 571–585. https://doi.org/10.1093/llc/fqac073

Kahle, B. (2023, December 4). *AI@IA — Extracting Words Sung on 100 year-old 78rpm records.* Internet Archive Blogs. https://blog.archive.org/2023/04/12/aiia-extracting-words-sung-on-100-year-old-78rpm-records/

Kaufman, J. C., & Glăveanu, V. P. (2019). A Review of Creativity Theories. In *The Cambridge Handbook of Creativity* (pp. 27–43). Cambridge University Press. https://doi.org/10.1017/9781316979839.004

Kavakoglu, A. A., Almag, B., Eser, B., & Alaçam, S. (2022). *AI Driven Creativity in Early Design Education: A pedagogical approach in the age of Industry 5.0*. Proceedings of the International Conference on Education and Research in Computer Aided Architectural Design in Europe, 1, 133–142. https://doi.org/10.52842/conf.ecaade.2022.1.133

Kemény, R. (2019). The social report (Társadalmi riport) 2018 and the Hungarian social report 2019. *Corvinus Journal of Sociology and Social Policy, 10*(1). https://doi.org/10.14267/CJSSP.2019.1.8

Labancz, I., & Barnucz, N. (2016). Kísérlet az IKT-eszközhasználat hatásának vizsgálatára hallgatók körében. In G. Pusztai, V. Bocsi, & T. Ceglédi (Eds.*), A felsőoktatás (hozzáadott) értéke: Közelítések az intézményi hozzájárulás empirikus megragadásához* (pp. 262–277). Partium.

Labadze, L., Grigolia, M., & Machaidze, L. (2023). Role of AI chatbots in education: Systematic literature review. *International Journal of Educational Technology in Higher Education, 20*(1), 56. https://doi.org/10.1186/s41239-023-00426-1

Lindgren, T. (2024, May 16). *How to Create Custom AI Chatbots That Enrich Your Classroom*. Harvard Business Publishing. https://hbsp.harvard.edu/inspiring-minds/how-to-create-custom-ai-chatbots-that-enrich-your-classroom

Lubart, T., Zenasni, F., & Barbot, B. (2019). Creative potential and its measurement. *International Journal of Creativity and Problem Solving, 23*(2), 41-62.

Luhmann, N. (2000). *The reality of the Mass Media*. Stanford University Press.

Nakamura, J., & Csikszentmihalyi, M. (2002). The Concept of Flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of Positive Psychology* (pp. 89–105). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199396511.013.1

Pléh, C. (2012). On the forerunners of the positive psychology vision. *Magyar Pszichológiai Szemle, 67*(1), 13–18. https://doi.org/10.1556/mpszle.67.2012.1.2

Rabinowitz, P. J. (1987). *Before reading: narative conventions adn the politics of interpretation*. Ohio State University Press.

Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan, 42*(7), 305–311.

Rivera, C., & Elksne, Paula. (2024, May 6). *Scenario planning The future will not look like the present*. Week 06 | Team Learning: Addressing the University's Role in the Future, ASEFInnoLab5. https://elearning.asef.org/pluginfile.php/15124/mod_label/intro/RBS%20Scenario%20Planning%20PPT_06%20June%202024.pdf

Robinson, K. (2011). *Out of our minds: Learning to be creative*. Capstone.

Routhier, P., M. (2023, April 28). *Internet Archive weighs in on Artificial Intelligence at the Copyright Office | Internet Archive Blogs.* Internet Archive Blogs. https://blog.archive.org/2023/04/28/internet-archive-weighs-in-on-artificial-intelligence-at-the-copyright-office/

Seligman, M. (2018). PERMA and the building blocks of well-being. *Journal of Positive Psychology, 13*(4), 333–335. https://doi.org/10.1080/17439760.2018.1437466

Seligman, M., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *The American Psychologist, 55*(1), 5–14. https://doi.org/10.1037/0003-066X.55.1.5

Stihler, C. (2023, July 20). *UPDATE AND NEXT STEPS ON CC'S AI COMMUNITY CONSULTATION*. Creative Commons. https://creativecommons.org/2023/07/20/update-and-next-steps-on-ccs-ai-community-consultation/

Szondy, M. (2011). Optimism, quality of life and positive psychotherapy. *Magyar Pszichológiai Szemle, 66*(1), 203–223. https://doi.org/10.1556/mpszle.66.2011.1.13

Padilla, T. (2023, March 10). *Leveraging Technology to Scale Library Research Support: ARCH, AI, and the Humanities*. Internet Archive Blogs. https://webservices.archive.org/pages/arch

Tarkowski, A. (2023, December 19). *AI AND THE COMMONS: THE WIKIMEDIA MOVEMENT*. Open_Future. https://openfuture.eu/blog/ai-and-the-commons-the-wikimedia-movement/

Tóth, Z. (2019). Managing some institutional, sociocultural and on-screen reading challenges of online learning. *International Journal of Recent Technology and Engineering, 8*(1 Special Issue 4), 610–613.

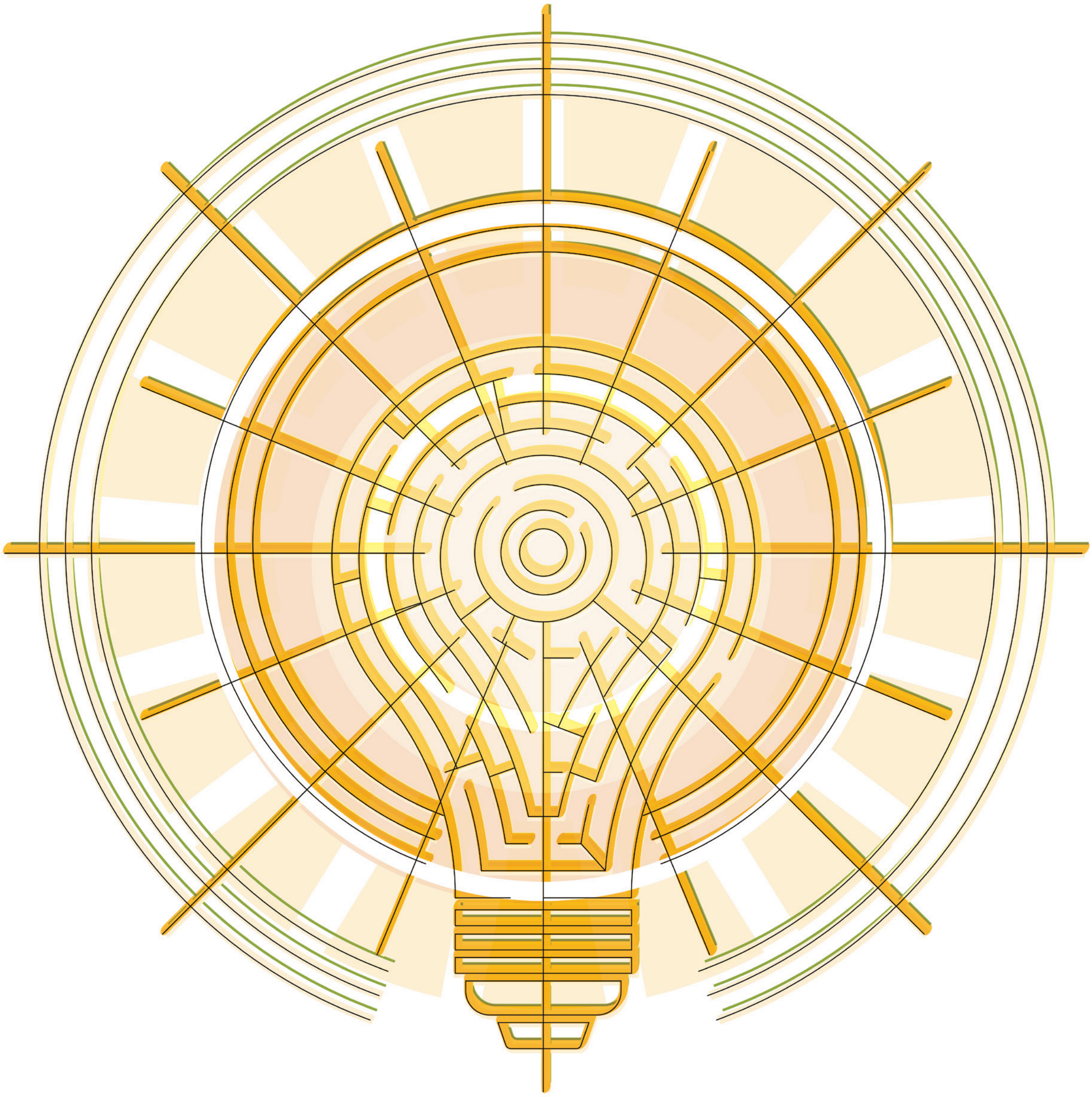
Unsworth, K. (2001). Unpacking Creativity. *The Academy of Management Review, 26*(2), 289–297. https://www.jstor.org/stable/259123

Vinchon, F., Lubart, T., Bartolotta, S., Gironnay, V., Botella, M., Bourgeois-Bougrine, S., Burkhardt, J., Bonnardel, N., Corazza, G. E., Glăveanu, V., Hanchett Hanson, M., Ivcevic, Z., Karwowski, M., Kaufman, J. C., Okada, T., Reiter-Palmon, R., & Gaggioli, A. (2023). Artificial Intelligence & Creativity: A Manifesto for Collaboration. *The Journal of Creative Behavior, 57*(4), 472–484. https://doi.org/10.1002/jocb.597

World Intellectual Property Organization. (2024). *Patent Landscape Report: Generative AI. WIPO*. https://doi.org/10.34667/TIND.49740

PART 3

Universities' Role in AI for Sustainable Development by 2060



Positioning for Success: How Universities in Developing Countries Can Thrive in the AI Era by Focusing on Sustainable Development

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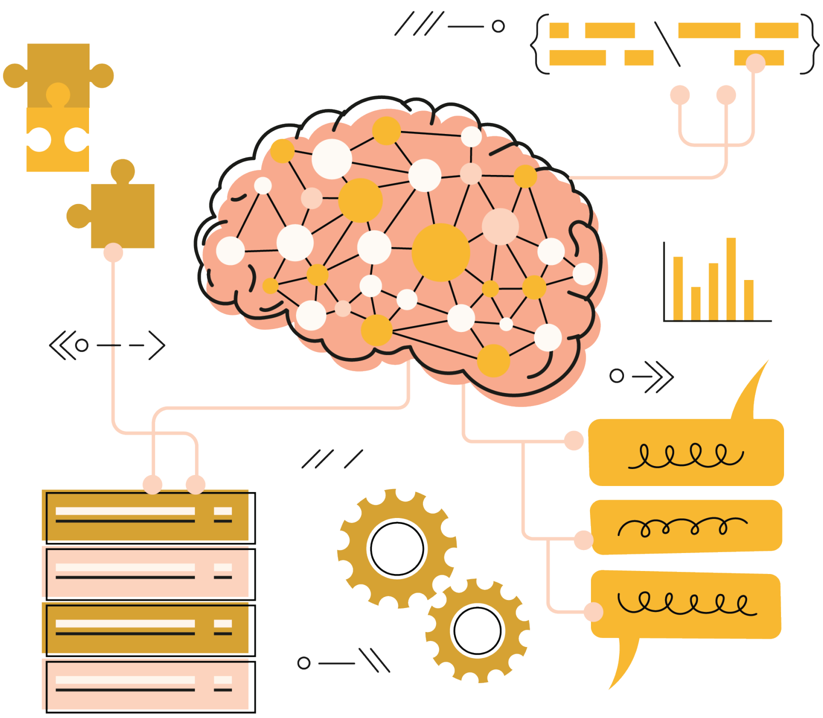


"The AI genie is out of the bottle. To the extent that LLMs were exclusively in the hands of a few large tech companies, that is no longer true. There is no longer a policy that can effectively ban AI or one that can broadly restrict how AIs can be used or what they can be used for."
- Ethan Mollock, "An AI Haunted World"

"Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
- Gro Harlem Brundtland

Introduction

Innovation ecosystems are irreversibly transforming because of Artificial Intelligence (AI), collapsing the traditional divide between the "knowledge economy" and the "commercial economy."

This shift threatens the traditional role of universities as primary knowledge producers, as global commercial companies can now independently create knowledge using advanced computational power and proprietary datasets. While some universities are adapting, many remain vulnerable, risking catastrophic outcomes by not evolving.

Resource-poor universities, especially in developing countries, face additional challenges. While such universities often play important roles in local innovation ecosystems, they also face difficulties due to policy failures, infrastructure deficiencies, and institutional barriers, which can reduce their effectiveness and influence in the global context (Fu & Shi, 2022).

The rapid development of AI systems such as large language models (LLMs) represents both a challenge and a significant opportunity for these universities. To survive, these universities must adopt a "differentiation" strategy, producing unique knowledge to attract funding, collaborations, and students. Focusing on sustainable development, a critical and diverse field, can enhance this strategy.

Sustainable development is already an important area of knowledge, and its importance is likely to continue growing. The fate of the world may indeed hinge upon the advancement of knowledge and understanding related to sustainable development, as well as the effective translation of this knowledge into policies, products, and practices.

Developing expertise in specific areas of sustainable development, forging international research collaborations and adopting a "whole-of-country" approach to AI resource allocation will enable universities in developing countries to be recognised as global leaders in sustainable development, influencing both local and global innovation ecosystems.

In the following four sections, we explore these themes in more detail. In section 2, we investigate the nature of innovation ecosystems and how these ecosystems are rapidly transforming due to the impact of AI. Building on this, section 3 outlines four future scenarios based on different combinations of technology focus and equity. We also briefly examine the implications of each scenario for universities, especially those in developing countries. Section 4 then offers recommendations aimed at positioning universities in developing countries to thrive in the AI era, primarily by focusing on sustainability. The final section summarises key insights and conclusions.

The Reality for Universities for the Emerging AI Era

The Nature of Innovation Ecosystems

Innovation ecosystems are an "evolving set of actors, activities, artifacts and institutions that are important for the innovative performances of these actors" (Granstrand & Holgersson, 2020). Traditionally, they comprise 'two distinct but separated economies: the knowledge economy, driven by research, and the commercial economy, driven by the marketplace' (Jackson, 2011).

To date, universities have played a critical role in the knowledge economy through engagement in basic and applied research, producing new knowledge that is traditionally transferred to the commercial economy through technology transfer offices. Universities have also played a fundamental role in education and talent development, helping to produce a skilled workforce that contributes to the innovation ecosystem in both the knowledge and commercial economies.

Innovation Ecosystems are Transforming

However, innovation ecosystems are now undergoing transformation due to the rapid advancement of LLMs, which have blurred the distinction between the knowledge and commercial economies. Companies such as Alibaba, OpenAI, Baidu, Google, Meta, Microsoft, and Tencent now possess computational platforms and vast proprietary datasets, allowing them to generate knowledge and influence education on a global scale.

Transformation processes within innovation ecosystems tend to be driven by the changing value propositions of the actors and entities within them (Oghazi et al., 2022). Actors that no longer offer sufficient perceived value may be forced out. Other existing actors may assume new roles based on their evolving value propositions, and new actors offering attractive benefits may enter.

Cost-driven vs Differentiated Value Propositions: Implications for Universities

In innovation ecosystems, sustainable value propositions typically fall into two categories: cost leadership, where services or products are offered at lower costs than alternatives, and differentiation, where unique benefits justify higher prices (Porter, 1980).

In the emerging AI era, commercial entities, leveraging scale, low-cost data collection, and cross-subsidisation of services, are likely to enjoy cost advantages over many universities in producing and disseminating knowledge globally. Thus, for many universities, focusing on cost leadership is unlikely to be a viable strategy. Instead, these universities need to adopt a differentiation strategy that aims to offer unique benefits to students, researchers and other actors in the innovation ecosystem.

This is a particular issue for many universities whose primary value proposition has been their location (Winter and Thompson-Whiteside, 2017; Rainisto, 2003). While in the past, students have been attracted to such institutions primarily because of their geographical convenience, in the emerging AI era, students will be able to pursue their education online, enabling them to choose universities that best align with their needs and budgets, regardless of geographical location.

Universities are also at risk from commercial entities, such as Google, which offer students career certificate programs, that treat certifications as equivalent to traditional degrees and offer fully remote learning options (Gallagher, 2020). In addition, researchers are also increasingly drawn to commercial entities that possess the computational power and datasets necessary for generating new knowledge.

Recognising this threat, some leading universities such as Harvard University are offering courses online for free. Others, such as Fudan University in Shanghai, are developing their own computational platforms and proprietary datasets, enabling them to produce and disseminate new and unique knowledge in particular domains such as life sciences and ancient Chinese civilisation (Chen, 2024).

Other smaller universities with fewer resources have focused on differentiation strategies in areas such as sustainable development. This has evolved as an attractive area due to its importance to both the local and global community and also the diverse range of knowledge that it covers, as reflected in the UN's well-known Seventeen Sustainable Development Goals (Figure 1).

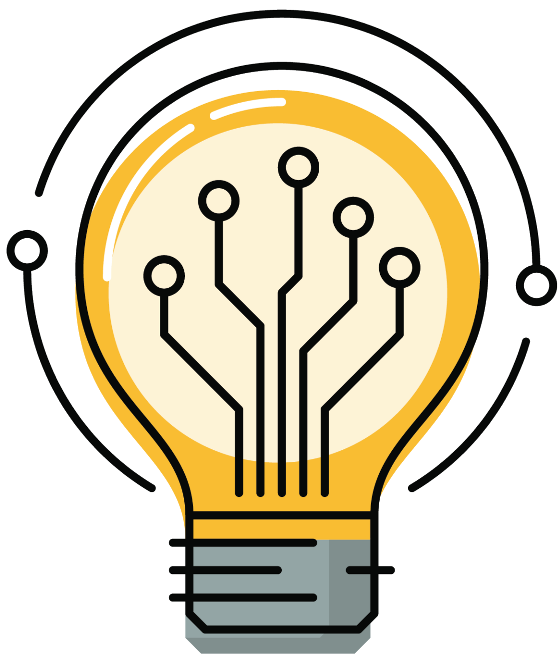


Figure 1. Sustainable Development Goals *Source: United Nations*

For many other universities, however, the implications of the transforming innovation ecosystem and the need to choose either a cost leadership or differentiation strategy in order to ensure long-term survival have yet to be fully recognised.

Universities in developing countries face particularly complex strategic decisions about how to position themselves as innovation ecosystems transform. These universities already experience significant challenges and vulnerabilities, including funding shortages, ongoing infrastructure deficiencies, policy setbacks and a lack of skilled personnel. While pursuing a cost leadership strategy may not be feasible, in formulating a differentiation strategy they must successfully navigate the substantial investment in computational power and associated infrastructure that will be required in the evolving AI era.

However, success stories do exist. As outlined in Figure 2, some universities in developing countries have meaningfully distinguished themselves by making significant strides in sustainable development:

In summary, universities face an uncertain future as innovation ecosystems transform. AI's advancement marks an irreversible shift in existing paradigms (Mollick, 2023), and universities must adapt and reposition themselves to stay relevant.

To provide more clarity about the future of universities, in the next section we will explore four potential scenarios they may face as the AI era unfolds.

1. **Tata Institute of Social Sciences** (India) is recognized as a key player in shaping social sustainability strategies in India and other developing countries (Mukherji, 2019; UN India, 2023).
2. **The Asian Institute of Technology** (Thailand) has significantly influenced environmental policies and practices in Southeast Asia (AIT, 2023; UNESCAP, 2021).
3. **Universitas Gadjah Mada** (Indonesia) is recognized for its leadership in community-based sustainability initiatives (Universities Gadjah, 2023; World Bank, 2021).
4. **Tsinghua University** (China) is a frontrunner in sustainable campus design, setting a standard for educational institutions in China and globally (Internationally Sustainable Campus Network 2022).
5. **The University of the Philippines Diliman** is a model for other universitiesin the Philpines due ot its comprehensive sustainability effort (Philippines Sustainable Development Network, 2023)
6. **The University of Malaya** is partnering with international universities and industries to develop sustainable technology and practices, contributing to Malaysia's national sustainability goals (UNESCO, 2022).

Figure 2. Examples of universities in developing countries that have achieved international recognition for their work in sustainable development

Four Potential Scenarios for Universities in Developing Countries in 2060

In order to develop recommendations for how universities in developing countries should adapt to changing innovation ecosystems, in this section four potential future scenarios for the year 2060 are explored. As described in Figure 3, the design of these scenarios is based on different combinations of two important drivers of change: 1) the emphasis on societal benefit and the overall good of users, versus 2) the technological progress and potential financial gains driven by major commercial entities.

Each scenario offers insights into possible futures, helping universities navigate the evolving innovation ecosystem and make informed strategic decisions.

Common to all four scenarios is the assumption that, in 2060, most students study online or can choose this option for significant portions of their education. Students therefore choose universities that best fit their needs and budgets, regardless of location. This has important implications for universities whose primary value proposition has traditionally been their convenient location.

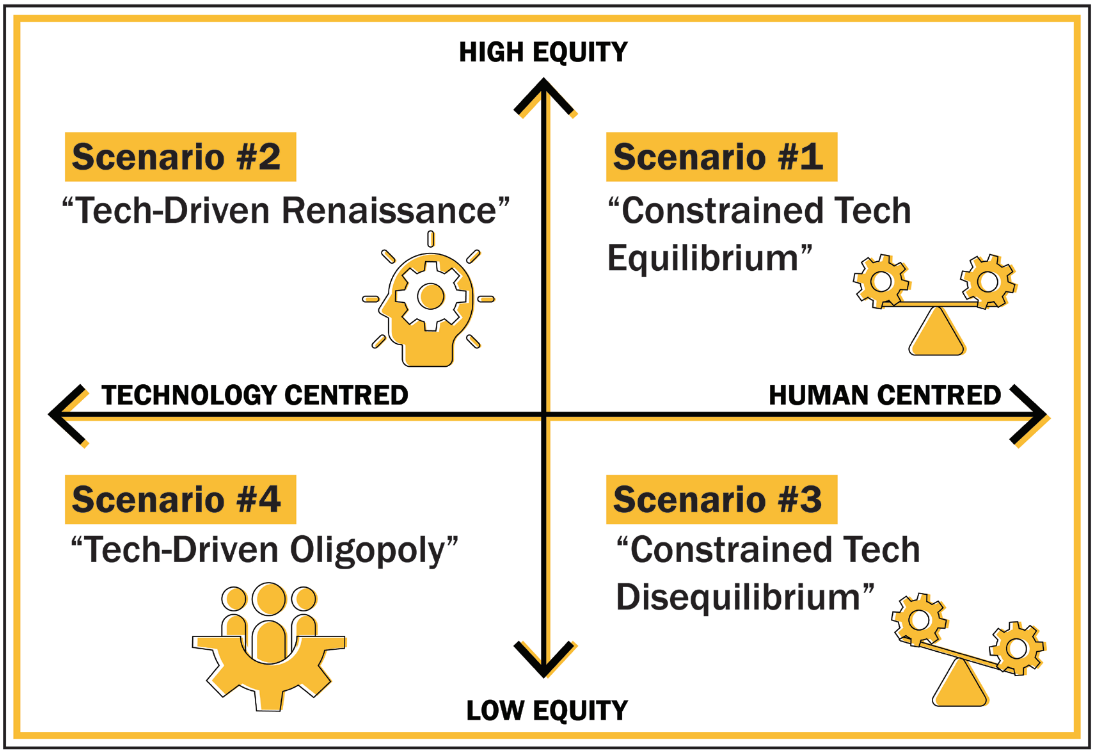


Figure 3. Four Potential Scenarios in 2060

Scenario 1: Constrained Tech Equilibrium (high equity, human-centred)

In this scenario, policies and initiatives act to constrain AI development in order to ensure AI technologies are accessible to all segments of society, thereby reducing the digital divide between those with and without access. Equality of access to efficient, well-performing systems that focus on achieving human-centred objectives is prioritised over cutting-edge development.

In this scenario, Sustainable Development Goals (SDGs) have become a focal point for AI technology development, generating significant benefits for society.

This results in many "winners", especially among developing countries where universities can contribute to specific sets of SDGs and develop unique knowledge and expertise.

This leads to competitiveness among universities, both for student recruitment as well as research and funding, as they develop niche areas of strength in using AI for specific SDGs. Researchers collaborate based on shared SDGs rather than who has the best technology and resources.

Universities are able to attract students and researchers based on their particular focus and expertise in SDGs, rather than relying on traditional prestige or location-based convenience.
As universities pour resources, talent and research into specific SDGs, most SDGs are achieved by 2060.

Scenario 2: Tech-Driven Renaissance (high equity, tech-centred)

In this scenario, AI development is driven by a focus on cutting-edge technology balanced by ethical considerations and ensuring that AI technologies are accessible to all. As for Scenario 1, a key aim is to reduce the digital divide. However, the important difference in Scenario 2 is that AI technology development is relatively unconstrained, leading to rapid advances in technology and knowledge that can empower communities.

As a result, there are both “winners” and “losers” among universities under this scenario.

Universities that have the resources to continue investing in AI and infrastructure have a competitive advantage and emerge as winners. They attract the best students and research collaborators and produce more advanced research results and educational programs. They also exert more power and influence over policy.

Accessibility for all means increased focus in areas such as SDGs, with universities worldwide conducting research in this area. Universities in developing countries that specialise in niche areas of knowledge have the potential to stand out, leading to greater international recognition, and more opportunities for research collaborations and funding.

Losers represent those universities that are not differentiated and receive minimal or no funding for AI. These institutions struggle to attract top talent and risk being absorbed by larger universities or closed.

Scenario 3: Constrained Tech Disequilibrium (low equity, human-centred)

In this scenario, AI development prioritises human-centred goals, but benefits are concentrated among elite groups with greater access to technology. Significant disparities exist in access to AI technologies, with underserved communities left behind.

Universities that have invested in AI and infrastructure have emerged as winners, producing advanced research and attracting top students and collaborators. Developing countries that have chosen a “whole-of-country” approach to AI, and whose universities have successfully adopted differentiation strategies in areas such as SDGs, have created winners that are internationally recognised and enjoy strong research collaborations.

Many winners have also invested heavily in applied research and commercialising their own knowledge rather than relying on the commercial economy. They have built their own self-contained innovation ecosystems to compete against large commercial enterprises.

Under this scenario, there are many more losers due to a lack of investment in AI and failure to successfully adopt a differentiation strategy. It is likely that fifty percent or more of universities that existed in 2024 have either been absorbed by larger universities or have closed down.

Scenario 4: Tech-Driven Oligopoly (low equity, tech-centred)

In this scenario, AI development is primarily focused on technological advancements and optimisation, with little regard for equitable access. The benefits of AI are concentrated among those who possess the resources and skills to leverage advanced technologies.

The pressure to keep pace with rapid technological advances and remain at the cutting-edge places an enormous strain on resources and is beyond the reach of all but the biggest and best-funded universities, who emerge as winners. It is likely that seventy-five per cent or more of the universities that existed in 2024 have either been absorbed by larger universities or have closed down.

Winners continue to invest heavily in high-performance computing, AI labs, and digital networks, positioning themselves as leaders in AI research and online education. Competing fiercely for talent, they wield significant policy influence and focus on applied research and commercialisation, creating self-contained innovation ecosystems.

Developing countries that have adopted a “whole-of-country” approach to AI may produce a few ‘winners’ through niche differentiation in areas like SDGs. However, these successes are rare. Most universities in these regions, lacking significant AI investments and struggling with infrastructural challenges, find it extremely difficult to compete on a global level. They fail to gain international recognition or secure critical collaborations. As a result, developing nations increasingly depend on franchise campuses or online degrees offered by elite universities in developed countries. This reliance further erodes local educational ecosystems, as the best students and researchers migrate towards these external institutions, perpetuating a cycle of dependency and underdevelopment.

Based on these scenarios, the next section offers four recommendations for universities in developing countries to consider if they are to survive and thrive in the emerging AI era.

Four Recommendations for Universities in Developing Countries to Thrive in the Emerging AI Era

No-Regret Move 1: Use AI to build/enlarge expertise in sustainable development and aim to become recognised leaders in this field

To remain relevant in the transforming innovation ecosystem, universities in developing countries need to differentiate themselves by offering value propositions that are perceived as unique by other ecosystem actors.

Harnessing AI to build expertise in sustainable development provides universities in developing countries with the opportunity to become recognised as leaders in a field that is critical to society's future. It will open up many new opportunities for them and allow faster and higher-quality research outcomes.

Sustainability imperatives are becoming increasingly central to the global educational system, particularly in emerging countries where the need to align development with environmental and social responsibility is critical. As these nations pursue economic growth, their educational institutions must integrate sustainability into their core strategies, equipping students and researchers with the knowledge and skills needed to address pressing global challenges (e.g., climate change, resource management or social equity).

In addition, sustainable development incorporates a diverse range of areas where more knowledge is required, allowing universities to develop their own specialist niches. This combination of an important field of research, with many unexplored areas that focus on social cohesion and human development makes sustainable development an ideal field for universities in developing countries to build their expertise and develop unique value propositions that enable them to stand out, thereby attracting top students, talented researchers, collaborations and funding.

Key evidence to support this recommendation includes:

- **Essential Role in SDGs:** Universities are crucial to achieving the UN's SDGs through education, research, and innovation. Sustainable development is a rapidly growing field of research, though many areas remain unexplored, providing significant opportunities for academic contributions (Yamaguchi, 2022).

- **World Bank Alignment:** The World Bank advises that universities prioritise strategies focusing on growth, competitiveness, social cohesion, and human development. This makes sustainable development an attractive area for universities to invest in, aligning with global priorities (World Bank, 2021).

- **AI for Leapfrogging:** Developing countries often trail in technology adoption, but AI offers a means to leapfrog traditional stages of development. By directly adopting advanced technologies, these countries can achieve rapid progress in sustainable development, driving economic and social gains without the constraints of legacy systems (Fong, 2019).

- **AI's Impact Across Sectors:** AI applications, such as telemedicine, can significantly improve health outcomes at lower costs in developing countries, highlighting AI's transformative potential in healthcare (Maisiri & van Dyke, 2018; Barros et al., 2019) and other critical sectors like education (Tarisayi, 2024), energy (Batinge, 2017), water management (César Casiano Flores et al., 2023), waste management (Kurniawan et al., 2022) and agriculture.

- **Existing Cases:** As outlined in section 2.3, some universities in developing countries have already achieved leadership roles in sustainable development.

No-Regret Move 2: Achieve a leadership position in sustainable development through strengthening collaborative research and adopting a "Whole of Country" Approach to resource-sharing

Universities in developing countries already possess valuable expertise in sustainable development, which can be leveraged to establish a leadership role in this field.

However, access to computational power and technology infrastructure will be a critical factor of success for universities in the AI era. This is likely to be expensive and out of reach for most universities in developing countries.

To address this, these universities should focus on collaborative research and resource-sharing by forming consortia and adopting a cohesive, "whole-of-country" strategy for AI infrastructure. Such collaboration allows universities to pool resources, enhancing their capabilities in sustainability research. In the AI era, where advanced technologies and data access are critical, this approach ensures that universities remain at the forefront of innovation.

By prioritising sustainable development as a collective national effort, universities can drive meaningful impact, attract international partnerships, and maintain competitive, high-quality sustainability education programs globally.

Key evidence to support this recommendation includes:

- **Collaboration in Sustainable Development:** Collaborative efforts in sustainable development are crucial for influencing policy and resource allocation, leading to improved research outcomes and knowledge creation. Universities that pool their resources in sustainability initiatives can achieve greater impact (Caniglia et al., 2018; Sadic, 2024).

- **Existing Collaborative Models:** Successful consortia, such as the African Research Universities Alliance and the ASEAN University Network, highlight how collective efforts in research and education can effectively advance sustainability goals across regions (ARUA, 2024; AUN, 2024).

- **National Strategies for AI and Technology Adoption:** The US Department of Defense's AI adoption strategy and Finland's National AI Strategy demonstrate how national coordination can drive technology adoption, ensuring that advancements benefit the entire nation (Clark, 2023; FCAI, 2024).

- **Examples of Effective National Strategies:** National strategies like the United States' National Innovation Pathway, Denmark's National Digital Healthcare Adoption, and Singapore's Singpass show how integrating technology into national frameworks can create widespread benefits for society (Mission Innovation, 2022; Health Policy, 2024; Singpass, 2024).

No-Regret Move 3: Treat AI data as a key strategic resource

In the AI era, access to proprietary and unique data will be crucial for universities aiming to lead in sustainable development.
For universities in developing countries, having data that generates new insights and knowledge will be essential. Their focus needs to be on locally relevant issues such as sustainable agriculture, renewable energy, and climate adaptation.

For this to happen, universities need to focus on collecting novel data, building proprietary datasets and protecting these as key strategic resources. This requires a focus on collecting original data, developing proprietary datasets, and safeguarding them as strategic assets. Initiatives such as robust access controls, Digital Rights Management (DRM) technology, formal intellectual property (IP) registration (copyright, patents), watermarking, and IP rights monitoring and enforcement are essential to prevent commercial platforms like ChatGPT from exploiting university data and knowledge without appropriate recognition and compensation.

Key evidence to support this recommendation includes:

- **Data as a Competitive Advantage:** Data is increasingly regarded as the "new oil" in the AI economy, serving as a vital resource that offers significant competitive advantages when it is exclusive and proprietary (Hartmann & Henkel, 2020).

- **Global Best Practices: the GDPR:** The necessity of strong data governance is underscored by global frameworks like the European Union's General Data Protection Regulation (GDPR), which highlights the importance of safeguarding data as a critical and valuable resource (European Commission, 2020).

- **Resource-Based Theory:** Organisations that effectively manage and protect their unique resources, such as proprietary data, are more likely to sustain a competitive edge, particularly in areas where AI and data-driven insights are crucial (Collis & Montgomery, 1995).

- **Strategic Data Management:** Successful organisations treat data as a strategic asset, employing strong protections like access controls, DRM, and IP registrations to prevent unauthorised use and to safeguard their competitive advantage (Johnston, 2020).

- **Industry Success - McKinsey Report:** Organisations that strategically manage their data assets tend to outperform competitors in innovation and market positioning, emphasising the value of high-quality, unique data in AI-driven sectors (McKinsey, 2022).

- **Practical Example - Fudan University:** Fudan University demonstrates the importance of developing and securing proprietary datasets, particularly in specialised fields like life sciences, to establish and maintain a competitive edge (Zhimin, 2024).

Universities in developing countries could follow the lead of Fudan and prioritise the collection, protection and governance of proprietary data to build a leadership position in sustainable development. Implementing strong data management strategies, including access controls, DRM, and IP registration, will ensure that their data remains a valuable and strategic resource, enabling them to generate unique insights and maintain a competitive edge in the AI era.

No-Regret Move 4: Leverage AI to create in-house innovation ecosystems and become more financially sustainable

Creating in-house innovation ecosystems that emphasise sustainable development can significantly enhance the financial sustainability of universities.

As the historical barriers between the knowledge economy (where universities have been key actors) and the commercial economy (which turns such knowledge into products and services) fall away, powerful corporations such as Alibaba, OpenAI and Google now possess the computation platforms and the datasets to produce knowledge and play an increasing role in education and talent development.

Universities in developing countries can respond to this challenge by extending their activities further into the commercialisation of knowledge, rather than leaving this to the commercial economy. This could involve the creation (or strengthening) of commercialisation offices, developing incubator and accelerator spaces within universities and establishing internal venture capital funds to financially support startup companies emerging from incubators and accelerators. They can also create innovation hubs and technology parks on university campuses to foster collaboration and innovation and share resources.

Key evidence to support this recommendation includes:

- **Relevance of Revenue Diversification:** Revenue diversification by universities has a significant positive relationship with financial sustainability (Jafaar et al., 2021). However, on average, universities only capture 16% of the revenue they have helped to create through ground-breaking discoveries (Wharton, 2021).

- **Shifts in the Role of Universities:** While many universities in Southeast Asia and India continue to play a traditional role of teaching and generating human capital, universities in other countries such as Singapore, China, Taiwan, and Japan are being transformed into entrepreneurial universities where innovation and commercialisation of research are highly encouraged (Krishna, 2019).

Conclusion

The transformation of innovation ecosystems, driven by AI advancements, presents universities in developing countries with both significant challenges and unprecedented opportunities. As commercial enterprises increasingly dominate knowledge production, universities must carve out a distinctive role if they are to survive and thrive in the AI era.

Focusing on sustainable development offers a compelling path forward. By embracing AI to deepen expertise in this critical field, universities in developing countries can achieve global recognition and influence. Adopting collaborative research models, prioritising resource-sharing at a national level, treating AI data as a strategic asset, and developing internal innovation ecosystems are key steps that will help these institutions remain relevant and competitive.

Universities that successfully integrate AI into their research and educational frameworks, particularly in the area of sustainable development, will not only secure their survival but also play a pivotal role in shaping a more equitable and sustainable global future.

References

ARUA. (2024). *African Research Universities Alliance: Promoting collaborative research in Africa*. https://arua.org

AUN. (2024). *ASEAN University Network: Advancing higher education in Southeast Asia*. https://www.aunsec.org

Barros, J. M., Melo, C., & Couto, M. E. (2019). Artificial Intelligence in Clinical Decision Support: A Focused Review. *Frontiers in Medicine, 6*, 154. https://doi.org/10.3389/fmed.2019.00154

Batinge, B., Musango, J. K., & Brent, A. C. (2017). Leapfrogging to renewable energy: The opportunity for unmet electricity markets. *South African Journal of Industrial Engineering, 28*(4). https://doi.org/10.7166/28-4-1702

Caniglia, G., John, B., Bellina, L., Lang, D. J., Wiek, A., Cohmer, S. S., & Laubichler, M. D. (2018). The glocal curriculum: A model for transnational collaboration in higher education for sustainable development. *Journal of Cleaner Production, 171*, 368-376. https://doi.org/10.1016/j.jclepro.2017.09.059

Casiano Flores, C., Rodriguez, P., Dolman, N., & Özerol, G. (2023). Assessing the leapfrogging potential to water sensitive: The Dutch case of Zwolle. *Journal of Water and Climate Change, 14*(5), 1638–1655. https://doi.org/10.2166/wcc.2023.493

Centre for EU-Asia Connectivity. (n.d.). Retrieved June 21, 2024, from https://ceac-rub.org/network/

Chen, Z., (2024) Vice President of Fudan University Keynote address to ASEFInnoLab5 participants, on “AI for Science,” 2 May 2024

Clark, J. (2023). *DOD releases AI adoption strategy*. DOD News. https://www.defense.gov/News/News-Stories/Article/Article/3578219/dod-releases-ai-adoption-strategy/

Collis, D. J., & Montgomery, C. A. (1995). Competing on resources: Strategy in the 1990s. *Harvard Business Review, 73*(4), 118-128. https://doi.org/10.1057/9780230367685_7

European Commission. (2020). *General Data Protection Regulation (GDPR): Strengthening the EU data protection framework*. European Commission. https://ec.europa.eu/info/law/law-topic/data-protection_en

FCAI. (2024). *AI ecosystem in Finland*. Finnish Center for Artificial Intelligence. https://fcai.fi/ai-ecosystem-in-finland

Fong, M. W. L. (2009). Technology leapfrogging for developing countries. In *Encyclopedia of Information Science and Technology, Second Edition*. https://www.igi-global.com/chapter/technology-leapfrogging-developing-countries/14129

Fu, X., & Shi, L. (2022, April). *Direction of Innovation in Developing Countries and its Driving Forces*. World Intellectual Property Organization (WIPO) Economic Research Working Paper Series No. 69. http://dx.doi.org/10.2139/ssrn.4422271

Gallagher, S. R. (2020, January). *The Future of University Credentials: New Developments at the Intersection of Higher Education and Hiring*. Harvard Education Press.

Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation, 90,* 102098. https://doi.org/10.1016/j.technovation.2019.102098

Hartmann, P., & Henkel, J. (2020). The rise of corporate science in AI: Data as a strategic resource. *Academy of Management Discoveries, 6*(3), 359-381.

Health Policy. (2024). *Digital health in Denmark: The national strategy*. Health Policy. https://healthpolicy.se/digital-health-in-denmark/
Iansiti, M. (n.d.). *The value of data and its impact on competition.* Harvard Business School. https://www.hbs.edu/ris/

Jackson, D. J. (2011). *What is an Innovation Ecosystem?* National Science Foundation. Arlington, VA. https://doi.org/10.1016/j.technovation.2019.102098

Jaafar, J. A., Latiff, A. R. A., Daud, Z. M., & Osman, M. N. H. (2021). Does Revenue Diversification Strategy Affect the Financial Sustainability of Malaysian Public Universities? A Panel Data Analysis. *Higher Education Policy*. https://doi.org/10.1057/s41307-021-00247-9

Johnston, R. (2020). *The Rise of Corporate Science in AI: Data as a Strategic Resource*. ResearchGate. https://www.researchgate.net/publication/340566964_The_Rise_of_Corporate_Science_in_AI_Data_as_a_Strategic_Resource

Khan, F., Zhang, B., Khan, S., & Chen, S. (2011). Technological leapfrogging e-government through cloud computing. In *2011 4th IEEE International Conference on Broadband Network and Multimedia Technology* (pp. 201-206). Shenzhen, China. https://doi.org/10.1109/ICBNMT.2011.6155925

Krishna, V. V. (2019). Universities in the national innovation systems: Emerging innovation landscapes in Asia-Pacific. *Journal of Open Innovation: Technology, Market, and Complexity, 5*(3), 43.

Kurniawan, T. A., Dzarfan Othman, M. H., Hwang, G. H., & Gikas, P. (2022). Unlocking digital technologies for waste recycling in Industry 4.0 era: A transformation towards a digitalization-based circular economy in Indonesia. *Journal of Cleaner Production, 357*, 131911. https://doi.org/10.1016/j.jclepro.2022.131911

Li, S., Zhou, K., Guo, S., Li, Z., & Li, H. (2020). Intelligent optimization for combined cooling, heating and power systems using deep reinforcement learning. *Applied Energy, 279*, 115823. https://www.sciencedirect.com/science/article/pii/B9780128206256000116

Maisiri, E., & van Dyke, D. (2018). AI-based telemedicine programs and healthcare outcomes in developing countries. *Journal of Health Informatics, 12*(3), 45-60.

McKinsey & Company. (2022). *The role of data management in business success: A McKinsey Report*. McKinsey & Company. https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights

Mehta, N., & Maarala, M. (2020). *Building an AI Innovation Ecosystem in Higher Education*. The Tambellini Group. https://www.thetambellinigroup.com/building-an-ai-innovation-ecosystem-in-higher-education/

Ministry of Economic Affairs and Employment of Finland. (2019). *Leading the way into the age of artificial intelligence. Final report of Finland's Artificial Intelligence Programme 2019*. http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41_19_Leading%20the%20way%20into%20the%20age%20of%20artif

Mission Innovation. (2022). *National Innovation Pathway Roundup: All MI Countries*. https://mission-innovation.net/wp-content/uploads/2022/09/National-Innovation-Pathway-Roundup_All-MI-Countries.pdf
Mollick, E. (2023, December). *An AI haunted world*. One Useful Thing. https://www.oneusefulthing.org/p/an-ai-haunted-world

Mollick, E. (2023, March 15). *The future of universities in the AI era*. Wharton Knowledge. https://knowledge.wharton.upenn.edu/article/future-universities-ai/

Oghazi, P., Parida, V., Wincent, J., & Mostaghel, R. (2022). Ecosystems transformation through disruptive innovation: A definition, framework and outline for future research. *Journal of Business Research, 147*, 16-26. https://doi.org/10.1016/j.jbusres.2022.03.072

Porter, M. E. (1998). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: Free Press.

Rainisto, S.K. (2003). *Success Factors of Place Marketing: A Study of Place Marketing Practices in Northern Europe and The United States.* [Doctoral dissertation, Helsinki University of Technology].

Reichstein, M., Röder, A., Papale, D., Schulz, K., Boehlert, S., Linke, S. & Knohl, A. (2019). Making Earth system science data more accessible to machine learning. *Bulletin of the American Meteorological Society, 100*(11), 2133-2144.

Sadic, S., Emre Demir, E., & José Crispim, J. (2024). Towards a connected world: Collaborative networks as a tool to accomplish the SDGs. *Journal of Cleaner Production, 462*, 10.

Siemens, G., Long, P., & Kleiber, M. (2019). Personalized Learning with AI: A Review of Recent Developments. *Educational Research Review, 27*, 164-181. https://www.researchgate.net/publication/351255837_Personalized_Education_in_the_Artificial_Intelligence_Era_What_to_Expect_Next

Singpass. (2024). *Singapore's national digital identity system.* Singpass. https://www.singpass.gov.sg

Tarisayi, K. (2024). Preparing for AI's transformational potential: Rethinking teacher education in South Africa. *International Education Trend Issues, 2*(1), 31-40. https://ijble.com/index.php/ieti/article/view/364

United Nations. (n.d.). *Sustainable Development Goals.* https://sdgs.un.org/

University of Belgrade, Serbia. (n.d.). *Data and data center trends in Southeast Asia.* https://www.digitaledgedc.com/blog/data-and-data-center-trends-in-southeast-asia

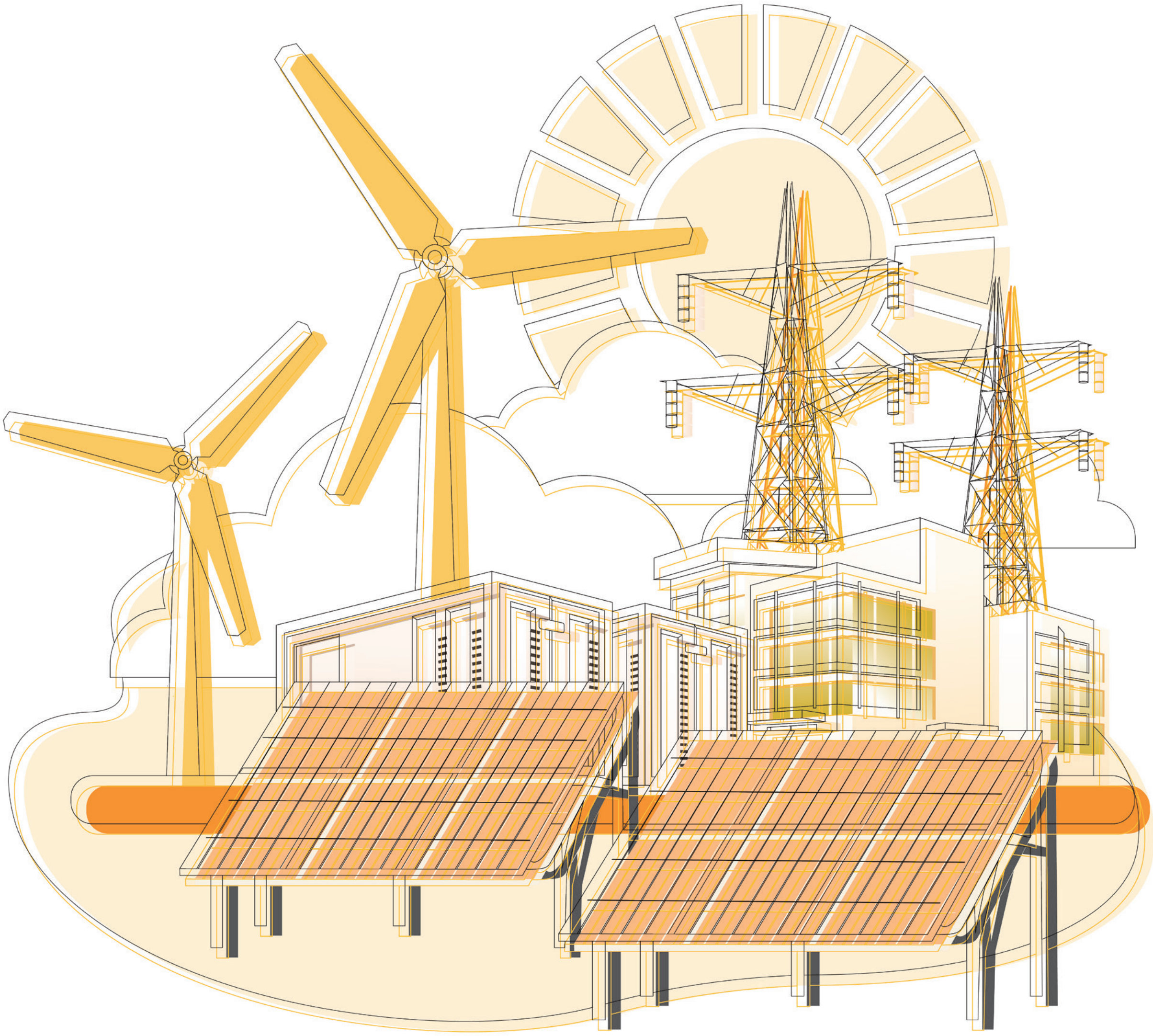
University of Malaya. (2022, April 6). *UM and WWF-Malaysia lead sustainable biodiversity and ecosystem development in Malaysia.* https://um.edu.my/news/um-and-wwf-malaysia-leads-sustainable-biodiversity-and-ecosystem-development-in-malaysia

Wharton University. (2021, January 28). *How could universities more effectively commercialize their work?* World Economic Forum. https://www.weforum.org/agenda/2021/01/university-research-academic-innovation-commercial-value-higher-education/

Winter, E. and Thompson-Whiteside, H. (2017). "Location, location, location: does place provide the opportunity for differentiation for universities?", *Journal of Marketing for Higher Education, Volume 27*.
World Bank. (2021). *World development report 2021: Data for better lives (Report No. 978-1-4648-1600-0)*. https://doi.org/10.1596/978-1-4648-1600-0

World Economic Forum. (2020). *The future of jobs report 2020*. World Economic Forum. https://www.weforum.org/publications/the-future-of-jobs-report-2020/

Yamaguchi, N. U., Bernardino, E. G., Ferreira, M. E. C., de Lima, B. P., Pascotini, M. R., & Yamaguchi, M. U. (2022). Sustainable development goals: A bibliometric analysis of literature reviews. *Environmental Science and Pollution Research, 30*(3), 5502–5515. https://doi.org/10.1007/s11356-022-24379-6



Universities as Catalysts for Responsible AI: Reconciling Conflicting SDGs within AI Innovation Ecosystems in 2060

No-regret move formulation using a scenario-based approach

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Introduction

The post-corona global society faces critical challenges in addressing sustainability issues that threaten Planetary Health (Fuller, 2022). Universities worldwide have led the way in developing models on planetary boundaries, predicting societal risks. However, the emergence of business-owned Artificial Intelligence (AI) is challenging the traditional role of universities as the guardians of high-quality knowledge. Universities, valued for their academic freedom and service to society, have been instrumental in advancing the Sustainable Development Goals (SDGs) (UN, 2024). While emerging AI models demonstrate significant potential in addressing complex sustainability challenges, and reconciling conflicting (↔) SDGs, they also introduce significant geopolitical risks that could lead to existential disruptions (Pauwels, 2019). Consequently, universities' role in shaping future applications is influenced by two key drivers: 1) ensuring equity in AI-Technology and 2) balancing technological advancements with human and ecological considerations.

AI technology is advancing rapidly, particularly in generative AI, with models like OpenAI's GPT-4, Google's Gemini, and the improved Claude model at the forefront. Investment costs for these models, ranging from tens to hundreds of millions of USD, are growing exponentially (AI Index, 2024). This trend is connected to the Graphics Processing Unit (GPU) demand, essential for the massive server parks that host these models. GPU production involves mining conflict materials such as tin, tantalum, and tungsten, negatively (↓) impacting 'life on land' (SDG 15 ↓) (Maus and Werner, 2024). This in turn increases concerns about 'responsible consumption and production' (SDG 12 ↓) and the environmental hazards of electronic waste, which endanger nature and human health (SDG 3 ↓) (Gupta et al., 2021; Dey et al., 2023). Additionally, the increasing energy requirements for these server parks threaten affordable and clean energy' (SDG 7 ↓) as Renewable Energy Sources (RES) are currently insufficient to meet rising demand. High costs associated with AI technology also lead to reliance on paid access services, aggravating disparities in 'quality of education' (SDG4 ↓) and 'reduced inequalities' (SDG 10 ↓), as free versions often fall short and place users at a disadvantage.

Universities are grappling with the ethical use of AI tools, including issues of plagiarism and appropriate usage. Often decisions on paid versus free services are left to individual discretion, raising concerns about equity and accessibility. Efforts are underway to develop AI models that enhance human interaction, and address privacy, transparency, and fairness. However, AI's impact on job roles and industry practices, potentially disrupting 'decent work and economic growth' (SDG 8 ↓) for certain professionals groups (Khogali and Mekid, 2023), is a significant concern. University responses to generative AI vary from outright bans to cautious adoption and stricter controls. The trend towards regulated use reflects a global transition phase where universities seek to balance innovation with Ethical, Legal and Social implications (ELSI).

To navigate these challenges effectively, we propose establishing SynergyHub, a collaborative platform designed to address these issues. By examining existing conflicts and outlining four potential AI-ecosystem scenarios, we have developed practical recommendations for universities. These recommendations are based on proven actions and aim to guide universities in managing the complex landscape of AI development while advancing sustainability goals.

The Status Quo of Striving for Sustainability; Conflicting SDGs

AI is increasingly applied in research and applications that can pave the way to positively impact (↑) SDGs. Technologies like satellite imagery and machine learning algorithms are optimising crop yields by predicting weather patterns and monitoring plants' health. AI-optimised supply chains and logistics also commute to waste reduction. AI became a game-changer in SDG3, where AI models are transforming healthcare by predicting disease outbreaks and health trends and diagnosing diseases with greater accuracy and speed than traditional methods, even from remote locations. AI is used to design and manage smart cities, optimising traffic flow, energy use and water management systems. Additionally, robotic systems powered by AI are performing hazardous tasks, supporting economic growth, decent work, and industrial innovations.

Vinuesa and colleagues (2020) provided a comprehensive overview of AI's role of achieving the SDGs, highlighting both positive and negative impacts on most SDGs, particularly in areas like quality of education. Surprisingly, few negative effects were reported for environmentally-focussed SDGs, such as 13, 14 and 15 (↓). This discrepancy is notable given that estimates suggest an electricity demand for information and communications technologies requiring up to 20% of global electricity demand by 2030, compared to around 1% in 2020. The environmental impact of AI's energy consumption, particularly concerning SDG 12 (↓), remains an unexplored area in research. The current discourse on responsible AI emphasises ELSI and transparent aligned development and use, addressing concerns about bias, privacy, security, and broader impacts. However, the issue of energy is often overlooked, with mentions only in frameworks like GreenAutoML (Tornede at al, 2023).

The complexity of pursuing SDGs reveals frequent conflicts of interest (Krzysztofiak, T. 2023). For example, striving for 'good health and well-being' (SDG 3 ↑) can conflict with 'affordable and clean energy' (SDG 7 ↓) and 'responsible consumption and production' (SDG 12 ↓). Large-scale RES projects, while essential for clean energy (SDG 7 ↑) and reduction of the carbon footprint, impact land use and ecosystem services, affecting food production and biodiversity (SDG 2, 15 ↓) (Rehbein et al, 2020). Moreover, the drive for clean energy technologies such as batteries and solar panels leads to intensified mining and resources extractions, which contradicts SDG 12's (↓) principles (Stone, 2022). These examples highlight the necessity for integrated policymaking that balances all SDGs. However, tipping the scales of equity of AI and human versus technology needs can lead to heavily favouring industry, innovation and infrastructure (SDG 9 ↑) over other SDGs (↓).

Currently, there are limited studies focusing on AI applications specifically designed to resolve conflicting SDGs (Meitei et al., 2023; Mazzi et al., 2024). Multi-objective optimisation using AI is a promising approach for balancing conflicting goals, identifying synergies, and trade-offs within large datasets. For instance, AI can help policymakers optimise solutions that balance economic growth (SDG 8) with environmental sustainability (SDG 13, 14, 15). Additionally, AI may optimise resource allocation across various SDGs, potentially resolving conflicts between economic growth and environmental sustainability. AI could also assist in urban and environmental planning by optimising city layouts to reduce pollution and carbon footprints while maintaining economic activity. These potential applications illustrate how AI might become a crucial tool for resolving conflicts between SDGs, supporting more integrated and sustainable policymaking.

Drivers of Change That Determine Future Scenarios

This section explores the key drivers of change that will shape future scenarios, focusing their implications for the development and application of AI in achieving SDGs.

Driver of Change 1: Human-centred vs technology-centred AI

In visualising AI ecosystems for 2060, achieving a balance between SDG 9 and other SDGs is crucial yet uncertain. Human-centred AI emphasises ethics, inclusivity, and societal benefit, aiming to empower individuals and promote equitable advancement. In contrast, a tech-centred approach may overlook ELSI considerations, prioritising rapid innovation and commercial gain. Collaborative innovation among developers, policymakers, and communities may steer AI towards a human-centred future that supports Planetary Health. This requires building trust, ensuring transparency, and mitigating adverse societal and environmental impacts to lay a strong foundation for sustainable development and equity.

This transformative driver is decisive for the prioritisation of either human needs or technological advancement and thus the balance between ELSI-proof user-centric design and technical excellence. Strategic vision and collaborative engagement are essential to ensure AI's development aligns with human values and global progress by 2060.

Driver of Change 2: Equity in technology access (high vs low)

Equity in AI technology access is the second driver of change in AI innovation ecosystems envisioned for 2060. It determines how advancements in AI are accessed, potentially empowering a wide range of society or concentrating power and knowledge among privileged groups. Key factors in analysing equity include disparities in technology access, affordability of AI tools, and the inclusivity of regulatory frameworks. Policymaking plays a significant role, as regulations can either promote inclusivity or reinforce existing inequalities. Investment patterns also impact equity, influencing whether funding is widely distributed or concentrated in affluent areas.

Ultimately, equity in AI technology involves a complex interplay of socio-economic factors, policy decisions, and investment strategies, all of which shape the future landscape of AI innovation and its impact on economic, educational, social, and ecological dimensions.

Four Scenarios of AI Ecosystems Development and their Impact on Resolving SDG Conflicts to Achieve Sustainability

To help universities define their role in future AI ecosystems, scenario planning was employed. This methodology was executed by 87 participants during the 5th ASEF Higher Education Innovation Laboratory (ASEFInnoLab5), under the guidance of two experienced scenario planning researchers. This interactive online design laboratory promotes peer learning and actionable outcomes through its sessions. Participants first acquired contextual knowledge individually, followed by team-based learning of the scenario planning methodology. Teams were organised with 3 to 5 members each, focusing on Governance (2 teams), Education (12 teams), and Sustainable Development (2 teams).

In the scenario-planning process, consisting of team breakout sessions and collective debriefs, two key drivers of change for future AI ecosystems were identified. Via brainstorming, teams formulated important but uncertain determinants. After participant voting, the two key drivers identified were: human versus tech-centred AI and equity of AI technology access (high versus low). These drivers define four potential scenarios: 1) high equity, tech-centred, 2) high equity, human-centred, 3) low equity, tech-centred; and 4) low equity, human-centred.

Teams then developed detailed descriptions for each scenario. These descriptions were subsequently collected, merged, and summarised into general scenarios. Each team defined their own subthemes within these scenarios, establishing the current status quo for each subtheme. Subthemes were then summarised into main elements and revised based on peer feedback. Finally, each team identified “no-regret moves” —low-risk, high-impact actions— supported by evidence and practicality, aimed to strengthen universities’ roles in future AI ecosystems. After critical peer-review, the revised formulation addressed subtheme-specific issues translated into actionable recommendations.

Scenario 1: Basics guaranteed (high equity, tech-centred)

AI development will be largely driven by technological advancements aimed at creating efficient, high-performance systems. Policies and initiatives will focus on making these advanced AI technologies accessible to all societal segments (SDG 11 ↑), thus addressing the digital divide. Investments in infrastructure (SDG 9 ↑) and education (SDG 4 ↑) will be emphasised to ensure widespread access to AI tools and resources (SDG 10 ↑). The main objective will be to maximise AI’s technological potential, often at the expense of broader considerations of human well-being (SDG 3 ↓).

At the behest of governments, tech companies will tailor AI-driven solutions for renewable energy projects (SDG 7 ↑) to mitigate social displacement (SDG 8 ↑) and environmental impacts (SDG 13-15 ↑). AI will be employed to balance land use with public health impacts (SDG 15 ↔ SDG 2, 3), ensuring project efficiency. AI will support the development of cost-effective, sustainable materials and technologies (SDG 9 ↑), making health-related products more affordable and accessible (SDG 3 ↑). AI will also enhance resource management in mining and extraction (SDG 12 ↑), though this may not offset the overall increased mining and land conversion (SDG 12, 15 ↓). While AI will promote efficient resource use and waste management (SDG 12 ↑), it could compromise clean energy goals (SDG 7 ↓). The tech-centred focus may conflict with societal (SDG 7 ↓), economic (SDG 12 ↓), and environmental sustainability goals (SDG 13-15 ↓). Universities will need to use their intellectual integrity and academic freedom to develop responsible AI tools that better balance these SDGs, with a stronger emphasis on environmental needs.

Scenario 2: We are all individuals (high equity, human-centred)

AI development will focus on enhancing human well-being, ELSI considerations, and expanding human capabilities (SDG 1-6, 16, 17 ↑). Policies will aim to make AI technologies accessible to all, reducing the digital divide and empowering underserved communities (SDG 10 ↑). Investments will prioritise education (SDG 4 ↑) and community engagement (SDG 11 ↑), ensuring diverse backgrounds benefit from AI advancements. AI systems will be designed with input from varied stakeholders to address broad societal needs. The main goal will be to tackle societal issues, potentially sidelining technological and environmental concerns (SDG 8, 9 ↓; SDG 13-15 ↓).

Local governments will use AI to enhance community engagement (SDG 16 ↑) and plan renewable energy projects (SDG 7 ↑), focusing on human health and well-being (SDG 3 ↑). Public and private sectors will develop AI systems integrating local health data and community feedback to support health and clean energy goals (SDG 3 ↑; SDG 7 ↑). Transparent AI will enable sustainable production methods (SDG 12 ↑), reducing costs (SDG 8 ↑) and inequalities (SDG 10 ↑). AI will promote equitable health access and innovation in clean energy, balancing energy needs with responsible production (SDG 7 ↔ SDG 11, 12). However, technological advancement (SDG 9 ↓) will be deprioritised in favour of addressing individual privacy and equality needs, potentially neglecting environmental concerns (SDG 13-15 ↓). Universities will play a crucial role in integrating Planetary Health into the human-centred AI paradigm

Scenario 3: The lucky ones (low equity, human-centred)

AI development will prioritise human-centred goals (SDG 3, 4, 6 ↑), but benefits will disproportionately favour elite groups with greater access to technology. Significant disparities in access to AI technologies will persist, leaving underserved communities behind (SDG 10, 11 ↓). While ethical considerations and human well-being will be emphasised, they will primarily benefit those who can afford advanced AI solutions. Consequently, AI innovations will mainly serve affluent populations, potentially widening social and economic gaps. The primary objective will be to address societal issues for those who can pay for solutions.

Consortium-developed AI will focus on optimising health outcomes for wealthy communities (SDG 3 ↑), potentially neglecting broader community needs (SDG 11 ↓) and ecological impacts (SDG 13-15 ↓), thus exacerbating the equity gap (SDG 10, 11 ↓). Although AI can enhance sustainable production methods (SDG 12 ↑), these solutions will remain expensive and inaccessible to lower-income populations. Businesses will utilise AI to create high-end sustainable health products (SDG 3, 9 ↑), prioritising wealthy consumers and further sharpening inequalities (SDG 10 ↓).

AI-driven advancements in clean energy (SDG 7 ↓) will primarily benefit affluent groups, neglecting global environmental impacts (SDG 13-15 ↓). Despite low equity in AI consumption, universities will leverage their expertise to develop narrow AI (NAI) solutions that are freely accessible, sharing high-quality knowledge and resources to support marginalised groups and environmental projects.

Scenario 4: Tech takes over (low equity, tech-centred)

AI development will be primarily focused on technological advancements and optimisation (SDG 9 ↑) for an oligopoly of leading tech. businesses and their suppliers, with little regard for equitable access (SDG 10 ↓). Benefits of AI will be concentrated among those with the resources and skills to leverage advanced technologies. Large segments of the population will be excluded from the benefits of AI, increasing existing social (SDG 5, 7, 11 ↓) and economic (SDG 8, 10, 12 ↓) inequalities. The focus on the benefits of technology for the few will lead to socio-economic tensions (SDG 16, 17 ↓), as part of the society will be marginalised for the technology and its development.

AI-facilitated commercial renewable energy projects (SDG 7 ↑ for more responsible businesses) will prioritise technological optimisation in the interest of businesses (SDG 9 ↑) over local community health (SDG 3, 11 ↓) and environmental impacts (total SDG 7 ↓, 13-15 ↓), driven by obligations on financial gain. Overall, an oligopoly of businesses will implement AI to maximise energy output, ignoring Planetary Health consequences for marginalised communities and the environment (SDG 1-8, 11-15 ↓). AI will drive product innovation (SDG 9 ↑), but this will remain costly and inaccessible to many. AI will enhance the efficiency of clean energy (SDG 7 ↑) and health products technologies (SDG 3 ↑) but will not mitigate its own effect on energy consumption and waste production (total SDG 7, 12 ↓). This will come at the expense of increased Planetary Health degradation from resource extraction and pollution (SDG 13-15 ↓). Societies and businesses will prioritise AI-driven effectiveness (SDG 7, 8 for affluent groups ↑), but at the cost of weaker groups and neglecting macro-economic responsible production principles with respect to the global natural ecosystem (SDG 12-15 ↓). Commercial business owned General and Super AI (GAI & SAI) will increasingly ensure their own success, at the cost of life on earth (SDG 1-18, 9-17 ↓). As GAI & SAI rapidly take over tasks of white collar workers and academia for which cognitive knowledge is required, this will lead to governmental and socio-economic disruptions (SDG 8, 16, 17 ↓), undermining the decision-making position of governments and the role of universities in high-quality knowledge creation. Few universities that are able to use AI for high-quality knowledge creation within specific niches and their own business processes and that have outstanding marketing for their added value to economic growth and innovation (SDG 8, 9 ↑) will survive.

In none of the scenarios above will commercial business-owned AI be able to ensure that all SDGs are reached and conflicts between them are resolved, as commerce depends on revenue maximisation within a global economic model that is not harmonised with environmental needs. Sustainability intelligence in which these needs are better integrated could be better equipped to balance economic and societal with environmental needs. It could help universities in future scenario-planning activities to better align key drivers of change to essential determinants of Planetary Health, tackling SDG conflicts at the base of the decision-making process.

No-Regret Moves for Universities Applicable for all Scenarios

Taking into account the status quo in the field of AI applications for the SDGs and the possible use of AI for conflicts between SDGs, as well as the two important views of the future defined as drivers of change and the four scenarios based on them, it is thus possible to define the so-called “no-regret moves”, or recommendations for universities in the future years to maintain their relevance, roles and values in the age of AI.

Being low risk, high impact actions applicable for universities in all of the scenarios above, no-regret moves are crucial for universities in order to still play a role in AI ecosystems in 2060. We recommend the following no-regret moves based on key evidence showing that these are already known to work in similar settings today:

No-Regret Move 1: Intensified interdisciplinary collaboration

Universities should use international, cross-sectoral interdisciplinary collaboration as a framework for research-activities. Embracing this approach as a no-regret move enforces diverse disciplines to jointly tackle complex SDG challenges. By leveraging the collective wisdom of various fields, universities can accelerate sustainable innovation and equip students with skills to achieve Inner Development Goals (IDG) essential to using AI sustainably (Prescott, 2024).

Protection of free exchange of ideas, pursuit of truth, and critical thinking are elementary for this approach. Constructing truth about the impact of SDG actions requires integrating methodologies and data from various disciplines. Empowering researchers to develop holistic, energy-efficient systems that balance conflicting SDGs is essential. A systems-approach of interdisciplinary SDG data analysis combined with critical sustainability evaluation of applied AI ensures that both ELSI and ecological concerns are addressed effectively.

Mitigating risks associated with fragmented solutions is crucial. Without a holistic approach, solutions may neglect critical interdependencies among SDGs, leading to ineffective responses to global challenges. Interdisciplinary collaboration fosters the innovation needed to identify synergies and trade-offs among SDGs, preventing the oversight of specific goals and improving scalability and impact.

To address complex global challenges, we propose the establishment of SynergyHub, an international platform for universities integrating diverse academic disciplines into a collaborative hybrid space, empowered by applied Data Science and AI-methods to achieve sustainability intelligence. SynergyHub aims to enhance sustainable innovation and system-based problem-solving by fostering comprehensive, cross-disciplinary AI-solutions using the support and advice of

AI-translators, novel professionals specifically trained for this task, and access to interdisciplinary datasets.

Several studies and projects underline the importance of interdisciplinary collaboration:

- Nasir et al. (2023) highlight the potential of integrated methodologies in supporting all 17 SDGs.
- Podgórska and Zdonek (2024) explore project-based learning innovations at a Polish university, demonstrating interdisciplinary collaboration among Biomedical Engineering, Automation, Robotics, and Environmental Engineering to address SDGs 9, 3, and 12.
- The AI4Cities Project uses AI to accelerate carbon-neutral urban transitions across European cities, enhancing energy efficiency and urban planning while targeting SDGs 7 and 11 (Marji et al., 2024).
- Singapore's Smart Nation Initiative, involving universities, tech firms, and startups, applies AI to urban planning, healthcare, and transportation, aligning with SDGs 11 and 9 to optimise resource management and improve quality of life.
- Soest et al. (2019) and Caudill et al. (2024) advocate for integrated methodologies like Integrated Assessment Models and participatory approaches to address SDG challenges, emphasising ELSI considerations.
- Lakerveld et al. (2020) show that interdisciplinary data and a systems-based approach help to better identify and understand complex relations between environment and health, supporting SDG 3.

No-Regret Move 2: Advanced community and stakeholder engagement

To address public and ecological needs effectively, universities must engage directly with communities on a large scale. This approach ensures that academic work is shaped by real-world concerns and that frameworks for sustainability and ethics in AI are applied meaningfully. One way to tackle these challenges is by achieving international academic consensus on responsible AI use. For example, to limit deployment of large language models (LLMs) to create sustainability tools that outweigh the energy cost of these LLMs. AI-sustainability performance should become a major criterion for research and education funding, with community representatives included in evaluation committees to ensure that diverse perspectives are considered.

Transparency in AI-sustainability achievements is crucial; universities should openly report their progress to the public. Legislation mandating sustainability reporting can help distinguish universities from commercial knowledge providers that often lack clarity about their environmental footprint. This transparency builds public confidence and underscores the university's commitment to ELSI and sustainability practices.

Integrating Community Service Learning (SL) into educational programmes is an opportunity to ensure that curriculum content reflects social and ecological needs, equipping students to navigate complex ELSI challenges sustainable. Strategic, tactical, and operational education committees should include work-field partners, community representatives, and advocates for nature. Addressing both expressed and latent needs in scientific and technological innovations is vital. Universities must identify and address hidden ecological impacts often neglected by corporate entities, adding unique value through research and education. Efforts to include underrepresented groups in data collection are essential to counteracting biases in AI models. Furthermore, considering the latent needs of all species, using biodiversity impact as a proxy promotes sustainable and equitable technological advancements. By sharing academic outcomes in an understandable way with the public, universities can extend these benefits beyond the academic sphere.

The SynergyHub as a central platform can directly facilitate involvement with communities, shape academic work to address public and ecological needs, and enhance transparency and accountability in sustainability practices. AI-translators serve as connectors for this hub.

Evidence from Europe and Asia underscores the relevance of these recommendations:

- Liu et al. (2023) highlight how EU-funded projects combining long-term city focus and citizen engagement contribute to monitoring SDG achievements.
- UNESCO's Recommendation on the Ethics of Artificial Intelligence has influenced AI policies, such as the European Parliament's Artificial Intelligence Act, emphasising the need for international consensus on responsible AI use.
- Veidemane (2022) discusses the development of internationally comparable indicators and the role of LLMs in merging environmental, social, and governance accounting methods, showing progress towards overcoming challenges in sustainability.
- Ortega-Rodríguez et al. (2020) advocate for transparency in non-profit organisations, a principle that can also enhance trust in universities through public reporting on sustainability achievements.
- Ma et al. (2019) note that Service Learning in Asia helps overcome distrust of institutions and fosters connections between communities and organisations.
- Al-Olaimy (2020) from the World Economic Forum emphasises the importance of considering biodiversity as a stakeholder, advocating for public-planet partnerships to address ecological needs.

No-Regret Move 3: Universal ethics education for responsible AI innovation

To lead universal ethics education in fostering responsible AI innovation, universities must emphasise honesty, transparency, and adherence to ELSI and sustainability standards. These principles, deeply rooted in academic institutions, are critical in a world where fake news, conspiracy theories, misinformation, and disinformation erode trust in social interactions. Supporting universal ethics education and addressing implementation challenges is essential to gaining trust from governments and positioning universities as unbiased key players in AI development. By underscoring honesty as a foundational value, universities can ensure AI development aligns with truthfulness and integrity.

Openly sharing AI research is vital for demystifying its workings and preventing misuse. Adherence to ELSI and sustainability standards requires the integration of ethics into AI curricula, respect for human rights, and promotion of sustainability. Because many students lack basic understanding of sustainable ELSI practices in AI, universities should implement responsible AI principles in their curricula. This ensures that future AI practitioners are well-versed in these critical aspects.

Furthermore, universities should critically review the AI-decision-making processes of major corporations and tech companies. By contributing their expertise in ethics, universities can stimulate responsible development and deployment of AI technologies. Critical reviewing stimulates building AI systems on strong ethical foundations, ultimately benefiting society as a whole.

To support universal ethics education for responsible AI innovation, we recommend utilising SynergyHub as a platform to integrate transparent ELSI and sustainability standards for AI in curricula. SynergyHub can promote honesty and integrity in AI research, positioning universities as leaders in fostering ethical practices across the industry.

Several studies and reports underscore the importance of universities in promoting ethical AI development through education, research, and active collaboration with industry stakeholders:

- Aler Tubella et al. (2024) identify significant challenges in teaching AI ethics in higher education. The study calls for more effective integration of professional ethics into AI curricula to foster a mindset that recognises the ethical dimensions of technical decision-making. This approach ensures that the next generation of AI professionals contributes to ethical, safe, and cutting-edge AI development.

- Bleher and Braun (2023) emphasise the need for comprehensive ethics education in AI. Their study highlights that current ethical guidelines are often insufficient, being overly principles-oriented, and stresses the importance of bridging the theory–practice gap. They explore various methods to integrate ethical considerations directly into the AI development process, advocating for ethics experts to work alongside technical teams throughout the development lifecycle.

- Borenstein and Howard (2021) stress the importance of instilling a professional mindset in AI developers and stakeholders. They argue that ethical considerations should be inherently part of technical decisions, calling for a more integrated view where developers see themselves as responsible for the ethical impacts of their work.

- Gillespie et al. (2023) highlight the necessity of trust in AI systems for their acceptance and effective use in society. This aligns with the need for universities to champion honesty and transparency in their AI initiatives.

- The University of Oxford's Institute for Ethics in AI emphasises the importance of transparency and rigorous methodological standards to regain public trust in AI. This mirrors the development of ethics in medical sciences, emphasising the critical need for ethical advancements in AI today.

Conclusion

As AI rapidly expands globally, natural ecosystems and societies struggle to protect Planetary Health. Key drivers likely to reshape the AI ecosystem are the balance between human- and tech-centred AI and equity in AI technology. Universities, known for academic freedom, intellectual integrity, and societal service, must urgently 1) intensify interdisciplinary collaboration, 2) engage communities and stakeholders extensively, and 3) establish universal ethics education for responsible AI innovation. To support these efforts, we propose SynergyHub, a collaborative platform designed to tackle these challenges, ensuring that universities remain pivotal in achieving all SDGs, regardless of AI innovation ecosystem changes.

References

Adeh, E. H., Good, S. P., Calaf, M., & Higgins, C. W. (2019). Solar PV power potential is greatest over croplands. *Scientific reports, 9*(1), 1-6.
AI Index (2024). *Artificial Intelligence Index Report 2024*. Stanford Institute for Human-Centered Artificial Intelligence https://aiindex.stanford.edu/report/

AI4Cities. (2024). "What is AI4Cities about?" https://ai4cities.eu/about/project

Al-Olaimy, T. (2020). Why nature is the most important stakeholder of the coming decade. World Economic Forum. https://www.weforum.org/agenda/2020/01/why-nature-will-be-the-most-important-stakeholder-in-the-coming-decade/

Aler Tubella, A., Mora-Cantallops, M., & Nieves, J. C. (2024). How to teach responsible AI in Higher Education: challenges and opportunities. *Ethics and Information Technology*, *26*(1), 3.

Bleher, H., & Braun, M. (2023). Reflections on putting AI ethics into practice: how three AI ethics approaches conceptualize theory and practice. *Science and Engineering Ethics*, *29*(3), 21.

Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, *1*, 61-65.

Caudill, C. M., Pulsifer, P. L., Thumbadoo, R. V., & Taylor, D. F. (2024). Meeting the Challenges of the UN Sustainable Development Goals through Holistic Systems Thinking and Applied Geospatial Ethics. *ISPRS International Journal of Geo-Information*, *13*(4), 110.

Chissini, G. (2023). Renewable energy: the potential negative socio-environmental impacts. LinkedIn. https://www.linkedin.com/pulse/renewable-energy-potential-negative-impacts-giselle-chissini

Dey, S., Veerendra, G. T. N., Padavala, S. S. A. B., & Manoj, A. P. (2023). Recycling of e-waste materials for controlling the environmental and human heath degradation in India. *Green Analytical Chemistry*, *7*, 100085.

European Parliament. (2024). Artificial Intelligence Act. https://www.europarl.europa.eu/doceo/document/TA-9-2024-0138_EN.html

Fuller, R., Landrigan, P. J., Balakrishnan, K., Bathan, G., Bose-O'Reilly, S., Brauer, M., ... & Yan, C. (2022). Pollution and health: a progress update. *The Lancet Planetary Health*, *6*(6), e535-e547.

Gillespie, N., Lockey, S., Curtis, C., Pool, J., & Akbari, A. (2023). Trust in artificial intelligence: A global study. *The University of Queensland and KPMG Australia*, *10*.

Gupta, U., Kim, Y. G., Lee, S., Tse, J., Lee, H. H. S., Wei, G. Y., ... & Wu, C. J. (2021, February). Chasing carbon: The elusive environmental footprint of computing. In *2021 IEEE International Symposium on High-Performance Computer Architecture (HPCA)* (pp. 854-867). IEEE.

Khogali, H. O., & Mekid, S. (2023). The blended future of automation and AI: Examining some long-term societal and ethical impact features. *Technology in Society*, *73*, 102232.

Krzysztofiak, T. (2023). The world's goals for saving humanity are still the best option. *Nature*, *621*, 227-229.

Lakerveld, J., Wagtendonk, A., Vaartjes, I., & Karssenberg, D. (2020). Deep phenotyping meets big data: the Geoscience and hEalth Cohort COnsortium (GECCO) data to enable exposome studies in The Netherlands. *International Journal of Health Geographics*, *19*, 1-16.

Liu, H. Y., Ahmed, S., Passani, A., & Bartonova, A. (2023). Understanding the role of cities and citizen science in advancing sustainable development goals across Europe: Insights from European research framework projects. *Frontiers in Sustainable Cities*, *5*, 1219768.

Ma, C., Chiu, T., & Wei, L. T. (2019). Service-learning in Asia. *Metropolitan Universities*, *30*(3), 3-9.

Marji, N., Kohout, M., Chen, L., Isik, G. E., & Kumar, A. R. (2024). AI-enabled transition to smart European cities. *Acta Polytechnica CTU Proceedings, 46*, 85-93.

Maus, V., & Werner, T. T. (2024). Impacts for half of the world's mining areas are undocumented. *Nature*, *625*(7993), 26-29.

Mazzi, F., Taddeo, M., & Floridi, L. (2023). AI in Support of the SDGs: Six Recurring Challenges and Related Opportunities Identified Through Use Cases. In *The Ethics of Artificial Intelligence for the Sustainable Development Goals* (pp. 9-33). Cham: Springer International Publishing.

Meitei, A. J., Rai, P., & Rajkishan, S. S. (2023). Application of AI/ML techniques in achieving SDGs: a bibliometric study. *Environment, Development and Sustainability*, 1-37.

Nasir, O., Javed, R. T., Gupta, S., Vinuesa, R., & Qadir, J. (2023). Artificial intelligence and sustainable development goals nexus via four vantage points. *Technology in Society, 72*, 102171.

Ortega-Rodríguez, C., Licerán-Gutiérrez, A., & Moreno-Albarracín, A. L. (2020). Transparency as a key element in accountability in non-profit organizations: A systematic literature review. *Sustainability*, *12*(14), 5834.

Pauwels, E. (2019). *The New Geopolitics of Converging Risks*. UNU CPR. https://unu.edu/cpr/project/new-geopolitics-converging-risks-un-and-prevention-era-ai

Podgórska, M., & Zdonek, I. (2024). Interdisciplinary collaboration in higher education towards sustainable development. *Sustainable Development, 32*(3), 2085-2103.

Prescott, S. L. (2024). Planetary Health: A New Approach to Healing the Anthropocene. *Annals of Allergy, Asthma & Immunology*.

Ramautar, V., Ritfeld, N., Brinkkemper, S., & España, S. (2024, May). Optimising Sustainability Accounting: Using Language Models to Match and Merge Survey Indicators. In *International Conference on Research Challenges in Information Science* (pp. 338-354). Cham: Springer Nature Switzerland.

Rehbein, J. A., Watson, J. E., Lane, J. L., Sonter, L. J., Venter, O., Atkinson, S. C., & Allan, J. R. (2020). Renewable energy development threatens many globally important biodiversity areas. *Global change biology*, *26*(5), 3040-3051.

Singapore computer society. (2019). *Singapore smart nation initiatives and possible opportunities*. https://www.scs.org.sg/articles/smart-nation-singapore#:~:text=Our%20Smart%20Nation%20Initiative%20was,Digital%20Government

Stone, M. (2022). Mining Is a Polluting Business. Can New Tech Make It Cleaner?. *National Geographic*.

Tornede, T., Tornede, A., Hanselle, J., Mohr, F., Wever, M., & Hüllermeier, E. (2023). Towards green automated machine learning: Status quo and future directions. *Journal of Artificial Intelligence Research*, *77*, 427-457.

UN (2023). *Global Sustainable Development Report (GSDR) 2023*. Department of Economic and Social Affairs - Sustainable Development. https://sdgs.un.org/gsdr/gsdr202

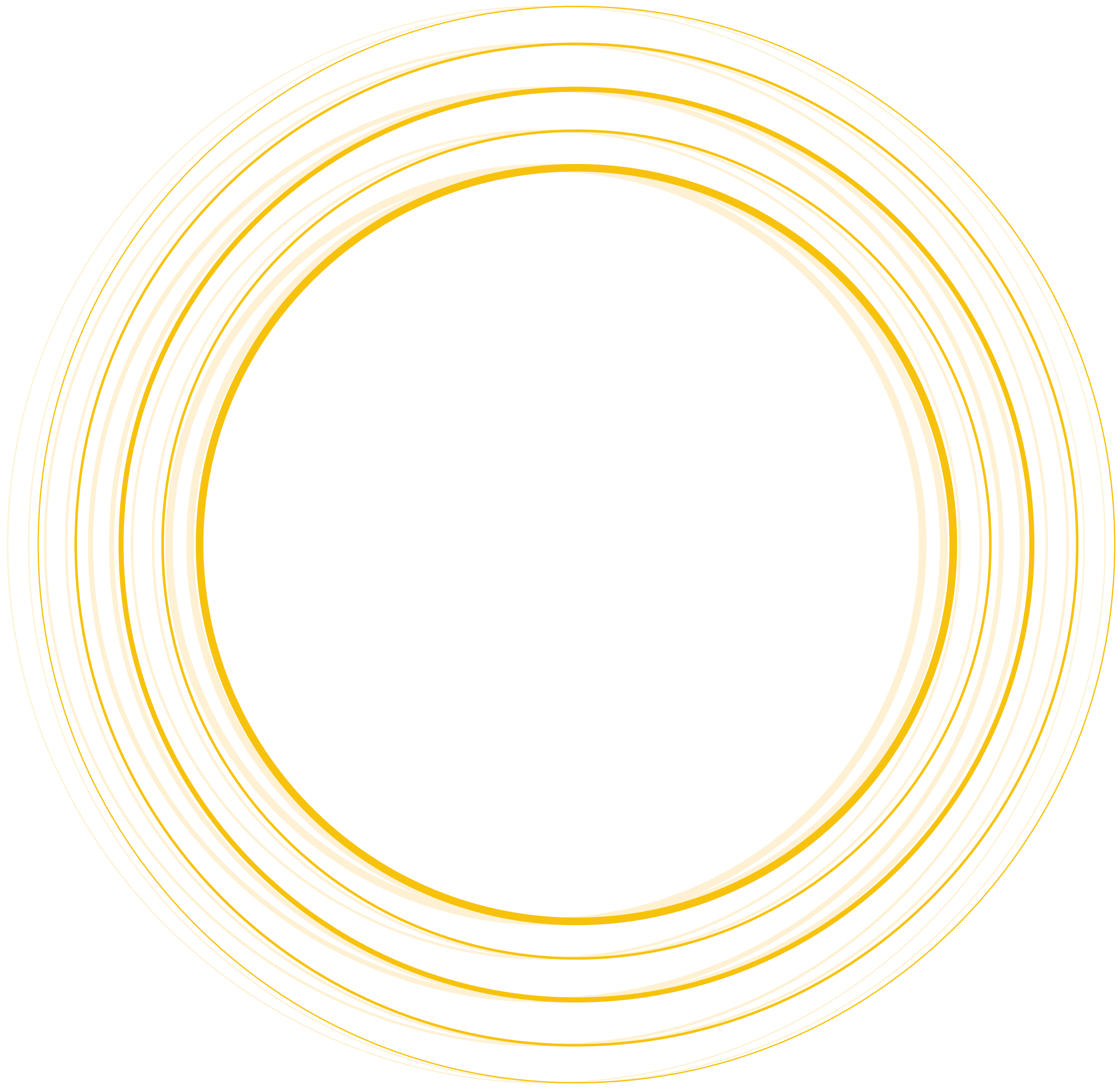
UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. https://unesdoc.unesco.org/ark:/48223/pf0000381137

University of Oxford (n.d.). Institute for Ethics in AI. Confronting the ethical implications of AI from a philosophical and humanistic perspective. https://www.oxford-aiethics.ox.ac.uk/

van Soest, H. L., van Vuuren, D. P., Hilaire, J., Minx, J. C., Harmsen, M. J., Krey, V., ... & Luderer, G. (2019). Analysing interactions among sustainable development goals with integrated assessment models. *Global Transitions*, *1*, 210-225.

Veidemane, A. (2022). Education for sustainable development in higher education rankings: Challenges and opportunities for developing internationally comparable indicators. *Sustainability*, *14*(9), 5102.

Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., ... & Fuso Nerini, F. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature communications*, *11*(1), 1-10.



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Asia-Europe for Artificial Intelligence (AE4AI) Network

The AE4AI Network was established by 20 academics and university managers from Asia and Europe in 2023 with the intent to enhance universities' role in AI innovation ecosystems and together pursue collaboration and actions on AI Governance, AI in Education, and AI for Sustainable Development. For more information, please visit https://www.asiaeurope4ai.org/.