

CLOUD

> Connecting Leaders Online for
University Digital Transformation

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East Asian Higher Education Insights in the Digital Intelligence Era

CLOUD - Connecting Leaders Online for University Digital Transformation



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Greetings from UNESCO Regional Office for East Asia.

It is with great pleasure that I contribute to this special edition of *CLOUD* magazine, capturing the key outcomes and forward-looking perspectives from the 2025 High-Level Policy Dialogue on “Fostering an AI-enabled Higher Education Ecosystem” in East Asia.

Held in the vibrant city of Ulaanbaatar, this gathering was a testament to collaboration, made possible by the vision and dedication of the Ministry of Education and the Ministry of Digital Development and Communications of Mongolia, the Mongolian National Commission for UNESCO, UNESCO-ICHEI, the Mongolian University of Science and Technology (MUST), and our many esteemed partners. My deepest gratitude extends to all who made this timely dialogue a resounding success.

The integration of artificial intelligence into higher education is no longer a future prospect; it is a present reality, reshaping learning, research, and institutional governance at an unprecedented pace. This transformation, however, must be steered with purpose and principle. As we witness dynamic innovation across East Asia, we are reminded of our collective responsibility to ensure this evolution is ethical, equitable, and firmly rooted in human rights.

This imperative is at the heart of UNESCO’s *Recommendation on the Ethics of Artificial*

Intelligence, the first global standard-setting framework on the subject. The Dialogue in Ulaanbaatar served as a vital platform for translating these global principles into regional action. Stakeholders from government, academia, and industry reaffirmed that AI must be harnessed not merely as a tool for efficiency, but as a public good - a force for advancing equity, empowering educators, and supporting inclusive lifelong learning for all.

Further anchoring these discussions, this edition of *CLOUD* marks the launch of the joint report, *Digital Leap in East Asia: A Regional Synthesis on Higher Education Transformation*. Co-developed by the UNESCO Regional Office for East Asia and UNESCO-ICHEI, this report provides a data-rich foundation and practical case studies, offering an invaluable resource for policymakers and institutional leaders worldwide.

The experiences from East Asia, as detailed in this issue, offer profound lessons for the global community. The interplay between technological innovation and ethical governance will define the future of higher education in the age of AI. UNESCO remains steadfast in its commitment to supporting Member States, providing concrete tools such as our *Guidance for Generative AI in Education and Research* to help build institutional capacity, promote AI literacy, and shape human-centered digital policies.

It is my firm belief that the insights captured here will inspire continued collaboration and inform evidence-based policymaking. Together, we can foster an AI-enabled future for higher education that not only embraces innovation but, more importantly, upholds human dignity and advances our shared mission of education for all.

Sincerely,

Prof. Shahbaz Khan

Director and Representative

UNESCO Regional Office for East Asia



Dear Readers,
We welcome you to this issue of *CLOUD*.

A global wave of intelligent transformation is reshaping industries, with artificial intelligence (AI) innovations approaching collective breakthroughs. Advances in large language models, multimodal systems, and embodied intelligence are driving unprecedented efficiency and sophistication, catalysing profound changes in higher education worldwide. Within this shift, East Asian nations offer valuable case studies, leveraging practical experience to generate insights for the international community. Supported by economic growth, globalisation, and technological innovation, the region has advanced digital transformation in higher education. Serving as a knowledge platform, *CLOUD* connects UNESCO-ICHEI with global partners, acting both as a bridge for intellectual exchange and as a showcase for cutting-edge achievements and practices—**within which East Asia figures prominently.**

The East Asian region is currently in a strategic window of opportunity for AI development, where the integration of AI and higher education shows exceptional dynamism. China, through its *Next Generation Artificial Intelligence Development Plan*, leverages the

research capacity of major technology firms to promote interdisciplinary integration. Japan prioritises “AI and educational reform” within its national *AI Strategy*, anchored in the *Super Smart Society (Society 5.0)* vision. South Korea has set clear goals for AI talent development and reinforced industry-academia-research collaboration through legislation such as the *Act on AI Industry Promotion and Trust*. Mongolia advances AI and digital transformation under its *Vision 2050* and *Digital Nation* programmes, with a strong emphasis on digital learning resources. Collectively, these initiatives present a compelling vision of technology-enabled education. By showcasing such regional exemplars, *CLOUD* contributes insights to the global digital transformation of higher education.

The reshaping of higher education by AI extends far beyond technological updates; it encompasses systematic transformation of the educational ecosystem. Through presenting concrete case studies from East Asia such as enhancing AI literacy and skills among faculty and students, and industry-academia collaboration, including initiatives like the IIOE Mongolia Micro-Certification Project, *CLOUD* also presents good practices for digital transformation to our global partners.

We extend our gratitude for your continued support of *CLOUD*. We trust this issue will prove both informative and inspiring, and look forward to working together in fostering a more open and inclusive higher education landscape in the age of AI.

Sincerely,
JIN Li
Director of UNESCO-ICHEI



UNESCO Regional Office for East Asia:

Seeking an Inclusive Future amid Opportunities and Challenges



The *Digital Leap in East Asia: A Regional Synthesis on Higher Education Transformation*, released in 2025 by UNESCO and the International Centre for Higher Education Innovation under the auspices of UNESCO (UNESCO-ICHEI), outlines the digitalisation processes of higher education in China, Japan, Mongolia, and South Korea, offering recommendations for advancing educational digitalisation across the region.



Scan the QR code to read

East Asian Higher Education AI Policy Highlights

While AI is reshaping the global education landscape, East Asian countries have demonstrated a leading position. It benefits from the emphasis and investment of national governments in optimising educational resources, upgrading digital teaching, cultivating future-oriented competencies, and adhering to the principle of inclusive development, as well as close government-

university-industry trilateral collaboration. These countries share distinctive commonalities in building robust digital infrastructure to ensure educational equity and inclusion, establishing lifelong learning systems and enhancing citizens' digital skills, and creating education provision systems centred on talent cultivation.

Government of China has formulated comprehensive strategic plans and regulatory systems, established effective management mechanisms. The government does not regard technological investment as merely fiscal expenditure, but the key driver of educational transformation. In higher education digitalisation, China has developed a sound policy framework. Policies such as the *Action Plan for 5G Applications* have been introduced in recent years to strengthen digital infrastructure in the education sector. In 2024, the 101 "Plan" for AI was launched to promote world-class courses and high-level teaching teams in AI. In 2025, the China's *White Paper on Smart Education* was released, innovatively proposing the "3N" approach to educational digital transformation—New Stage, New Standard, and New Ways, focusing on integrated planning of education digitalisation, utilisation of smart education public service platforms, and AI empowerment in education. In August 2025, the State Council issued the *Opinions on Deeply Implementing the 'AI+' Initiative*, calling for the integration of AI into all elements and the entire process of teaching and learning, and encouraging innovative human-machine collaborative models such as intelligent learning companions and smart teachers, to improve education quality and promote educational equity.

Government of Japan has also introduced a series of policies and strategic initiatives, demonstrating its determination to advance the digital transformation of education. In 2024, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) updated the certification system for the “Mathematics, Data Science, and AI Education Program” requiring higher education institutions to integrate data science and AI into their curricula. It aims to equip students with foundational digital knowledge in AI and related fields, enabling them to apply these skills within their respective academic fields. In 2025, the Diet of Japan passed the *Act on the Promotion of Research and Development and the Utilisation of AI-Related Technologies*, which encourages higher education and research institutions to actively participate in

AI research, disseminate outcomes, cultivate talent, and align with government policies, while also highlighting the promotion of AI literacy and public awareness as a policy priority.

Government of South Korea has consistently taken the lead in higher education by strategically applying educational technologies, cultivating digital skills, and advancing personalised learning. In 2024, the South Korean National Assembly passed the *Framework Act on the Development of Artificial Intelligence and Establishment of a Foundation of Trust*, establishing a legal framework mandating the formulation of AI competitiveness enhancement plans every three years. The same year also marked an internalisation period guiding the education



system to adapt to AI. Based on the previously published *Education Policy Direction and Core Tasks in the Age of Artificial Intelligence*, education authorities and relevant institutions actively promoted the integration of AI education concepts into educational practice. In 2025, the *Regional Innovation System and Education (RISE)* programme was rolled out nationwide, with local governments and universities increasingly forming partnerships. Funding was provided to higher education institutions to support research projects and curriculum development in high-tech sectors such as AI and robotics, aiming to attract international talent and strengthen global competitiveness.

The Mongolian government has identified digital transformation as a key strategy for ensuring inclusive and equitable quality education in the post-pandemic era. In recent years, Mongolia has launched the *Vision 2050* and *Digital Nation* initiatives, which call for the development of digital educational content, open educational resources, and MOOCs, thereby advancing the shift of education at all levels toward online learning. In February 2025, Mongolia released the *National Strategy for Big Data and Artificial Intelligence*, outlining its plan to transition from an “AI user country” to an “AI developer country,” with a focus on establishing domestic AI innovation hubs and entrepreneurial ecosystems. Leveraging its strengths in mining and renewable energy, the country is promoting the construction of energy-efficient data centres to attract global AI investment. Furthermore, Mongolia, in partnership with the Asian Institute of Artificial Intelligence and UNICEF Mongolia, launched the “*National AI*” program to train 500 local government and institutional professionals as well as 2,250 teachers, with the aim of narrowing the digital divide and enhancing the inclusiveness of digital transformation.

East Asian countries, each based on their own characteristics and developmental conditions, are committed to building digital infrastructure and developing online learning resources, with varying emphases on hardware construction and curriculum development. Yet without exception, all have leveraged their unique advantages to expand educational opportunities and strengthen competitiveness through higher education digital transformation.

Transformation in Focus: The “Differentiation” of Higher Education Digitalisation

Although East Asian countries have made significant progress in higher education digital transformation and enhancing educational inclusivity based on their comparative advantages, they still face structural challenges.

Population ageing is particularly pronounced in Japan and South Korea, where the number of young people entering higher education continues to decline. In Japan, this trend has led to colleges and universities (especially local institutions) experiencing declining enrolment, being in financial crisis and even facing the choice of merging or closing. This not only threatens access for rural students, but also exacerbates educational inequality.

Meanwhile, there is a disconnect between the rapid pace of technological tools and the lagging development of pedagogical approaches to teaching and learning, and it is a challenge to ensure that these results translate into improved teaching quality and learning outcomes.

In order to deal with these problems, universities across the region have built advanced digital ecosystems, including high-speed networks, artificial intelligence (AI) platforms, learning management systems (LMS), and digital libraries, while expanding access through massive open online courses (MOOCs) and virtual classrooms. These initiatives foster personalised and active learning, addressing the limitations of traditional pedagogies. Distinct national practices illustrate this diversity of innovation: China has established the world's largest MOOC repository to promote educational equity; Japan has advanced context-specific localisation strategies; and South Korea has prioritised strengthening teachers' AI competencies.

Human-Centred Approach: UNESCO's Normative and Guiding Role

To address these challenges, UNESCO reaffirms its guiding principles of human-centred, equitable, and inclusive development. At the international level, UNESCO has taken a leading role in

regulating the use of artificial intelligence in education. Its *AI and education: guidance for policy-makers* (2021) and *Guidance for generative AI in education and research* (2023)

aim to support both long-term and short-term policymaking, ensuring that generative AI adheres to human-centred principles, safeguards education as a fundamental right and public good, and guarantees equal opportunities for all learners in the digital era.

Technology itself is neutral; its value lies in how it is applied. National AI strategies should therefore place ethical standards and equity considerations at their core. The report calls for elevating the task of "bridging the digital divide" from a peripheral concern to a policy priority, ensuring that the benefits of technological progress reach every learner.

The rise of generative AI risks deepening the digital divide between the Global North and South in higher education, while in parts of Asia, existing AI-in-education policies lack explicit measures to address this challenge. Policymakers at both national and



international levels must therefore confront the risk of “digital poverty” and actively design strategies that advance justice and equity in education.

Global Collaboration: Building an Open and Equitable Digital Education Future

The United Nations and its specialised agencies have outlined a clear roadmap for the digital transformation of global education. The draft *UN Global Digital Compact (2024)* provides a framework for systemic reform, emphasising inclusive development through multi-stakeholder collaboration and placing human rights and sustainability at the core of digital governance. In parallel, guided by UNESCO's *Recommendation on Open Educational Resources*, the 2022 UN Transforming Education Summit affirmed virtual learning spaces as both a public good and a basic right, calling for the development of high-quality digital resources and universal connectivity.

Bridging the global digital divide has become central to this vision. The UN system, multilateral development banks, international organisations, and donor countries, including China, Japan, and South Korea, must expand investment in digital infrastructure to ensure stable and affordable internet access in underserved regions. Equally, UNESCO and partner agencies should prioritise the adoption of a global *Digital Competency Framework for Teachers*, providing standardised pathways

for educators to acquire digital skills and fostering the integration of technology and pedagogy to cultivate students' critical thinking and collaboration in the digital economy.

In this process, strengthening regional and international cooperation remains essential to advancing equity, quality, and sustainability in education. UNESCO urges governments to develop robust policy frameworks, encourage cross-border institutional partnerships, and support capacity-building initiatives. By establishing regional and global mechanisms for the mutual recognition of digital credentials and micro-certifications, UNESCO can leverage its unique role in coordination and standard-setting to support the interoperability of national accreditation systems. This, in turn, will enhance the quality and reach of digital education worldwide, ensuring that no learner is left behind in this era of rapid transformation.



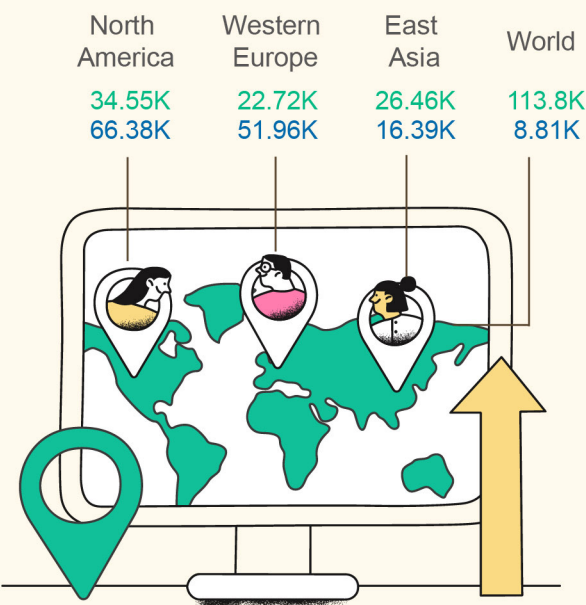
▼ Pact for the Future, Global Digital Compact and Declaration on Future Generations, outcome documents of Summit of the Future

Regional Economic and Demographic Profile

Economic Scale

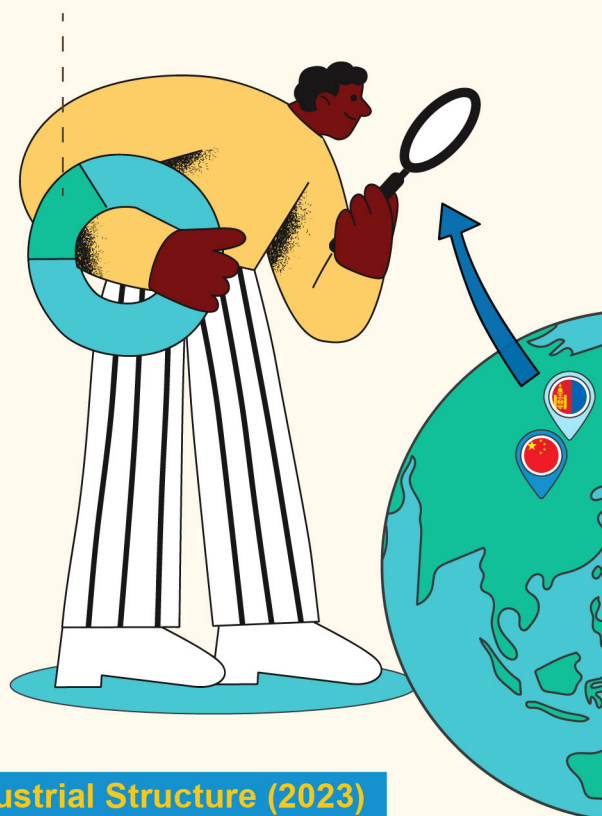
GDP and GDP per Capita

- GDP, current prices (Billions of U.S. dollars)
- GDP per capita, current prices (U.S. dollars per capita)

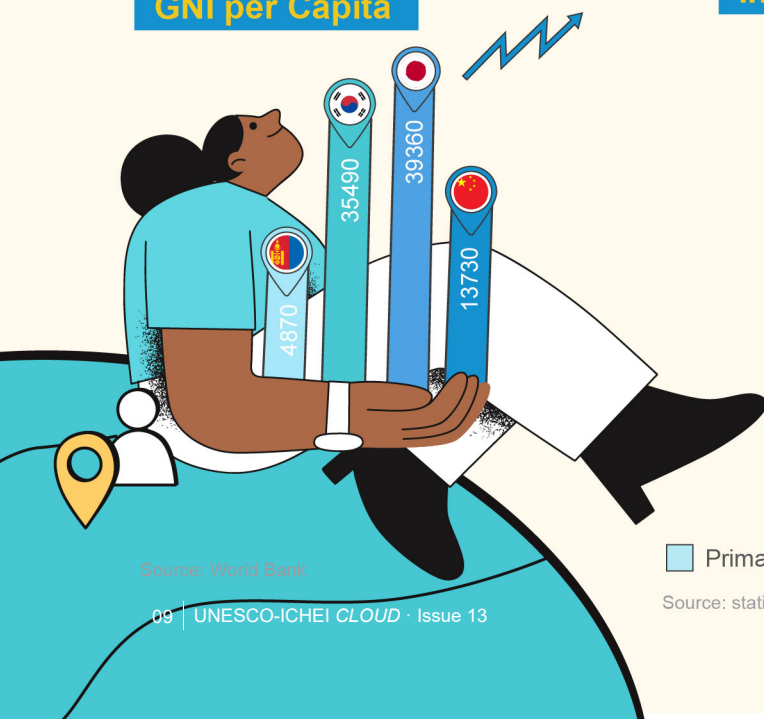


Source: IMF

East Asia's GDP is projected to reach **\$26.46 trillion**, accounting for **23.25%** of the global total.

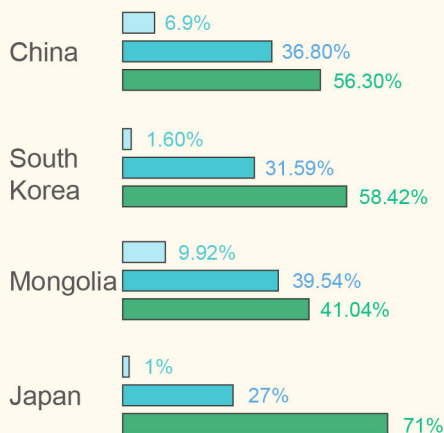


GNI per Capita



Source: World Bank

Industrial Structure (2023)



■ Primary sector ■ Secondary sector ■ Tertiary sector

Source: statista

Population Density

As of 2024, East Asia is home to 1.6 billion people



accounting for 22% of the global population

928 million
1.72 times
that of Europe
and Central Asia

742 million
2.16 times
of the Middle East
and North Africa

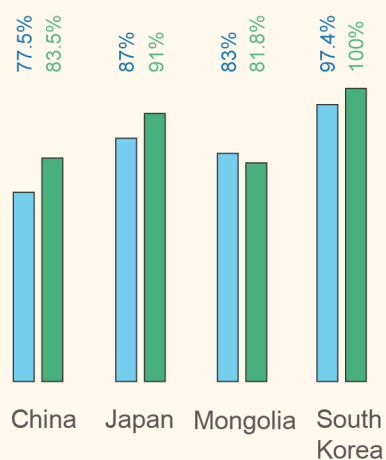
380 million
4.2 times
that of
North America

The region has an average population density of 133 people per square kilometer—about three times the global average. From **Tokyo** and **Seoul** to **Beijing** and **Shanghai**, East Asia hosts some of the most densely populated megacities in the world.

Source: World Population Review

Individual Internet Usage Rates and Household Internet Access Rates by Country (2023)

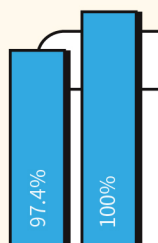
- Percentage of individuals using the internet in recent year
- Percentage of households with internet access in recent year



Internet Infrastructure Development

Internet Usage Rates

East Asia has shown strong performance in global internet infrastructure development. In 2024, major East Asian countries all surpassed the global average internet penetration rate of 67.6%.

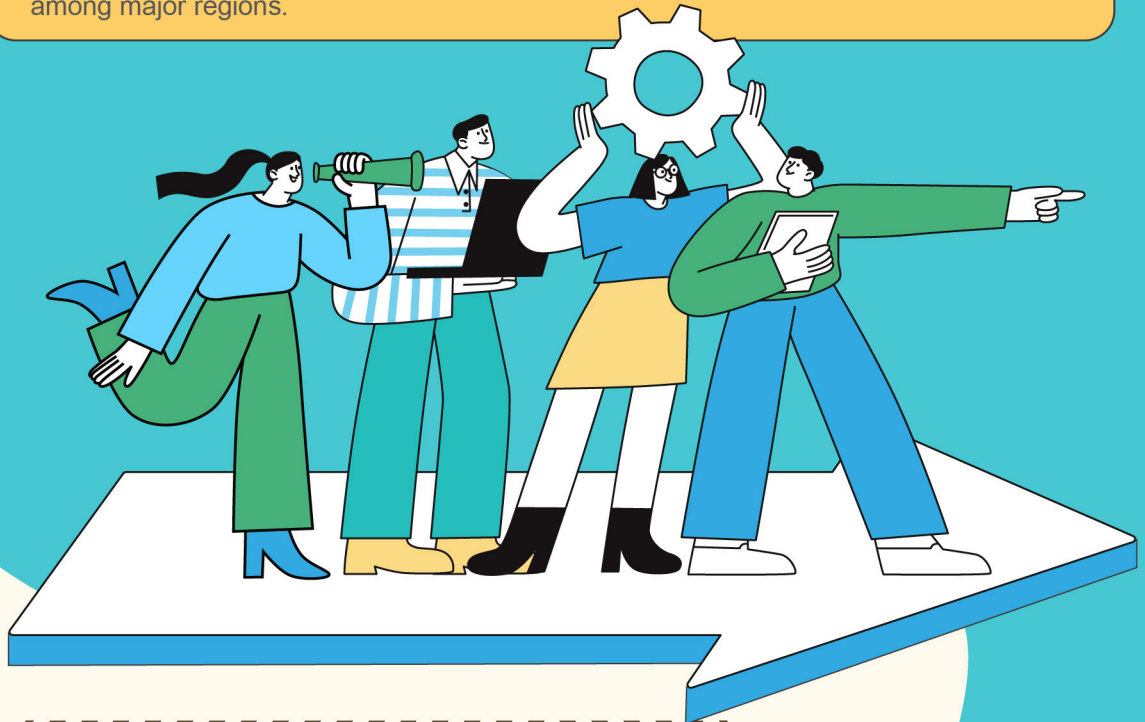


Among them, South Korea stood out with a world-leading **97.4%** individual usage rate and **100%** household internet access rate, highlighting the region's achievements in digital development.

Research, Education, and Investment

Expenditure on R&D

East Asian countries place a strong emphasis on expenditure on R&D. In 2022, East Asia's Gross domestic expenditure on R&D (GERD) accounted for 2.83% of its GDP—well above the global average of 1.95% and second only to North America (3.42%) among major regions.



East Asia: Government AI Readiness Index

East Asian countries demonstrate strong AI governance capabilities. Government AI Readiness Index 2024,

East Asia ranked third globally.
performed across all three key pillars:

Government

Data & Infrastructure

Technology sector



Source: Oxford Insight

Expenditure on Education

Education investment is a key driver of development in the East Asia region. According to UNESCO, expenditure on education as a percentage of GDP stands at 5.8% in Mongolia, 5% in South Korea, 4% in China, and 3.5% in Japan. These investments are primarily directed toward improving educational infrastructure, enhancing teacher capacity, and optimizing learning outcomes—helping to build a new competitive edge for the region in the global knowledge economy.



Expenditure on Higher Education as a Percentage of GDP in East Asian Countries



0.4%
in Japan



0.5%
in China



0.6%
in Mongolia

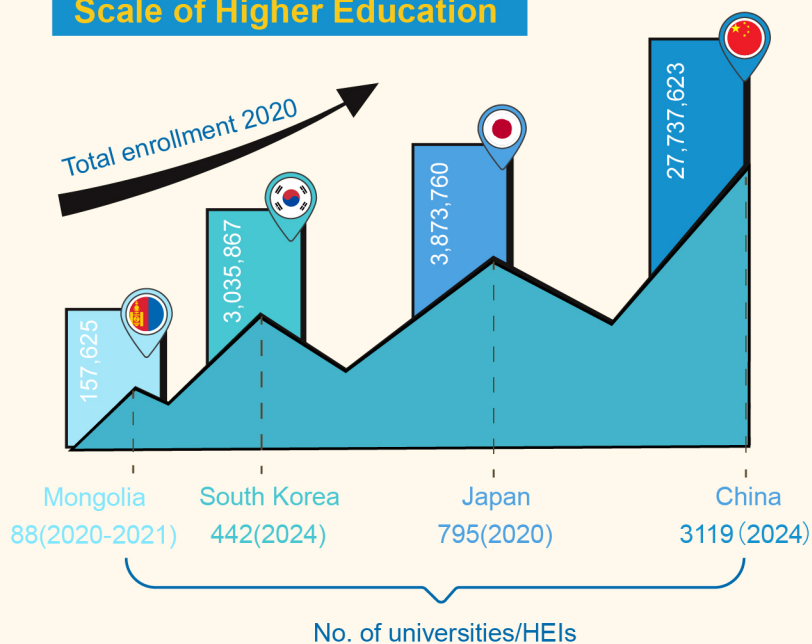


0.9%
in South Korea



Source: UNESCO Digital leap in East Asia

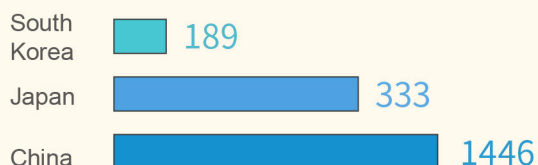
Scale of Higher Education



AI and Higher Education Outcomes

Number of Newly Funded AI Companies by Country

China's AI boom has been largely driven by intensive venture capital investment (amounting to hundreds of billions of RMB), creating a dynamic and thriving startup ecosystem. In comparison, Japan and South Korea have maintained a more cautious and conservative approach to venture funding. Although they invest in fewer new AI companies than China, their contributions remain notable.



Source: AI Index Report 2025

Granted AI Patents

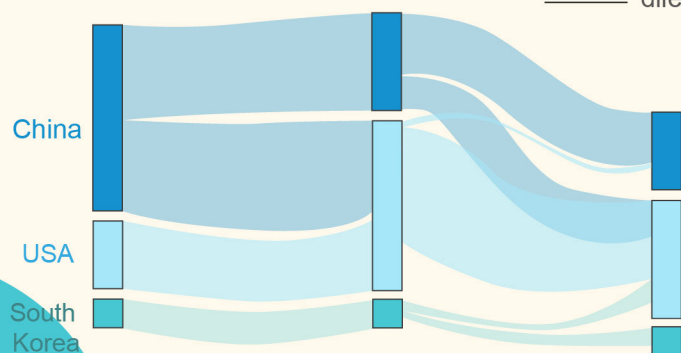


In 2023, the East Asia and Pacific region accounted for **82.4%** of all granted AI patents globally, demonstrating the region's strong capacity for technological commercialisation.

In terms of innovation intensity, South Korea had the highest number of granted AI patents per 100,000 people—**3.3 times** that of the United States and **14.16 times** that of Germany.

Source: AI Index Report 2025

Talent Mobility



In terms of talent cultivation and mobility, East Asian countries are facing the dilemma of losing high-end AI talent.

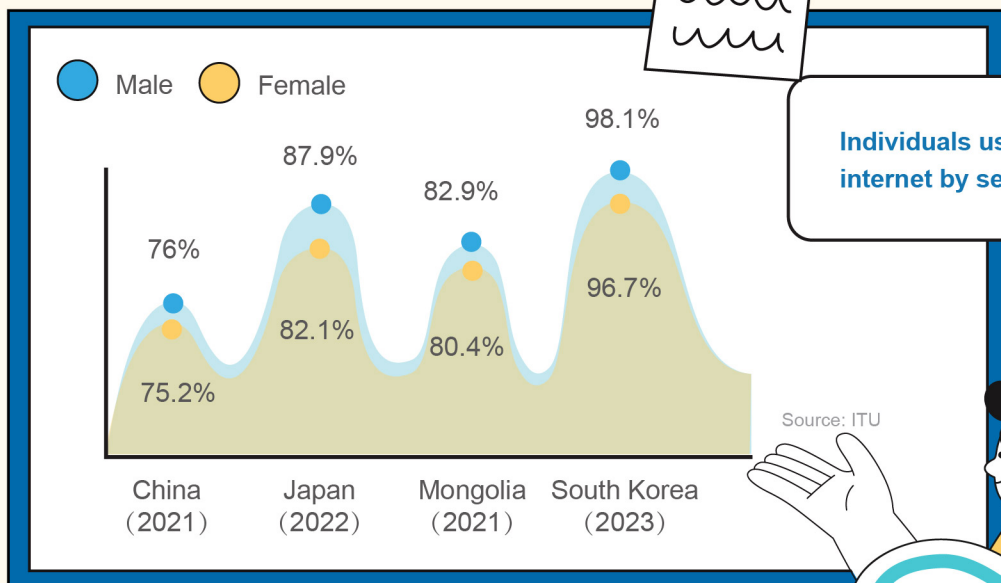
Over one-third (**36.12%**) of China's AI undergraduates choose to pursue further studies in the United States.

Although South Korea maintains an advantage in training domestic graduate students (nearly 100%), **40%** of its top AI talent still flow to developed countries in Europe and the United States.

Source: Macro Polo

Digital Divide

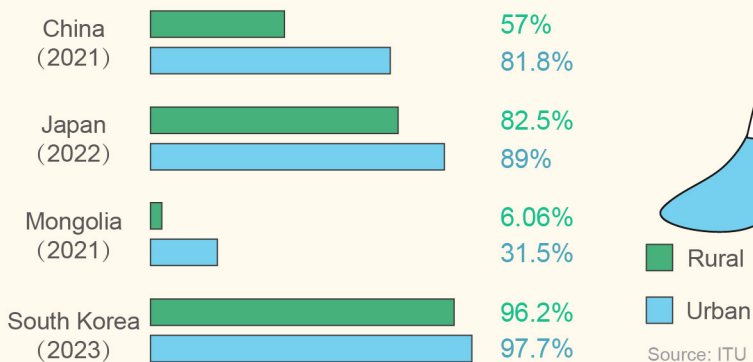
Internet Usage Divide



Individuals using the internet by sex (%)

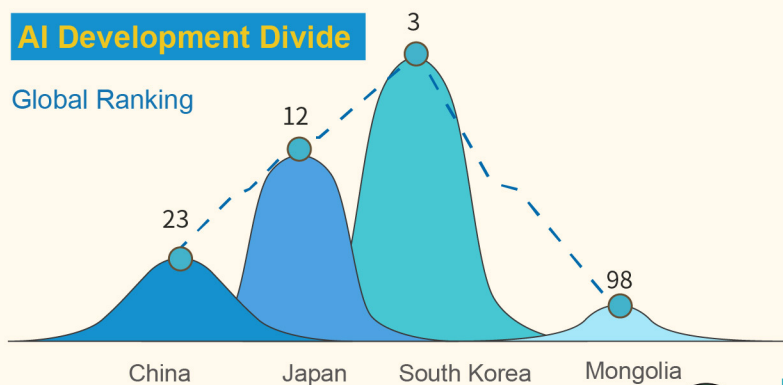


Individuals using the internet by location (%)



AI Development Divide

Global Ranking



Integrating Generative AI into Japanese Higher Education: Policy Responses, Pedagogical Practices, and Future Directions

Introduction

Japan, known for its long-standing commitment to technological innovation, is now navigating this transformation in its higher education sector. The rise of Generative AI presents both exciting opportunities and pressing challenges for Japanese universities: How can they embrace new technologies to enhance learning, while safeguarding academic integrity and educational quality? How can they prepare students not just to use AI tools, but to think critically about them?

This article reviews the latest developments in national policies, university guidelines, and teaching practices, highlighting The



University of Osaka as a case study of its comprehensive approach to AI in education. Drawing on interviews with AI research leaders and university leaders, it also outlines the directions universities are likely to take as they move toward deeper integration of AI.

LI Ming (PhD) is a Guest Associate Professor at the Institute for Transdisciplinary Graduate Degree Programmes, The University of Osaka, Japan. In recent years, her work has focused on the integration of Generative AI into higher education, with particular attention to policies at both governmental and university levels, as well as students' understanding and acceptance of the technology. Her broader research interests include interdisciplinary education, the internationalisation of education, student mobility, and global talent mobility.



Government Policies: A Human-Centered AI Strategy

In November 2019, Japan released its *AI Strategy 2019*, which laid out three core principles: human dignity, diversity, and sustainability [1]. The strategy emphasised that AI development must be human-centered, uphold human dignity, and foster broad, sustainable applications of AI across sectors. A critical focus of the strategy is education reform, aimed at cultivating professionals through the establishment of dual-degree programmes that integrate AI and domain-specific studies, and encouraging higher education institutions to incorporate general education courses in data science and AI into their major fields of study.

In 2021, Japan introduced a certification system for education in mathematics, data science, and AI, led by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) [2]. This initiative aims to accredit educational



programmes that meet established standards and ensure high teaching quality, and to further promote composite human resources with professional knowledge and AI capabilities.

As AI technology advanced further, new challenges emerged. In July 2023, MEXT issued official guidance *Policies for Addressing the Use of Generative AI in Universities and Technical Colleges*, which aims to



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help institutions appropriately incorporate Generative AI to enhance education while managing associated risks [3]. The document is concerned about technology-induced issues such as academic misconduct, information security, and copyright infringement, and recommends that institutions establish and update tailored usage guidelines of technology based on the institutional needs. It also stresses the importance of transparency in student use of AI tools, encouraging diversified assessment methods to prevent overreliance on AI-generated content and the significance of content validation and the cultivation of critical thinking.

In parallel with these education-focused initiatives, the Japanese government has since 2023, been actively promoting the development of homegrown Generative AI models. One notable initiative is led by the National Institute of Informatics (NII), which has identified a critical issue: conventional English-centric models tend to lack sufficient understanding of the Japanese language and cultural context. To address this, NII

has placed strong emphasis on developing "sovereign AI" trained with extensive Japanese corpora. The result of this effort is the LLM-JP model, designed with the ability to grasp Japan's history, literature, and cultural heritage [4]. In the field of higher education, its application for learning support is also highly anticipated.

Institutional Generative AI Usage Guidelines

Since 2023, numerous Japanese universities have introduced policies governing the use of Generative AI. The authors conducted a survey of the 37 universities involved in Japan's Top Global University Project (a national initiative launched by MEXT to enhance the global competitiveness of selected universities) and found that 27 of them had issued guidelines on the use of Generative AI for students and faculty. We subsequently carried out a detailed analysis of the content of these guidelines to examine their scope, focus, and underlying principles [5].

In terms of benefits, 44% of universities cite AI's ability to enhance efficiency and automate tasks, 22% highlight its potential in content creation and editing, 19% emphasise personalised learning support, and 11% discuss its role in fostering creativity and innovation (Figure 1). However, these descriptions are often general, with limited detailed application scenarios.

In contrast, concerns regarding AI risks are more comprehensively addressed: 78% of universities highlight data security issues, 67% raise concerns about copyright, 63% warn against the spread of misinformation, and 41% specifically address academic plagiarism (Figure 2). However, other risks—

such as environment risks, AI divide, and control of speech and thought—remain largely unaddressed.

For instance, in response to these challenges, The University of Tokyo recommends that faculty evaluate AI tools prior to classroom use, while Tohoku University offers strategies to reduce inappropriate student use of AI in assignments. Sophia University and Hiroshima University have included AI education in their faculty development programmes to enhance AI literacy among teaching staff.

The survey also reveals that 63% of universities allow instructors to determine the scope and manner of AI use in their

Figure 1. Percentage of Universities that Address Usefulness in Guidelines

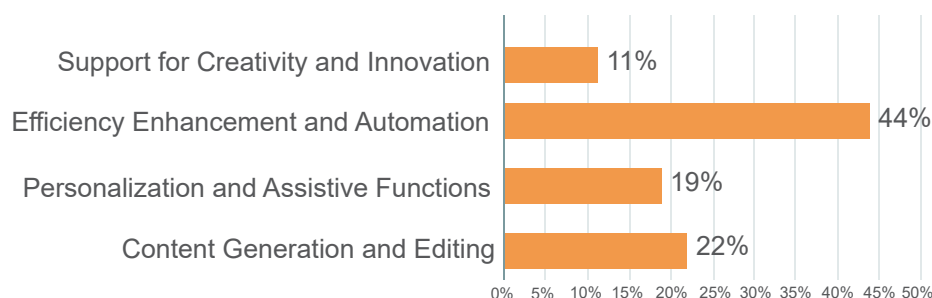
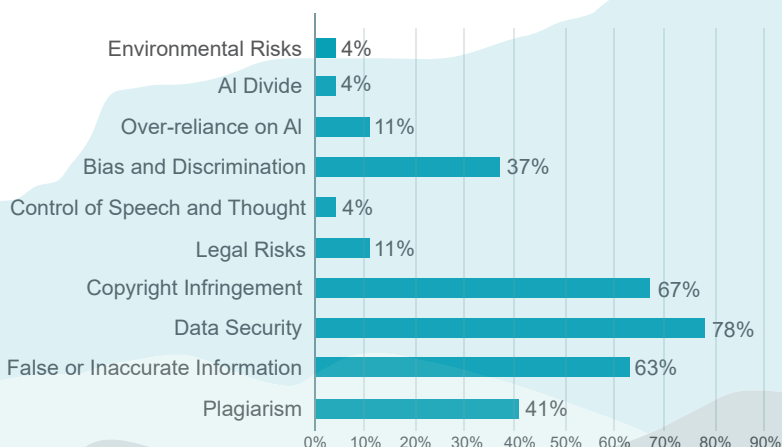


Figure 2. Percentage of Universities that Address Risk in Guidelines



classrooms, reflecting an autonomous policy approach. Additionally, 52% regularly revise their policies in response to technological advancements, promoting adaptive course design and pedagogical innovation.

Case Study: The University of Osaka's Comprehensive Approach to AI in Education

As one of Japan's leading comprehensive research universities, The University of Osaka (UOsaka) issued Japanese- and English-language guidelines on the use of generative AI for students as early as April 2023 [6]. The guidelines recognises the role of generative AI in supporting pre-research for learning, but suggests that students must use it responsibly—remaining mindful of risks such as misinformation, data leaks, and copyright issues—while valuing independent thinking, dialogue, and the overall learning process as the true essence of higher education. Furthermore, UOsaka has adopted a multi-layered, systematic approach to integrating generative AI across undergraduate and graduate education, faculty development, and institutional innovation.

Undergraduate Education: Building Foundational Literacy and Interdisciplinary Skills

In alignment with MEXT's AI education initiative, UOsaka structures its undergraduate AI education into two tiers: foundational AI literacy for all students and applied courses tailored to individual disciplines. All undergraduates, regardless of major, engage in hands-on analysis of social data to develop basic competencies in mathematics, data science, and AI. The curriculum combines



▼ Tekijuku, the University of Osaka

theoretical knowledge with practical applications, often delivered through industry-collaborative project-based learning, to strengthen students' analytical and problem-solving skills.

Graduate Education: Deepening AI Integration through Interdisciplinary Learning

At the graduate level, Institute for Transdisciplinary Graduate Degree Programmes offers interdisciplinary programmes such as "Graduate Minor Programme" and "Graduate Programme for Advanced Interdisciplinary Studies" that incorporate AI into diverse academic fields [7]. The Digital Humanities Programme targets students in the humanities and social sciences, equipping them with the ability to utilise AI tools in their research. Another initiative, the "Programme for Developing



Security Human Resources for Secure Data Utilisation" aims to cultivate high-level professionals equipped to address challenges related to data ethics and privacy. These programmes balance technical expertise with societal application, reinforcing AI literacy among advanced learners.

Faculty Development: Enhancing AI Teaching Competencies

To support faculty, UOsaka's Center for Education in Liberal Arts and Sciences offers Generative AI Teaching Guide website, which outlines core AI principles, ethical considerations, and practical teaching strategies. As part of its faculty development initiative, the center offers both "introductory" and "advanced" workshops to enhance pedagogical integration of AI. Additionally, educational videos aimed at incoming

students are disseminated via platforms like YouTube to foster early engagement and comprehension of AI concepts.

D3 Center: Building a Data-Driven Institutional Ecosystem

In October 2024, UOsaka established the D3 Center—focusing on Digital Design, Datability, and Decision Intelligence—to drive institutional transformation through data science. "Digital Design" involves structuring information for analysis, "Datability" emphasises extracting actionable insights from large datasets, and "Decision Intelligence" supports data-informed strategic decision-making. The center builds an integrated framework from data generation to application, accelerating the university's transition into a data-driven organisation and enhancing the role of AI in research and administration.

ELSI Center: Addressing the Ethical, Legal, and Social Dimensions of AI

In response to the ethical and societal challenges posed by AI, Ethical, Legal, and Social Issues (ELSI) Center published two research reports on the implications of Generative AI in March 2023 and August 2024. The center aims to identify and address key concerns such as ethical dilemmas, legal accountability, and social equity, promoting a responsible use of technology framework. By integrating expertise from law, ethics, and sociology, the center offers theoretical and policy support for the sustainable development of AI in education and research.

Through these initiatives, UOsaka has developed a structured AI education framework that includes foundational courses,

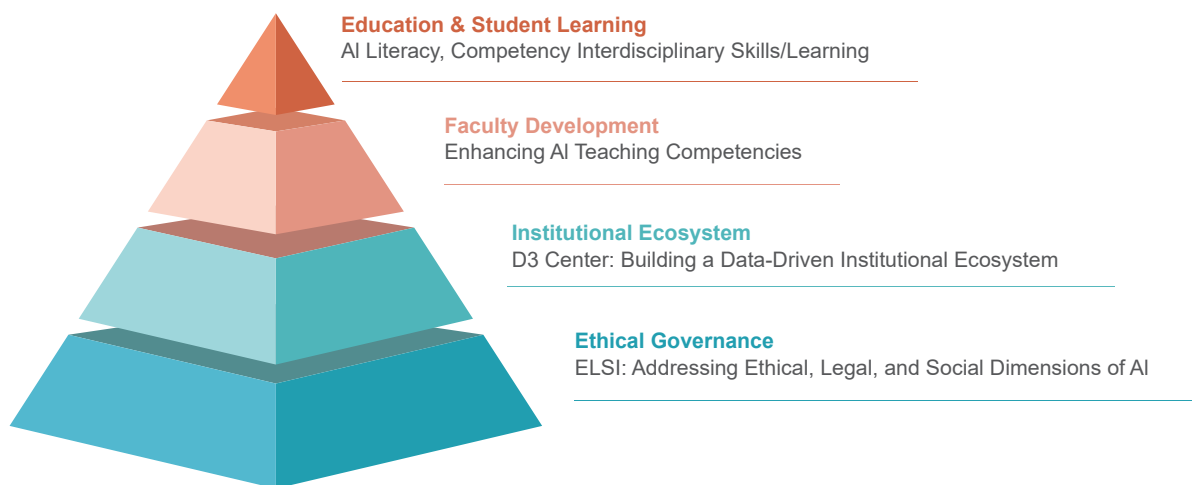


Figure 3. AI Education Ecosystem at The University of Osaka (visuals illustrated by the authors)

graduate-level training, faculty support, institutional adjustments, and attention to ethical considerations. This approach reflects efforts to build a data-informed, technologically integrated, and ethically aware academic environment.

Future Directions: Insights from Japanese Academic Leaders

Currently, AI experts in Japan are actively working to promote the adoption and utilisation of Generative AI. In February 2025, the Science Council of Japan released a proposal titled *Toward the Realisation of a Society that Accepts and Utilises Generative AI* [8]. Prof. Sadao Kurohashi, Secretary of the Committee on Informatics at the Science Council of Japan and Director-General of the National Institute of Informatics, emphasised the need for active discussion and utilisation of Generative AI across a wide range of fields, including education, healthcare, and industry. In particular, he stressed the importance of dialogue and collaboration between AI and other disciplines, positioning this as essential

for society as a whole to advance efforts that take into account the broader impact of Generative AI.



Prof. Sadao Kurohashi

Director-General, National Institute of Informatics-Programme-Specific Professor, Graduate School of Informatics, Kyoto University

At The University of Osaka, Senior Executive Vice President, Prof. Toshihiro Tanaka further pointed out that, in an AI-driven society, respect for humanity must serve as the foundation for shaping the future. Building on advances in science and technology, universities should place humanistic values at



Prof. Toshihiro Tanaka

Senior Executive Vice President, The University of Osaka

the center of education and nurture individuals who can move beyond dependence on AI to stay one step ahead. To this end, it is essential to foster a deep understanding of humanity, including ethics, through education that transcends disciplinary boundaries, and

to cultivate the ability to create new value beyond AI. Providing such an environment, is the very mission of universities.

This shared vision highlights Japan's balanced approach toward Generative AI, where technological advancement is pursued in tandem with human-centered values. By emphasising interdisciplinary collaboration, ethical awareness, and the cultivation of creativity beyond machine capabilities, Japanese university leaders underscore that the future of AI should not only drive efficiency and innovation but also reinforce social trust and human dignity. This perspective positions universities and research institutions as critical bridges between technology and society, ensuring that Generative AI contributes to sustainable and inclusive progress.

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Mongolia:

Leaping Across the Digital Divide

How can higher education navigate geographic isolation, economic disparity, and social inequality in its digital transformation? Mongolia has adopted an approach that balances efficiency and equity: advancing long-term goals through top-level planning while addressing the most urgent digital access needs. International collaboration has provided critical impetus for this transformation.

After returning from Ulaanbaatar to his hometown Sumu during the pandemic, university student Sergelen found that a stable internet connection had become an obstacle he could not avoid in his studies. With no high-speed internet available, mobile data was his only option. Yet, a single online lecture could quickly consume his entire data allowance. He felt uneasy about asking his parents for money to buy more.[1] Another student, Zulaa, faced a shortage of devices. The family's only laptop had to be shared with her sister, also a university student, leaving her to study mostly on a small phone screen. [1]

These accounts are far from isolated. Together, they reveal the challenges individuals may face in the digital

transformation of education, from internet access and economic strain to limited devices. Such feedback highlights where policy efforts should focus and underscores the necessity of the country's efforts to narrow the digital divide, while lending them a distinctly human touch.



The Digital Divide

Mongolia has entered a pivotal stage in its digital transformation. In the frontier field of artificial intelligence, Mongolia has begun to advance top-level planning, technology ecosystems, and data infrastructure, yet it still lags behind regional leaders. The *Oxford Insights* "Government AI Readiness Index 2024" ranks Mongolia 98th among 188 countries worldwide—an improvement of 11 places from 2023.[2][3]

Enhancing digital literacy across the population remains a pressing task. According to the International Telecommunication Union, only 14.3% of Mongolians possess basic ICT skills, with an even smaller proportion demonstrating intermediate or higher proficiency.[4] This skills gap hampers the adoption of new technologies and the growth of the domestic digital industry, making digital education a national development priority.

In the long term, talent cultivation hinges on building a more dynamic innovation ecosystem. The World Intellectual Property Organisation's "Global Innovation Index

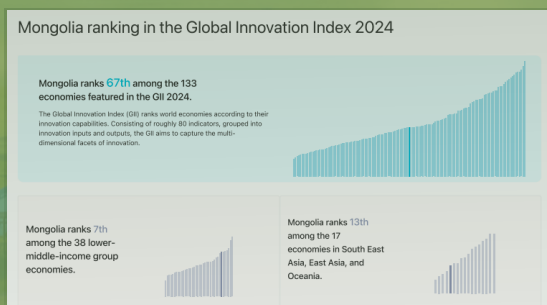
2024" notes Mongolia's improved ranking, while identifying room for progress in market sophistication, institutional environment, human capital, and research[5]—foundational elements for the digital economy and likely focal points for future policy adjustments.

Geography is another perspective to understand Mongolia's digital trajectory. As the nation's political and economic centre, Ulaanbaatar concentrates most digital resources and higher education institutions, creating a "digital oasis." In contrast, vast rural and pastoral areas encounter far greater infrastructure difficulties. This uneven distribution of resources not only places heavy pressure on the capital but also constrains the development of higher education in the regions. Achieving a more balanced allocation of digital resources and educational opportunities has thus become a central challenge for advancing the country's digital strategy.

“

Geography shouldn't define destiny. — Secretary-General António Guterres said at the Third UN Conference on Landlocked Developing Countries

”



► Mongolia ranking in the Global Innovation Index 2024
(Source: Global Innovation Index 2024)

“Turning Barriers into Pathways”

In the face of multiple challenges, Mongolia has developed a comprehensive response framework that spans national strategic planning, concrete project implementation, and the mobilisation of global resources. Behind this ambitious blueprint lies the country's effort to chart its own path across the digital divide, grounded in national realities and attuned to the currents of the Fourth Industrial Revolution.

“

Its core strategy combines long-term and short-term measures, laying the groundwork for future development through systematic planning, while deploying direct interventions to address the most urgent digital divide issues.

”

Notably, international cooperation has played an indispensable role in Mongolia's transformation. The government is actively engaging with international organisations and the global technology industry, leveraging external resources as accelerators for bridging the digital divide and promoting educational equity. In doing so, Mongolia has taken an active role in shaping the direction, pace, and model of its reforms.

Ensuring Equal Access to Quality Education for All

In 2020, the Mongolian government adopted its long-term national development policy, *Vision 2050*, affirming a firm commitment to advancing educational equity. As a key driver of this vision, the “Digital Nation” strategy focuses on enhancing nationwide digital literacy and accelerating the digital transformation of public services, thereby providing the technological foundation and social environment necessary for inclusive education.

To ensure that “inclusive education” does not remain a policy ideal, Mongolia has taken concrete steps to address two core aspects of the digital divide: network connectivity and device availability.

Tackling the challenge of extending networks across its vast territory, the government, through public–private partnerships (PPP) and with World Bank support, has expanded fibre-optic coverage to all 360 Sumu (county-level) centres nationwide.[6] To fill connectivity gaps in remote areas, the government approved the introduction of SpaceX’s *Starlink* satellite internet service in 2023.[7] With the planned launch of

Empowering People: Building an Inclusive Digital Education Ecosystem

With infrastructure steadily improving, Mongolia has shifted its focus to enhancing the digital literacy of students, teachers, and the public. By

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From Yurts to YouTube:
Inside Mongolia’s Internet
Revolution

5G in May 2025, the era of lagging connections in virtual classrooms for herder children may soon come to an end. On the device front, the government has partnered with major technology companies.[8] In a 2023 collaboration with Google, the first batch of 20,000 Chromebook laptops was distributed to schools, and older devices were upgraded free of charge with ChromeOS Flex. The ultimate goal is a one-device-per-teacher-and-student ratio,[9] directly addressing the device shortages exposed during the pandemic and ensuring hardware support for equal online learning opportunities.

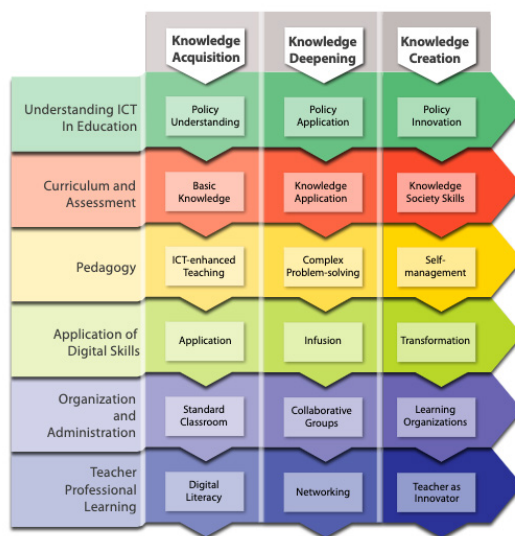
developing inclusive digital education platforms and comprehensive training systems, the country is transitioning from mere hardware provision to capacity building.

To strengthen digital skills, Mongolia is committed to creating a unified and equitable digital content ecosystem. In 2022, the country signed a seven-year cooperation agreement with UNESCO to jointly advance education digitalisation. Supported by UNESCO, the government introduced its first *ICT Master Plan*, proposing the establishment of an integrated national e-learning system to align digital learning resources with national

curriculum standards and international benchmarks. Within this framework, the nationally accessible digital resource platform *Medle.mn* was developed, now hosting over 10,000 teaching materials, including digitised textbooks, online courses, and virtual labs, effectively addressing disparities in educational resources between urban and rural areas.

Recognising the urgent need to enhance teacher and student digital literacy, the government adapted UNESCO's *ICT Competency Framework for Teachers (ICT-CFT)* to develop national *ICT Competency Framework for Teachers*, prioritising teacher training in education reforms.[10] Through a “training of trainers” (ToT) model, large-scale implementation is underway, complemented by UNICEF-supported digital community informant projects aimed at boosting teachers’ ICT skills.

Mongolia continues to embed digital literacy across the entire student lifecycle. On one hand, digital literacy cultivation is incorporated into the national curriculum. On the other hand, targeted programmes provide skills



UNESCO ICT Competency Framework for Teachers
(Source: UNESCO)

training for vulnerable groups. For example, the civil society–initiated *Girls Code project* offers coding training specifically for girls from pastoral and disadvantaged families. This initiative has helped many participants secure scholarships at prestigious universities and enabled some to improve their household income through freelance programming. Building on this success, the *AI Academy Asia* has expanded outreach to broader vulnerable

Over 110 Mongolian girls between the ages of 14 to 18 have graduated from the Girls Code programme



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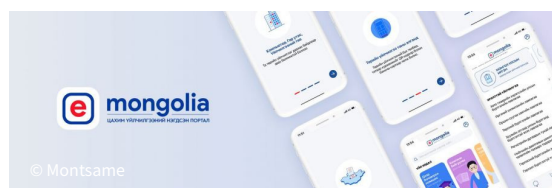
Digitalisation is key to unlocking Mongolia's sustainable and inclusive development potential.

—Tapan Mishra, United Nations Resident Coordinator in Mongolia

”

populations, popularising artificial intelligence knowledge through specially designed mobile-friendly courses that support offline learning, effectively overcoming connectivity challenges in underserved areas.

By cultivating digital skills among the most marginalised groups and remote nomadic communities, digital initiatives will provide critical support for Mongolia's transition to a digital nation. From these focused efforts, Mongolia is advancing widespread social digital literacy through the normalisation of digital services. In partnership with UNDP and UNICEF, the government developed the *e-Mongolia* e-government platform, promoting digital skills development by integrating hundreds of public services, including ID registration and social security enquiries. This "learning by using" model enables all



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 e-mongolia platform

Individual Experiences Bridging the Digital Divide

With support from United Nations agencies in Mongolia, the country established its first Digital Training Facility (DTF) to address urgent local needs for digital skills. After participating in the "training of trainers" (ToT) programme, teacher N. Erdenetuya from Darkhan-Uul province reflected, "This training equipped me not only with systematic knowledge of proper ICT use and effective information retrieval in digital spaces, but also solidified my technical skills. More importantly, I am now able to teach students safe internet practices to ensure their online security."[11]



© United Nations in Mongolia

▶ Induction training for Ulaanbaatar community information workers

citizens, including marginalised and remote communities, to gradually acquire digital competencies through practical engagement, facilitating fuller participation in the digital society.

Notably, Mongolia's digital education transformation is receiving strong support from the private sector. Within the framework of the *Vision 2050* policy, the government actively encourages private institutions, including international training organisations, to participate in training programmes aligned with national ICT competency standards. This policy approach helps address uneven distribution of educational resources, particularly in remote areas with limited training infrastructure. To ensure quality, the government authorises the Institute of Teacher's Professional Development (ITPD) to accredit private training programmes. This public–private partnership model not only standardises training content but also

leverages market mechanisms for efficient resource allocation, providing a sustainable pathway for Mongolia's digital talent development.

Through a series of pragmatic policies, from infrastructure development and digital literacy cultivation to innovative international partnerships, Mongolia is boldly pursuing its ambition to bridge the digital divide, gradually turning the blueprint for digital education transformation into reality. While these efforts may appear technical, they fundamentally concern the development opportunities of ordinary people. The key to technology-enabled education lies in building an inclusive digital ecosystem that allows learners in remote areas to share the benefits of development. Though the journey ahead remains long, Mongolia has taken a critical and solid step forward. In the digital age, equity and innovation may mutually reinforce each other.

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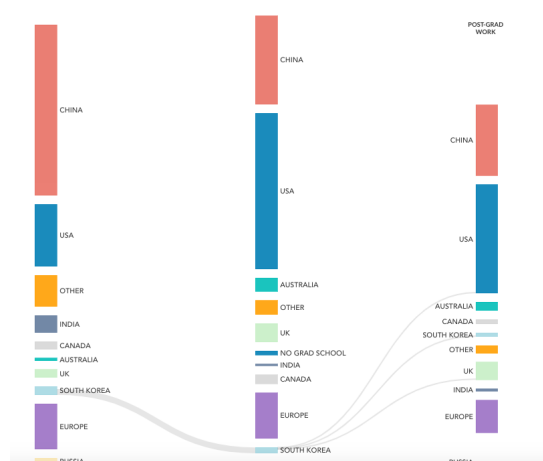
Industry Demand-Driven: South Korea's AI Talent Development Policies and Practices

To address challenges such as the outflow of AI talent and the widening technological gap, South Korea has adopted a proactive policy framework. By building an open legal and policy environment, aligning initiatives with local industrial needs, and flexibly reallocating higher education resources, the country is fostering an innovation ecosystem based on "industry–education integration". These policy measures jointly promote the cultivation, retention, and value realisation of AI talent, driving the intelligent upgrading of key industries and offering a distinctive model for global higher education–industry integration.

Retaining AI Talent

As a globally recognised technological leader, South Korea has long been at the forefront of science and innovation. Yet in recent years, it has faced a serious problem: the outflow of artificial intelligence (AI) talent. In 2024, South Korea ranked only 35th among the 38 OECD member states in AI talent retention, with a net loss of 0.36 AI specialists per 10,000 people.[1] The United States and the United Kingdom are the main destinations, attracting nearly 40% of Korean AI graduate students for employment.[2] This talent drain has had a tangible impact on Korea's share of the global AI talent pool. According to Stanford University's *Artificial Intelligence Index Report 2024*, South Korea's AI talent concentration in 2023 was only half of what it was in 2016.[8] The underlying reasons include the relatively limited competitiveness of Korean universities in frontier AI research, less attractive salaries and opportunities compared

to global standards,[3] a weaker AI industrial ecosystem, and insufficient investment.



▶ The Global AI Talent Tracker 2.0 (Source: Macro Polo)

To counter these challenges, South Korea has adopted an "industry demand–driven" strategy aimed at cultivating and attracting

professionals who can be deeply embedded in core domestic industries and enhance their competitiveness. Top-level initiatives such as the *AI Strategy for Realising I-Korea 4.0* and the *Smart Factory Plan 2033* designate AI as a key driver for the transformation and upgrading of manufacturing, semiconductors, and carbon neutrality-related industries.[4] This approach explicitly requires AI development and talent training to revolve around industrial needs, focusing on solving practical problems rather than competing in the global race for generic technologies. As a result, South Korea's higher education seeks to nurture individuals who are not only technically proficient but also possess strong industry knowledge and humanistic literacy. These individuals are expected to take root in front-line sectors such as semiconductors, automobiles, shipbuilding, and digital healthcare, driving technological innovation and practical applications. Ultimately, they form the backbone of South Korea's strategy to consolidate its position in the global technological competition. South Korea's AI policies and educational investments are thus designed to systematically cultivate and attract this kind of talent.



Policy First

A forward-looking legislative system lies at the core of South Korea's policy approach. In recent years, the country has established a top-down AI governance framework through the *AI Basic Act* and the Presidential National AI Committee. The *AI Basic Act* integrates principles such as privacy protection and bias regulation into legislation, laying an

ethical foundation for AI development. More significantly, the *Framework Act on the Development of Artificial Intelligence and Establishment of a Foundation of Trust* (hereafter the *AI Framework Act*), passed in 2024 and set to take effect in January 2026, makes South Korea the world's second jurisdiction to introduce a comprehensive AI law after the European Union (EU).[5]

The *AI Framework Act* functions both as a regulatory measure and a carefully crafted industrial policy tool designed to create a predictable and innovation-friendly environment. Its core aim is to balance technological advancement with the protection of citizens' rights. By adopting a risk-based classification approach, it places stricter oversight on high-impact AI and Generative AI, while applying more flexible rules to other AI systems to lower barriers to innovation. High-impact AI refers to systems that may significantly affect human life, safety, or fundamental rights, such as those in healthcare, energy, public services, and law enforcement. Importantly, the Act avoids outright bans on AI practices, reflecting the government's pro-innovation stance. Its enforcement mechanisms are also relatively moderate, emphasising compliance guidance rather than punishments. This design offers innovators legal certainty and

stability, positioning South Korea as an increasingly attractive hub for AI research and development.[5] The message to the global AI community is clear: Korea is open for business, equipped with transparent and reasonable rules, and committed to fostering the integration of innovation and education.

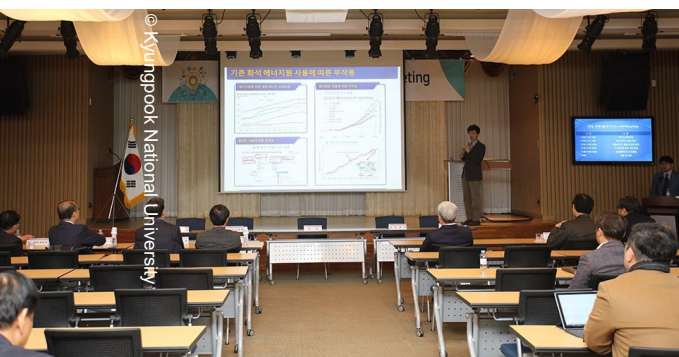
Beyond legislation, South Korea has also rolled out a series of talent cultivation policies, positioning higher education as a "national strategic innovation engine". Comprehensive Plan to Nurture Digital Talent released in 2022 explicitly stated: "Universities will be restructured as frontier bases for nurturing advanced digital talent, ensuring the nation achieves global leadership in digital technologies amid intensifying geopolitical competition".[6] In December 2023, the 5th Science and Technology Basic Plan (2023~2027) incorporated this goal into the national science and technology strategy, designating 12 strategic technologies, including AI and semiconductors, as mandatory priorities for universities.[7] Official documents outline a three-tier AI competency framework for higher education, namely basic, advanced, and expert, ranging from introductory programming to chip-level AI design. This framework is supplemented by ethics courses and supported by the planned digital transformation of four key domains: classrooms, laboratories, faculty, and credits, by 2027.

Resource-Driven Development

One of the defining features of South Korea's integration of higher education and AI is the construction of regional ecosystems that emphasise local distinctiveness rather than centralised breakthroughs. For example, regional innovation hubs such as Robotics in Daegu and Convergence AI in Honam, are designed to strengthen AI research capacity at the local level. To ensure precise implementation of national policies, the Ministry of Education has launched two key initiatives that channel talent and innovation resources into regional industrial clusters.

The first is the "Glocal University 30" programme, which will invest up to KRW 3 trillion over the next five years in 30 universities outside the capital region. The aim is to transform these institutions into engines of local economic growth. Funding is contingent on universities embedding themselves within regional industries and communities, addressing practical development challenges. For instance, Dongseo University partnered with Chinese universities to establish courses in AI-based digital imaging and smart media, directly aligned with the needs of the local digital content industry. This ensures that AI education remains rooted in regional economic characteristics and delivers tangible outcomes.

The second is the "Regional Innovation System and Education" (RISE) initiative, which devolves more than 50% of university funding authority (over KRW 2 trillion annually) to local governments, granting them autonomy to tailor university research and talent training to regional industrial needs. This reform deepens interactions between local universities and





industries, ensuring AI technology serves regional development priorities. For example, Daegu has prioritised the D5 industries (AI, big data, semiconductors, etc.), with Kyungpook National University becoming a major beneficiary, receiving KRW 5.7 billion annually in full-cycle R&D support to advance research at the intersection of AI, healthcare, and semiconductors.

University–Industry Collaboration

Public–Private Partnerships (PPP) further energise South Korea's higher education and AI ecosystem by bringing together technology firms, telecommunications companies, and public institutions to jointly advance infrastructure and AI-driven innovation. Guided by policy, regional universities are forging deep cooperations with local corporate champions to cultivate AI professionals who match industry needs, ensuring close alignment between education and the labor market.

A prime example is the development of "Contract-based Departments", which provide systematic, targeted training that exposes students directly to real-world industry challenges. Dankook University, for instance, has partnered with firms in South Chungcheong Province to create customised AI programmes in carbon neutrality and bio-convergence, enabling students to train around the actual requirements of their future employers. More commonly, joint university–industry laboratories and departments integrate resources from both sides to focus on cutting-edge R&D and product development. Sungkyunkwan University's Semiconductor and Display Engineering Department, established with Samsung Electronics, has become a vital training ground for high-end semiconductor talent. Likewise, Seoul National University's collaboration with Samsung Heavy Industries in AI-driven shipbuilding aims to cultivate engineers capable of driving the digital transformation of traditional industries, injecting new vitality into Korea's industrial base.

Global Talent Attraction

In responding to the transformation brought by AI, South Korea's higher education system does not only focus domestically but also looks outward, positioning itself as a destination for global talent. To infuse fresh vitality into its AI ecosystem, South Korea launched the "Global AI Challenge" and expanded the "AI Frontier Labs", offering platforms for outstanding AI professionals worldwide to showcase their innovations. These initiatives reflect a core belief: in the AI race, the decisive factor is not merely technological investment, but the ability to attract individuals who continuously push the boundaries of innovation. Through such efforts, South Korea is steadily becoming one of the most attractive destinations for AI professionals and researchers, building bridges between its domestic industries and international innovation networks.

Conclusion

South Korea's policy framework broadens our understanding of how education can drive AI innovation. It extends far beyond



the combination of technology and curricula, but evolving into a deeper dialogue between industry, talent, and the future. With a forward-looking legislative framework, flexible allocation of educational resources, and an innovation ecosystem rooted in industry–education collaboration, South Korea has carved out a distinctive path of smart factory development and industrial upgrading. Against the backdrop of fierce global competition, rising demand for AI literacy, and the urgent need for future-critical skills, South Korea's experience provokes reflection: How can policy design and resource integration help retain innovative talent? How can education serve as the engine of industrial transformation? These are questions whose answers may emerge through practice and experimentation, and South Korea's model offers valuable insights along the way.





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Dialogue with *CLOUD*: Interview with the IIOE Mongolia National Centre

The twelfth issue of *CLOUD* reported on the notable achievements of the IIOE Micro-Certification Project for Higher Education Workforce Digital Competency Building (IIOE Micro-Certification Project) implemented at the Mongolia University of Science and Technology (MUST). The project has achieved notable results by empowering educators and facilitating the localisation, contextualisation, and nationwide dissemination of AI courses. This initiative has not only enhanced the

digital literacy of university teachers in Mongolia but also established a sustainable capacity-building mechanism, making MUST a noteworthy case of good practice.

To gain deeper insight into the MUST's successful experience with the IIOE Micro-Certification Project, this issue of *CLOUD* features an in-depth conversation with Dr. Ariunbolor Davaa, Professor at the university's Open Education Institute (MUST-OEI).

Q: MUST has been highly engaged on the IIOE platform, especially in promoting MC Project and conducting teacher training at scale. MUST ranks first in new registrations during March and April. During the localisation process, did MUST develop any particularly effective practices or mechanisms?

A: We take great pride in serving as the IIOE Mongolia National Centre. Our engagement with the IIOE platform particularly through the Micro-Certification (MC) initiative has been both strategic and transformative.

One of our most effective practices was the development of a multi-tiered cascade training

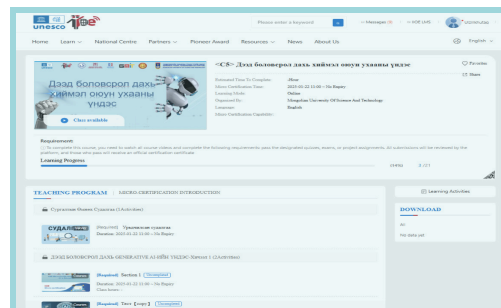
model. This involved preparing 22 master teachers who not only helped localise the content but also facilitated regional trainings and provided mentoring to peers. This innovative model integrates offline workshops with a peer-mentoring mechanism, using a progressive “train-the-trainer” approach to accelerate the dissemination of the

programme. It created a ripple effect that reached educators even in remote regions and greatly accelerated adoption.

In terms of content localisation, we translated and adapted three core AI courses *Fundamentals of Generative AI in Higher Education*, *Teaching with AI: Practical Tips and Prompts* and *A Journey through the Future Classroom* into Mongolian with full audio-visual support. This wasn't just about translation; it was about cultural and pedagogical relevance. The localised versions are now accessible on the IIOE platform and are widely used across Mongolian universities. Over 90% of participants rated the course highly for both content and usefulness, underscoring its effectiveness.

The project closely corresponds to Mongolia's national objectives for digital talent development. By June 2025, **2,054 educators from 38 institutions had participated in the programme, and 580 received certification.** Among the 1,698 educators who completed the three Mongolian-language courses, about

30% are now actively integrating AI concepts into their curriculum and instruction. This clearly demonstrates that our initiative didn't stop at training, it led to meaningful changes in classroom practice.



IIOE Mongolian Courses



IIOE MC Project Certificate

Q: In advancing digitalisation in higher education, institutions may face challenges such as limited ICT infrastructure or gaps in teachers' digital skills. How has MUST addressed these challenges (if any) while implementing the MC Project? For example, would you share any insights or strategies about expanding training coverage?

A: Yes, like many institutions in developing contexts, MUST also faced certain challenges in advancing digital transformation particularly in the early stages of the MC Project. These included uneven access to ICT infrastructure across regions, as well as varying levels of digital readiness among faculty.

To address these challenges, we adopted a phased and inclusive implementation strategy. One of the key success factors was leveraging our national network of master trainers, many of whom were developed through earlier capacity-building initiatives such as CDIO (Conceive, Design, Implement,

Operate) and blended learning programmes. These master trainers played a critical role in cascading knowledge, delivering localised training sessions, and providing ongoing mentorship to faculty in both urban and rural institutions.

We also collaborated with educational authorities and university leaders to raise awareness about the long-term value of micro-certification and digital pedagogy. This helped generate institutional buy-in and encouraged faculty to actively engage in training programmes. Additionally, we developed hybrid delivery models to ensure

accessibility offering both online and face-to-face sessions to accommodate bandwidth limitations and ensure broader reach.

Importantly, we ensured that the IIOE Micro-Certification training programmes were aligned with national policy goals and teacher qualification standards, which gave the initiative legitimacy and sustainability. Our experience shows that **local adaptation, peer-led training, and a clear alignment with national frameworks** are key to overcoming digital transformation barriers in higher education.

Q: Integrating IIOE Micro-Certifications into the national teacher qualification system was a significant innovation undertaken by MUST. Would you discuss the efforts MUST-OEI made in aligning policies, such as coordinating with educational authorities and designing credit-transfer mechanisms?

A: Integrating the IIOE Micro-Certifications into Mongolia's national teacher qualification framework has been one of the most impactful innovations led by the MUST), particularly through its OEI.

Our work began with **aligning institutional strategies to national education policies**. In close coordination with the Ministry of Education

and relevant regulatory bodies, we ensured that the micro-certification model would enhance not duplicate the existing teacher qualification system. This required thoughtful policy dialogue, shared understanding, and collaborative planning.

A core part of the initiative involved developing a **credit-transfer mechanism** to formally recognise micro-certification achievements. We are currently piloting the integration of selected micro-courses into our official master's degree programmes

at MUST, with the aim of creating seamless pathways from modular, informal learning to

recognised academic qualifications.

Our current progress builds upon a strong foundation of past reform. Since 2015, MUST has been joined in the global CDIO Initiative. With support from the Asian Development Bank and the Temasek Foundation of Singapore, and in collaboration with Singapore Polytechnic, we implemented several capacity-building programmes such as “CDIO,” “Advancing CDIO,” “Active Learning Approaches,” and “Quality Assurance in Higher Education.” These programmes, delivered through structured pedagogical training, led to the formation of **a national network of master trainers**, which helped scale innovation across Mongolia.

Leveraging this experience, we are now successfully implementing both the *Blended*

Learning Methodology and the IIOE Micro-Certification Project. These initiatives are modernising teaching practices and promoting AI-integrated learning environments.

Above all, our approach emphasises equitable and inclusive access to quality digital education. We strongly believe that every educator, regardless of their geographic or institutional context, should have meaningful access to AI education resources and opportunities for lifelong learning.



▼ The images used in this article are based on authentic photographs from the training, stylised and generated using AI tools.

Q: The recently launched joint action plan on *Capacity-Building and Recognition of Digital and AI Competencies in Mongolia’s Higher Education Sector*, introduced at the High-Level Policy Dialogue in East Asia, is a strategic framework for integrating AI into higher education. How does MUST plan to operationalise this framework?

A: The Joint Action Plan on Capacity-Building and Recognition of Digital and AI Competencies in Mongolia’s Higher Education Sector co-developed by MUST and UNESCO-ICHEI is a milestone initiative. Our implementation focuses on three key pillars:

■ **Digital Skills Development:**

We are delivering foundational and intermediate-level courses such as “*Digital Teaching Essentials*” and “*Applied Digital Pedagogy*,” along with advanced modules like

“*Advanced Teaching Design & Delivery*” to deepen pedagogical capacity. Additionally, we are implementing a Lightboard Technology Training course with Micro-Certification, localised in both English and Mongolian.

■ **AI Competency Enhancement:**

We are localising and delivering AI-focused training programmes such as “*Prompt & Teaching with AI*,” “*AI Tools in Teaching Scenarios*,” and “*Build Your Own AI Chatbot*.” These programmes are designed to promote

AI applications across various disciplines including education, natural sciences, and engineering. Special attention is given to generative AI and advanced AI tools through practical, context-relevant modules.

To further support faculty development, we are also introducing innovative tools such as the **Faculty AI Portfolio**, which enables instructors to document and showcase their competencies in AI-integrated pedagogy. This portfolio can support national-level recognition and career progression.

Moreover, our roadmap includes a series of **national events** to facilitate sharing of best practices and innovations:

- An annual *AI and Digital Education Summit* (starting in 2026)
- A bi-annual *Educators' Forum on Teaching Innovations*
- A *National AI and Digital Teaching Award* to recognise excellence in practice.

Through these initiatives, we aim not only to provide access to training but also to create a sustainable ecosystem where AI in education becomes deeply embedded, widely practised, and nationally recognised.

Q: In which areas does MUST hope to strengthen cooperation with the IIOE in order to better leverage the platform and support the university's own needs?

As one of the most engaged university partners within the IIOE network, MUST has had the opportunity to actively pilot and promote various platform-based initiatives. Through this experience, we've identified several areas where the IIOE platform and ecosystem could be further optimised to better serve local and regional needs.

Firstly, we see strong potential in **expanding localised course offerings** not only

through language translation but also by contextualising content to reflect national educational policies, cultural dynamics, and institutional practices. Localisation should move beyond language and address pedagogical relevance, especially in disciplines like teacher education, engineering, and public administration.

Moreover, MUST is committed to further strengthening its multilateral collaboration with IIOE. We believe the IIOE platform can serve as a more dynamic **collaborative space**. Features that enable peer-to-peer exchange, joint course co-creation, or thematic working groups would help strengthen professional communities and knowledge transfer across institutions.

▶ The images used in this article are based on authentic photographs from the training, stylised and generated using AI tools.





Professor Ganbat Danaa, Dean of the Open Education Institute, presented the action plan

Finally, as MUST continue to lead national efforts in AI integration and digital capacity-building, stronger coordination between IIOE and national stakeholders such as

ministries, accreditation bodies, and teacher development centres would ensure that platform activities align with national agendas and support system-wide transformation.

Dr. Ariunbolor Davaa

Professor and core member of the Open Education Institute at the MUST, plays a leading role in advancing higher education reform and international collaboration in Mongolia, with longstanding research focused on the modernisation of the national higher education system.

MUST's implementation of the IIOE Micro-Certification Project reveals: beyond equipment investment and external intervention, the digital transformation of higher education demands the strategic development of existing faculty and the creative mobilisation of local networks. The driving force for sustainable change lies in building enduring mechanisms for knowledge transmission—ensuring that each trained participant becomes a new dissemination node, enabling wide reach without compromising content quality. Its significance

extends beyond a replicable technical pathway to a return to the essence of education: when AI technology is transmitted through Mongolian-speaking master teachers, a subtle balance emerges between technological empowerment and cultural continuity. This underscores that AI integration is far more than a mere technical transplant; it is a multidimensional transformation requiring mastery of tools, innovation in pedagogy, and the establishment of an ecosystem that sustains the flow of knowledge.

Riding the Wave: The Diverse "AI+ Disciplinary" Ecosystem in Chinese Higher Education

The Rising Tide

China's pool of AI talent is expanding at a striking pace, with an average annual compound growth rate of 28.7%, reaching 52,000 individuals to date. This remarkable surge has been fuelled by Chinese universities' proactive embrace of the AI wave, in alignment with the imperatives of digital transformation and educational modernisation. Through the renewal of traditional disciplines, the deep integration of interdisciplinary fields, and the establishment of emerging AI-focused programmes, universities are exploring systematic and large-scale pathways for developing an "AI+X" disciplinary landscape.[1]

Advancing with the Current

AI is inherently comprehensive and interdisciplinary, encompassing algorithmic theory, computational architecture, data science, and cognitive science. At the same

time, it functions as a catalytic force that permeates nearly every field of knowledge, serving as a leading driver of innovation. Its interaction with traditional disciplines, therefore, is not characterised by unilateral disruption or substitution but rather by deep mutual engagement and reciprocal empowerment across knowledge systems, research methodologies, and application domains. This collaboration fosters the co-evolution of disciplinary paradigms and unlocks vast potential for cross-domain co-creation and structural transformation. Only when AI is fully integrated with the theoretical foundations and practical applications of diverse fields can its maximum innovative potential be realised.

Within the framework of disciplinary development, AI empowers traditional academic systems through three primary pathways. First, endogenous innovation within existing disciplines, whereby AI technologies are incorporated into established theories and

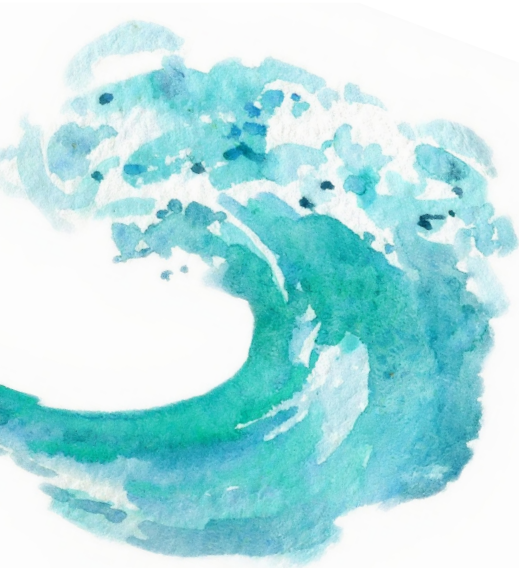
methods to enable iterative renewal of knowledge systems and research tools. Second, interdisciplinary convergence, which promotes deep coupling between AI and other disciplines across theoretical, methodological, and applied dimensions, giving rise to hybrid forms such as “new engineering” and “new science.” Third, the creation and evolution of emerging disciplines, in which new fields of research and application emerge around AI itself and its derivative technologies, thereby expanding the boundaries of higher education and research systems.

Innovation in Traditional Disciplines

Under the impetus of AI, both foundational and applied disciplines are undergoing comprehensive transformation, ranging from research methodologies to application scenarios. This transformation is particularly evident in the expansion of disciplinary boundaries, the upgrading of research tools and methods, and the breakthroughs in theoretical systems.

Linguistics provides a compelling example. As Professor LIU Haitao of Fudan University observes, language is not only a window into intelligence but also the ignition point of the current digital–intelligence revolution and a critical entryway for AI to decode the software system of humanity. Universities such as Beijing Language and Culture University and Xi'an International Studies University have established cross-disciplinary laboratories on AI and linguistics, while comprehensive universities such as Beijing Normal University and Hunan University have prioritised the cultivation of interdisciplinary talent in “language + AI” through new programmes. These initiatives demonstrate how AI is reshaping research agendas and driving theoretical innovation within traditional fields, while continually updating academic methodologies.

Moreover, AI has equipped traditional disciplines with powerful new tools such as big data analytics and behavioural



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modelling, enabling scholars to gain more precise insights into the complexities of social phenomena and human behaviour. Xiamen University, for instance, has sought to integrate AI technologies into the teaching and application of economics and finance in order to strengthen professional skills and improve educational quality. Building on a solid technological foundation, the university's Key Laboratory of Econometrics has deployed a locally integrated AI workstation featuring the Deepseek full-stack model matrix within the economics discipline, facilitating innovative applications by both students and faculty across diverse scenarios.[2] In terms of talent cultivation, the university has anchored its economics programme in an "Economics+" framework, adopting a dual-driven model of "quantitative analysis + AI modelling" to train versatile professionals equipped with expertise in both economics and AI. Furthermore, Xiamen University has introduced minors in AI Economics, Data Science and Big

Data Technology, thereby promoting cross-disciplinary education across the institution.[2]

Beyond theory, AI-driven innovations in traditional disciplines extend to industrial and societal problem-solving. The College of Media and International Culture of Zhejiang University has pioneered research into AI-enabled green screen production, as well as the relationship between AI and social trust.[3][4] It also spearheaded the creation of the International Digital Equity Alliance (IDEA), working with UNESCO to address pressing challenges in the Global South within the global digitalisation process, such as the technological divide and inequitable value distribution.[5] In this context, Zhejiang University proposed a community-based data-sharing governance model and initiated the *Digital Equity Handbook* to promote digital empowerment and inclusive governance. Meanwhile, Fudan University, in collaboration with the Shanghai Academy of AI for Science, has developed *CardioMind Beta*, a medical large model for cardiovascular care. This system realises full-process intelligentisation from medical history collection to diagnostic support, while ensuring data security through the anonymisation of patient information.[6]

▀ Nobel Laureate in Economics Thomas Sargent delivered a speech at the World Digital Education Conference, sharing his views on artificial intelligence.



Confluence of Currents: Interdisciplinary Integration

Beyond empowering traditional disciplines, AI is increasingly serving as a “catalyst” for interdisciplinary integration, driving the emergence of hybrid disciplines. Interdisciplinary integration is not merely the convergence of knowledge domains; it

technological breakthroughs and original innovations.

Interdisciplinary integration is spearheaded by talent cultivation. In 2025, Shanghai Jiao Tong University’s Paris Elite Institute of Technology, in partnership with École Polytechnique and Université Paris Sciences et Lettres, launched the inaugural “Descartes Class,” offering undergraduates an integrated training model

Demonstration of UBTECH’s Humanoid Robot Industrial Solutions at Beijing Economic Development Zone



represents an academic transformation that renews established knowledge systems. This process is driving the convergence of fundamental disciplines such as physics, mathematics, and chemistry with related domains, steering them toward the “new engineering” and “new science” paradigm shifts, and revitalising existing knowledge systems in the era of intelligent digitalisation. By leveraging AI, traditional fields are opening new avenues of inquiry, accelerating innovation and knowledge discovery, and extending their reach from purely theoretical domains into applied practice, while at the same time laying a solid foundation for AI

that combines mathematics, physics, AI, and engineering.[7] In the same year, Tsinghua University announced the establishment of a new undergraduate liberal arts college designed to highlight AI’s driving role in teaching design and research innovation, anchored in the principle of AI-enabled interdisciplinary integration.[8] Moreover, both Tsinghua and Fudan Universities are accelerating AI curriculum development. Tsinghua plans to introduce a new AI minor and certificate programme, while Fudan has launched a large-scale AI course initiative, aiming to offer at least 100 AI-related courses within a year, covering all undergraduate,



© Shanghai Jiao Tong University's Paris Elite Institute of Technology

postgraduate, and primary disciplinary programmes. [9] These courses seek to cultivate versatile professionals with both AI literacy and technical competence, enhancing their specialised learning while also fostering interdisciplinary synthesis.

The deeper value of AI's integration lies in its capacity to drive both knowledge system innovation and industrial application breakthroughs. Unlike AI's primarily instrumental role within traditional disciplines, its function in interdisciplinary contexts is characterised by the expansion of research paradigms, the discovery of new knowledge, and reciprocal feedback that further advances AI technologies. For example, at Fudan University, undergraduates across different faculties co-developed the algorithmic tool *VQ Crystal*, which has revolutionised the research paradigm for crystal material discovery and been applied in the design of both 3D and 2D materials.[10] Similarly, a team from Shanghai Jiao Tong University's School of Integrated Circuits became the first to embed time variables into AI models, developing

ManuDrive, the world's first "time-dimension-based AI industrial control system," which enables dynamic prediction and precise remote regulation of complex fermentation processes.[7]

Emergence of New Disciplines

AI is shifting from a frontier technology confined to laboratories into a core discipline within classrooms. In recent years, the development of AI-related programmes in Chinese universities has gone beyond upgrading curricula or layering AI onto existing majors; it has increasingly become a bridge for deep integration among industry, academia, and research.

In May 2025, Tsinghua University, together with Sichuan University, Zhejiang University, and technology enterprises such as Tencent, Huawei, and JD.com, co-founded the Jittor Industry–Academia–Research Alliance. This platform is designed to integrate the technological strengths and application

expertise of enterprises with the advanced theoretical knowledge of universities, thereby developing deep-learning frameworks and accelerating the transformation of innovations across the AI industry chain.[11] Tsinghua University has also partnered with Tencent to establish China's first postgraduate programme in Large Model Science and Engineering. By combining Tencent's real-world application scenarios and challenge-driven projects with Tsinghua's AI theoretical instruction, the programme seeks to cultivate students' engineering practice skills and capacity for scientific and technological innovation.[12] In parallel, Renmin University of China and Peking University, for instance, have partnered with the CBJ Think Tank to establish the AI Industry–Academia–Research Business Collaboration Alliance. Leveraging the think tank's informational advantages, this alliance seeks to align academic training with frontier market demands, foster versatile talent, and accelerate the industrialisation of AI achievements.[13] Similarly, Beihang University and Nankai University have

launched initiatives such as the “Mathematics and AI Experimental Class” and the “AI Industry–Academia–Research Collaborative Education Platform,” both initiatives place strong emphasis on university–industry cooperation to nurture professionals equipped for cross-sector innovation.

This mode of AI disciplinary construction, centred on deep integration of industry, academia, and research, is driving Chinese higher education from knowledge transmission toward knowledge co-creation. From classrooms to laboratories, from corporate R&D centres to international collaboration platforms, the learning and practice of AI are forming a value chain that seamlessly connects education, research, and industry.

Sailing into the Deep Blue

These diverse practices demonstrate that the integration of advanced technologies with the principle of open sharing not only

Media Professionals from Various Countries Discuss the Application Scenarios and Ethical Issues of AIGC Tools





Professor TENG Shanghu delivered a lecture at Renmin University of China

bridges disciplinary divides but also endows education with lasting momentum for advancing sustainable social development. Drawing on a solid foundation of scientific research, a well-established educational system, and close collaboration with industry, Chinese universities have forged a full-chain advantage in integrating AI with academic disciplines, from conceptual innovation to

practical implementation. In this resonance of technology and scholarship, a cohort of exemplary teaching and research models has emerged, rooted in local contexts yet oriented toward global horizons.

This article was composed using publicly-available online sources. ■

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Why should medical students learn artificial intelligence?

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In 2020, when Southern University of Science and Technology (SUSTech)'s School of Medicine introduced Introduction to Artificial Intelligence as a compulsory course, many students questioned its necessity, believing the traditional medical knowledge system was sufficient for future clinical practice. However, the rapid growth of medical knowledge, coupled with increasingly complex healthcare environments and diseases, has challenged traditional systems and teaching, demanding interdisciplinary education and AI integration in curriculum, assessment, and medical innovation.[1]

At present, the transformation of teaching paradigms by AI remains limited.[2] In AI curriculum design, problems are still widespread, including nominal or superficial course offerings, an overemphasis on technical operations at the expense of values, and the excessive promotion by private enterprises. There is also a lack of attempts to integrate AI with public curriculum development in education systems in an organic manner.[3]

iMED Team's Journey: From AI+Medicine to Educational Intelligence



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To enable AI technologies to better serve learners from diverse backgrounds, Professor LIU Jiang of SUSTech and his Intelligent Medical Imaging (iMED) team have advanced the concept of "Educational Intelligence" through the integration of AI with academic disciplines in both teaching and technological applications. Building on their practical experience in applying AI across medicine and education, this concept combines cutting-edge AI methods with evidence-based teaching strategies, emphasising the use of AI to understand education, thereby realising learner-centred personalisation and universality, and ultimately achieving the goal of "understanding education" and human-machine collaboration.

"AI + Disciplines": Pioneering Integration

The iMED team's success in merging medicine with AI stems from sustained efforts to apply "AI+" concepts in real-world disciplinary contexts. Here, "AI+" refers to the targeted application of artificial intelligence within specific industries. Professor LIU Jiang emphasises that students should go beyond mastering AI fundamentals to develop an awareness of how AI connects with sector-specific scenarios, understanding both its boundaries and its potential. The team's experiments in integrating AI with medicine and its subsequent development of the "Educational intelligence" concept arose directly from interdisciplinary teaching and research practice.



Since 2019, LIU has taught *Introduction to Artificial Intelligence* at SUSTech. By the following year, the School of Medicine had made it a compulsory course. The diversity of the student body and the limited technical background of non-computer science majors posed significant teaching challenges. Over five semesters, the iMED team developed an innovative "AI" + "AI +" pedagogy that integrates AI knowledge with the needs of specific disciplines and industries. This approach not only deepens students' understanding of cutting-edge AI technologies but also enables their application in real-world projects.

The team's early "AI + Medicine" work has concentrated on technical applications in ophthalmology. According to the World Health Organisation, 2.2 billion people worldwide suffer from vision impairment, with at least 1 billion cases preventable or untreated.[4] Conventional manual diagnosis of ophthalmic images is often constrained by reliance on physician expertise, high misdiagnosis rates, time consumption, and cost-challenges particularly acute in developing countries, where shortages of specialists and limited technical capacity persist. AI offers an effective solution, endowing ophthalmic imaging with dynamic features beyond the reach of traditional methods. iMED team focuses on the deep integration of AI with ophthalmic

diagnosis and treatment, dedicated to exploring the use of AI technologies to enhance early screening, assisted diagnosis, and clinical decision-making in ophthalmology.

By integrating clinical medical knowledge with deep learning methods, the research not only covers common high-incidence eye diseases such as glaucoma and cataracts, but also extends to areas including dynamic image analysis, remote screening, and personalised diagnosis and treatment. This approach not only compensates for the limitations of traditional imaging methods in terms of accuracy and efficiency, but also creates new possibilities for popularising intelligent diagnosis in primary healthcare institutions and for promoting greater equity and accessibility in ophthalmic services.

Crucially, the technology supports remote screening and preliminary automated diagnosis, strengthening primary healthcare capacity and expanding service coverage. On the clinical integration side, the team adheres to a needs-driven approach, closely combining AI technologies with medical domain knowledge. All methods are validated in real clinical workflows and experimental settings to ensure accuracy, interpretability, and compliance with ethical and operational standards in medicine.



Educational Intelligence: Deepening and Expanding “AI +”

The iMED team’s exploration in “AI + Medicine” not only demonstrates the vast potential of AI technologies in real clinical contexts but also underscores the importance of interdisciplinary teaching and practice in cultivating versatile talent.

Building on prior experience in AI-focused disciplinary integration, the team has advanced the concept of “Educational Intelligence”, an AI-supported, discipline-driven educational model aimed at achieving a deep transformation from “AI + Medicine” to “AI-powered medical education”. Technical innovations rooted in frontline clinical practice have, in turn, informed and enriched the philosophy and methods of medical education. This process has subtly reshaped how medical students learn and how educators teach. Moving from AI-assisted disciplinary knowledge expansion to AI-enabled pedagogical innovation, LIU Jiang’s team has proposed a conceptual framework for “Educational Intelligence”, exploring how large AI models can be applied in interdisciplinary teaching to deliver personalised assessments, assist instructors in evaluating learning outcomes, and open more efficient pathways for knowledge dissemination and understanding.[5]

Meanwhile, it involves using AI algorithms to strategically select and scientifically organise relevant knowledge from vast content repositories, thereby improving course delivery and talent development outcomes.[6] In teaching machine learning and multimedia topics such as perceptrons, decision trees, and image analysis, instructors

Micro-Certification Courses Developed by IIOE and the iMED Team

In 2025, IIOE partnered with the iMED team to launch two new micro-certification courses—*AI + Education: Ushering in a New Era of Education* and *AI + Medicine: Applications and Breakthroughs* [7]. These courses distil years of iMED's pedagogical experimentation and research, embodying an inclusive design philosophy rooted in deep educational reflection. Each course emphasises the logic of AI applications in the shared professional language of medicine, stripping away opaque coding jargon. Learners are encouraged to analyse localised challenges to AI adoption by considering factors such as regional healthcare resource distribution and public health systems. Ethical awareness is embedded into the curriculum to ensure that students not only acquire technical skills but also develop the capacity for prudent judgement in real-world practice. The courses have been met with an enthusiastic response, attracting participants from countries and regions including China, Burundi, and Egypt. The French-language version proved particularly popular, registering over 200 learners within just two months of release.

▼ The IIOE and Professor Jiang LIU's iMED team at SUSTech jointly launched the "AI + Medicine" course



should not only ensure that students build solid foundations but also guide them, through course projects, to consider how these algorithms can be applied in real-world contexts in medicine and education. This approach strengthens problem awareness and practical capabilities in interdisciplinary domains.

Moreover, the practice of “Educational Intelligence” goes beyond enhancing educational quality; it also prioritises improving access to education. Through collaboration with the International Institute of Online Education (IIOE), the iMED team has extended its innovations globally, helping to promote both accessibility and excellence in education, particularly in developing countries.

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Student feedback reflects this pedagogical shift: "The logic of AI mirrors human thinking. The professor explained complex algorithmic principles in simple terms, revealing the connections between disciplines—as if medicine and AI share tiny neural synapses, sparking flashes of human insight."

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The “Educational Intelligence” philosophy underpinning these courses is more than a pedagogical innovation; it is a pathway for guiding the interdisciplinary integration of future technologies. By design, the courses encourage students to understand algorithms while cultivating disciplinary thinking that interacts deeply with the real world, moving beyond AI itself.



The iMED team’s integrated approach reshapes our understanding of both medical education and the role of AI, prompting a rethinking of traditional disciplinary boundaries. The incorporation of AI technologies and the “Educational Intelligence” framework shifts the question from “what to teach” to “how to teach”, and to whom. This also prompts us to reflect on the more complex interactions between doctors and technology, and between students and knowledge. Student learning experiences serve as a mirror, reflecting the deeper transformation in teaching philosophy

and reminding us that technology is not merely an external tool but a medium for fostering connections in human thought. This reconfiguration broadens the depth of knowledge and the reach of its dissemination, challenging established notions of interdisciplinary integration. The resulting transformation in cognition, education, and technological boundaries is not simply a technological advance, but also a profound cultural resonance. In redefining human–AI collaboration, we also gain a deeper understanding of human potential and its future trajectory.

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Tohoku University:

How to Address an Ageing Society through “AI + Healthcare”

Amid the dual challenges of uneven healthcare distribution and accelerating population ageing, Tohoku University, a leading Japanese research institution, has built inter-university networks, designed AI-based medical curricula tailored to local needs, and advanced interdisciplinary, open innovation. These efforts transform regional healthcare challenges into solutions of global significance.

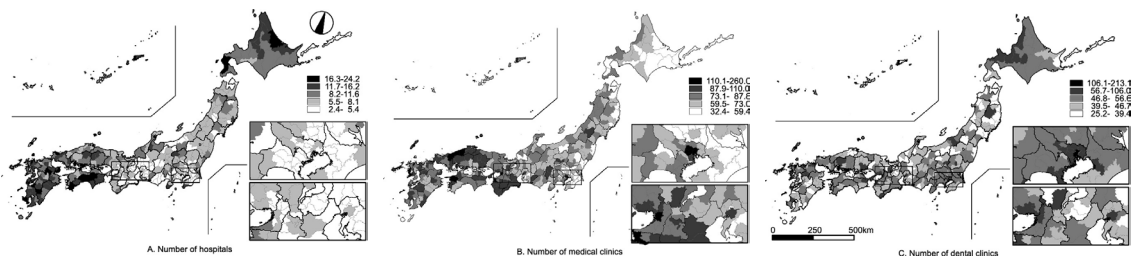
Ageing Society and Healthcare Imbalances

Artificial intelligence (AI), among the most transformative forces in healthcare, is reshaping Japan's medical system. Problems such as dispersed medical regions, unequal access to resources, and shortages of healthcare personnel are increasingly global, particularly in Asia. Japan's "super-aged society" presents both a pressing challenge and a unique opportunity: medical research not only advances diagnostics and treatment but also offers critical pathways to mitigate the effects of ageing. [1] Japan is thus

pioneering models of AI–medicine integration that may serve as references for other nations confronting demographic shifts.

As the world's most aged society, Japan faces acute urban–rural disparities. [2] While metropolitan centres host advanced hospitals, rural regions confront "medical desertification." Regional imbalances are stark: western prefectures possess greater resources than eastern areas, leaving residents in Tohoku and Hokkaido particularly disadvantaged. [3] By 2040, many local governments may vanish, and by 2050 one-fifth of residential areas are projected to be depopulated.





Number of Medical Institutions per 100,000 Population (by Secondary Medical Regions, 2014) Source: Nakamura 2017

Moreover, Japan is confronted with a significant shortage of medical professionals. [4] The ratio of clinical doctors is severely insufficient (only 2.4 per 1,000 people) and the existing education system has not adequately prepared professionals for AI in healthcare: clinicians often lack technical expertise, while AI specialists struggle to grasp medical contexts. This disconnect stalls many innovations at the laboratory stage, underscoring the urgency of embedding AI literacy in medical higher education.

In response to the evolving demands of smart healthcare, Japan is developing a distinctive path for training next-generation

medical professionals. Regional universities, exemplified by Tohoku University, are central in addressing challenges in remote areas lacking major corporate presence. Beyond higher education leadership, Japanese society exhibits unique advantages in the application of medical AI: a comprehensive universal health insurance system provides an ideal environment for AI deployment, a highly educated population accelerates technology adoption, and a mature industry–academia–research collaborative ecosystem collectively fosters promising prospects for both the training of medical AI talent and the practical application of AI technologies.

Tohoku University



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Training Research-Oriented Talent

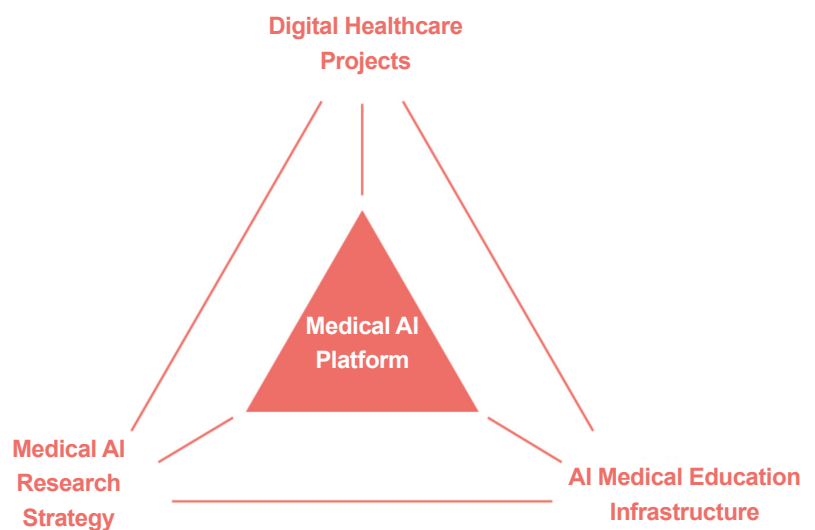
With the accumulation of clinical big data and the rapid advancement of AI technologies, particularly deep learning, data-driven medical research is demonstrating immense potential to transform healthcare systems and address societal health challenges. Tohoku University has keenly recognized this trend and is driving innovations that push the boundaries of traditional medical education.

In fact, the university's medical school began reforms as early as 2020, with a key highlight being the development of AI-focused medical research. Beyond its United Centers for Advanced Research and Translational Medicine (ART), which applies life sciences methodologies for foundational research, Tohoku University established two new AI departments: one dedicated to basic AI medicine and another to applied AI medicine. These departments bring together talent from both within and outside the graduate school to advance AI medicine collaboratively. Functioning as complementary “wings,” one focuses on fundamental AI research, while the other applies cutting-edge technologies in clinical diagnostics, health management, and medical imaging analysis. A dedicated AI healthcare platform department serves not only as a hub for talent cultivation but also as a platform for industry–academia–research collaboration.

This transformation is far from insular. Leveraging



its status as a comprehensive university, Tohoku University has engaged in deep collaborations with multiple top-tier institutions both on and off campus. In addition to joint talent development centers with Hokkaido University and Okayama University, the ART has established three core initiatives—“Digital Healthcare Projects,” “AI Medical Education Infrastructure,” and “Medical AI Research Strategy”—to support programs and practices for training the next generation of medical AI researchers. From the Clinical Research,



Innovation and Education Center, Tohoku University Hospital (CRIETO) to the Big Data Medicine Center and the Open Bed Laboratory, the Tohoku Medical Mega-Bank Organization (ToMMo), and the Graduate School of Biomedical Engineering, the university leverages its rich human, big data, and AI resources to tackle complex medical problems and contribute to the creation of a sustainable society.

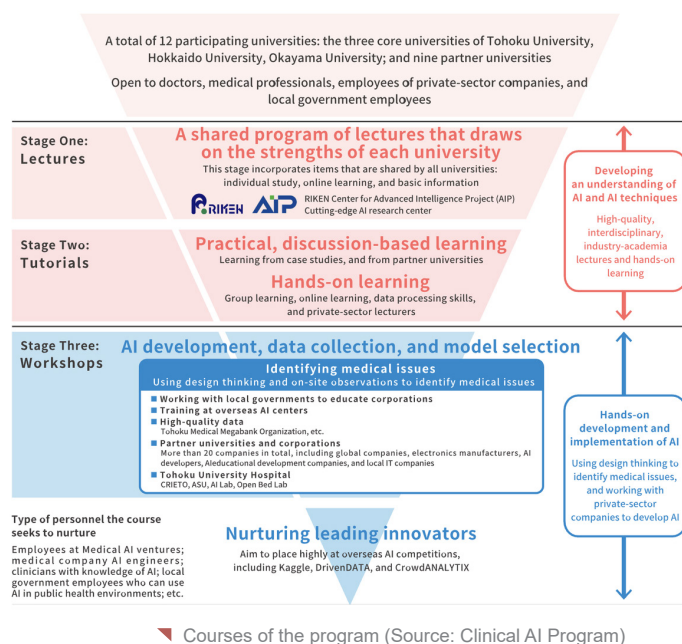
University Alliances

In 2020, leveraging local healthcare contexts and disciplinary strengths, Tohoku University, under the "Industry-Academia Collaboration Project for Human Resource Development to Accelerate AI Research and Development in the Healthcare Field" program of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), led a collaborative initiative with Hokkaido University and Okayama University: "Global x Leading-Edge AI Research and Development for Solving

Problems in the Medical Field". [5] Through inter-university cooperation, the project focuses on the development of ready-to-use medical AI systems and actively promotes their societal application, achieving broad implementation of these technologies in healthcare settings. The project targets six MEXT-designated areas of AI application in medicine: enomic medicine, diagnostic imaging assistant, medical diagnosis and treatment, drug development, dementia care, and surgical assistant. [6] Under this initiative, the three universities jointly established a "Clinical AI" education center, a talent development hub dedicated to leveraging cutting-edge AI research to solve global and local healthcare challenges.

Traditional medical education in Japan faces a shortage of professionals capable of leading practical medical AI R&D. While some healthcare practitioners use AI in their work, no systematic programs previously existed to cultivate these skills. Through the *Clinical AI Human Resources Development*

Program (Medical AI Talent Project), the three universities innovatively promote "bidirectional integration," aiming to train professionals who can apply AI solutions developed within participating universities to a range of fields, including inpatient care, home healthcare, commercial and public-interest-oriented public health, and administrative roles. The program is open to physicians, medical professionals, private-sector employees, and local government staff.





▼ Six Priority Domains for AI (Source: Clinical AI Program)

As part of the initiative, Tohoku University, Hokkaido University, and Okayama University offer doctoral and intensive courses. The four-year doctoral program trains experts capable of conducting advanced medical AI R&D, while the one-year intensive course prepares professionals to apply and utilize medical AI. The program also invites instructors from specialized institutions such as the RIKEN Center for Advanced Intelligence Project (AIP), the Artificial Intelligence Research Center (AIRC) at the National Institute of Advanced Industrial Science and Technology (AIST), and the Japanese Association for Medical Artificial Intelligence to guide students in planning future career paths.

In addition, Tohoku University spearheaded the creation of Japan's largest AI talent development alliance composed solely of local universities. The alliance includes the three core universities——Tohoku, Hokkaido, and Okayama, alongside 9 partner universities and over 20 private-sector companies. The AIP, which houses Japan's most advanced AI research infrastructure, has also pledged support.

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By forming this alliance, the three universities aim to explore new medical fields, identify unique healthcare challenges across Japan, consolidate locally specific medical issues, and cultivate professionals capable of designing AI-based solutions to address them. [7]

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“AI + Healthcare” Innovation Community

Beyond bridging universities and hospitals, Tohoku University is weaving an innovation network that embraces a broader range of actors. By leveraging real-world medical data, this ecosystem feeds research findings back into AI development to create technologies applicable to the medical field.

This spirit of collaboration is deeply rooted in the evolution of medicine itself. From traditional low-molecular compound drugs to today's gene therapies, cell-based therapies, and nucleic acid drugs, the boundaries of medicine are constantly expanding. Since the



21st century, with the rise of biologics and personalized medicine, a single-disciplinary perspective has proven insufficient to address complex healthcare challenges. The integration of computer science and biomedical engineering has pushed medical innovation into an entirely new dimension. Academia, as a driver of medical innovation, is playing an increasingly important role. Beyond chemistry and biology, engineering and information sciences (as well as their convergence) are now seen as indispensable, and cross-disciplinary open innovation is becoming ever more vital.

Of course, the vision is ambitious, while reality remains challenging. No single pharmaceutical company can develop every product independently, making industry-academia-research collaborations with venture capital firms and IT companies essential. Furthermore, public funding for university research often falls short of covering all translational studies, including investigator-initiated clinical trials. Therefore, utilizing investment capital, such as venture funding, to advance research and development is critical. A single university has limited capacity, but forming university alliances and

pooling resources from multiple institutions can generate significant impact.

Moreover, while AI in healthcare is a theme with vast potential, the stakeholders driving R&D face distinct difficulties. Physicians and medical institutions, though familiar with medical challenges and equipped with abundant data and ideas, often lack knowledge of AI and maintain limited ties with AI enterprises, making it difficult for them to carry out concrete development. Conversely, IT companies that possess advanced AI technologies may be eager to enter the healthcare sector but lack established networks with doctors and medical institutions. Their limited experience with medical needs and regulatory requirements also makes it difficult to execute comprehensive development in clinical environments.

This is precisely where Tohoku University's breakthrough lies. By constructing an ecosystem that connects AI research in medicine with commercial application, while emphasizing medical needs and the healthcare context, the university has positioned itself as a critical hub. Drawing on its extensive clinical research networks and

long-standing expertise in pharmaceutical clinical trials, Tohoku University serves as the key node linking stakeholders. Here, physicians' needs are conveyed precisely to engineers, technological feasibility is assessed by experts, and companies can identify the most promising projects for investment. This deep integration of industry, academia, and research allows sparks of innovation to be truly transformed into solutions that reshape medical practice. [8]

The approach of seeking solutions based on local medical issues, the open collaboration mechanisms that break down disciplinary silos, and the sustainable development philosophy rooted in deep integration of industry, academia, and research, may offer inspiration to universities worldwide. These experiences are not one-size-fits-all templates, but rather adaptable directions that can be flexibly applied depending on context. For countries exploring pathways to integrate technology and medical education, effective solutions often originate from profound

insights into local challenges and innovative, practice-based responses.

This article was composed using publicly-available online sources. ■

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Building such an ideal ecosystem is inseparable from open innovation, cross-sector collaboration, and accumulated experience.

— Professor Toshio Miyata,
Center for Translational
and Advanced Research
Interviewed by The Science
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GONG Ke:

Unleashing AI to Transform Higher Education's Digital and Green Future



◀ Gemini

Amid the dual pressures of the digital surge and the climate crisis, higher education is undergoing a historic transformation. Drawing on the perspectives of GONG Ke, President of the World Federation of Engineering Organisations (WFEO), and Executive Director of the Chinese Institute of New Generation Artificial Intelligence Development Strategies, this article explores how universities can reshape the future of education through the synergistic innovation of AI and the green revolution. In his view, AI is not merely a technological tool but a driving force that advances digital and green transitions in tandem.

Dual Transformation

The contemporary world is experiencing two concurrent transitions: a digital transformation of the economy and society, propelled by emerging productive forces rooted in advanced digital technologies; and a sustainability transformation, necessitated by the imperative of sustainable development of humanity. These two forces are deeply intertwined, like golden gears of digitalisation meshing with green gears of ecological civilisation, together powering an innovation engine where intelligence and sustainability advance in parallel, steering humanity toward a more sustainable future.

Digital technologies provide the methodological and operational foundations for the green transition, while the principles of sustainability define the ethical boundaries and strategic directions of digital applications. For higher education, this requires moving beyond superficial measures, such as the mere introduction of digital tools or the addition of environmental courses, towards a fundamental reconfiguration of educational philosophy, institutional structures, and talent development models from a strategic perspective.

AI for Education & Education for AI

AI plays a distinctive role in advancing the dual transformation. On the digitalisation front, AI is reshaping the educational ecosystem by transforming modes of knowledge dissemination and catalyzing



This article draws on President GONG Ke's presentation at the *Higher Education Innovative Development Conference—Talent Cultivation Resonating with Digital Intelligence* in December 2024, as well as publicly available sources. As President of the World Federation of Engineering Organisations (WFEO), former President of Nankai University, and former Vice President of Tsinghua University, he has long focused on the development of digital technologies, engineering education, and engineer training, and played a key role in promoting UNESCO's designation of 4 March as *World Engineering Day for Sustainable Development (WED)*.

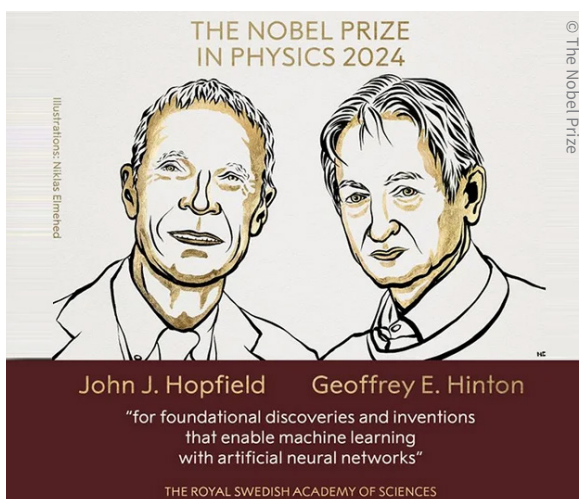
interdisciplinary innovation. Universities must cultivate students' capacity to harness AI, including technical literacies such as prompt engineering and chain-of-thought guidance, alongside core competencies such as ethical reasoning and creative thinking. This emerging competency framework is central to meeting the challenges of the dual transformation. On the greening front, AI acts as a driver of sustainable development. GONG Ke's "green-intelligent talent" model emphasises a solid disciplinary foundation, sensitivity to underlying principles, cross-disciplinary proficiency, a practice-oriented mindset, and ethical awareness. Such talent should master green and low-carbon technological pathways, understand intelligent systems' operational principles, and possess the capacity for original innovation at disciplinary intersections. GONG stresses that cultivation requires not only curricular design but also problem-oriented, task-driven, and immersive practice platforms.

GONG's "dual-wheel drive" strategy outlines a pathway for higher education transformation: on one hand, leveraging AI to enhance

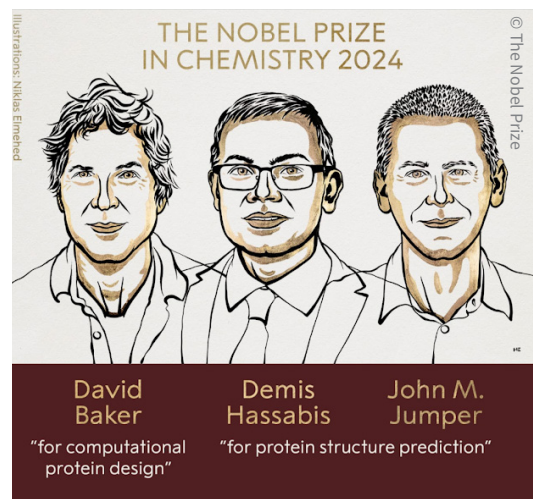
efficiency, inclusiveness, and adaptability in education (AI for Education), improving learning effectiveness, initiative, and practical application, and fostering AI literacy; on the other, nurturing high-quality innovative talent for the intelligent era (Education for AI), producing both competent professionals and AI innovators who can advance productive forces for high-quality development. In this process, AI itself can be further improved in effectiveness, trustworthiness, and safety. Education should not treat AI merely as a tool, but as a foundation for innovating AI theory and promoting the development of trustworthy, controllable AI—an approach that directly addresses societal concerns over AI ethics, interpretability, and governance.

Cross Traditional Boundaries of Disciplines

The key to achieving the dual transformation lies in dismantling traditional disciplinary barriers. Citing physicist Max Planck, GONG Ke notes that disciplinary divisions stem from



▴ "Science for AI"



▴ "AI for Science"



Science is an intrinsic whole. Its division into separate branches depends not on the nature of things, but on the limits of human cognitive capacity. In reality, there exists an unbroken chain from physics to chemistry, through biology and anthropology, to the social sciences—a chain in which no link can be severed.

— Max Planck, *The Unity of the Physical Pattern of the World*

the limitations of human cognition rather than the inherent logic of knowledge itself. In the context of dual transformation, universities must pursue deep structural reforms.

GONG sharply points out that one major challenge facing Chinese higher education is the rigidity of disciplinary catalogues, which constrains the flexibility needed for interdisciplinary integration. The segmentation of knowledge into narrowly defined disciplines hampers comprehensive responses to real-world problems. In the context of the green transformation, universities should actively “dismantle walls” and foster problem-oriented interdisciplinary collaboration to build future-ready educational structures.

This transformation entails three dimensions: first, the cross-disciplinary integration of knowledge systems, forming problem-driven disciplinary clusters; second, the innovative restructuring of organisational forms, creating new educational platforms suited to the dual transformation; and third, a fundamental reform of evaluation

systems, establishing incentives that promote collaborative innovation. Digitalisation and greening must permeate all disciplines, and each discipline should actively transform to realise both “-isations.” In this process, AI, as a key enabling technology, can facilitate the dissolution of disciplinary boundaries and provide new methodologies and pathways for both digital and green transformations.

The result is an emerging competency framework characterised by interdisciplinarity and proactive thinking. Future education will no longer be centred on rigid disciplinary divisions but will revolve around “tool use” and “problem solving.” The transformations in modes of production brought by AI require students to develop higher-order integrated abilities, including prompt design, chain-of-thought guidance, recognition of uncertainty in large-model outputs, and understanding of AI’s foundational mechanisms. These competencies transcend traditional disciplinary boundaries, highlighting uniquely human capacities for judgement and creativity.

Global Vision and Responsibility

Against the backdrop of intensifying global competition and ethical controversy surrounding AI, large models do carry risks such as uncertain outputs, high error rates, and potential misuse or abuse. Building AI systems that are explainable, trustworthy, and secure is therefore not only a scientific challenge but also a task of institutional construction in which the education system must actively participate.

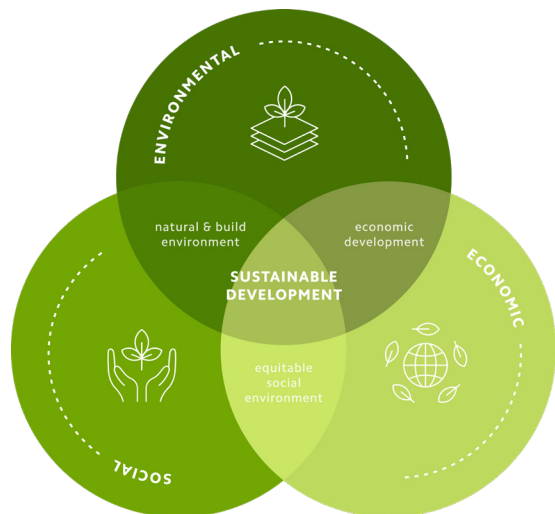
In the face of global challenges such as climate change and the digital divide, universities should leverage their role as think tanks to propose innovative solutions for sustainable development, while also cultivating globally minded leaders to help build a shared future for humankind. This international perspective constitutes a vital dimension of the dual transformation strategy.

In July 2025, UNESCO and the China University of Political Science and Law are co-hosting Global AI Policy Dialogue and Collaboration Development Forum during the 2025 World Artificial Intelligence Conference, aiming to promote the participation of universities in jointly building a trustworthy and secure intelligent governance system.

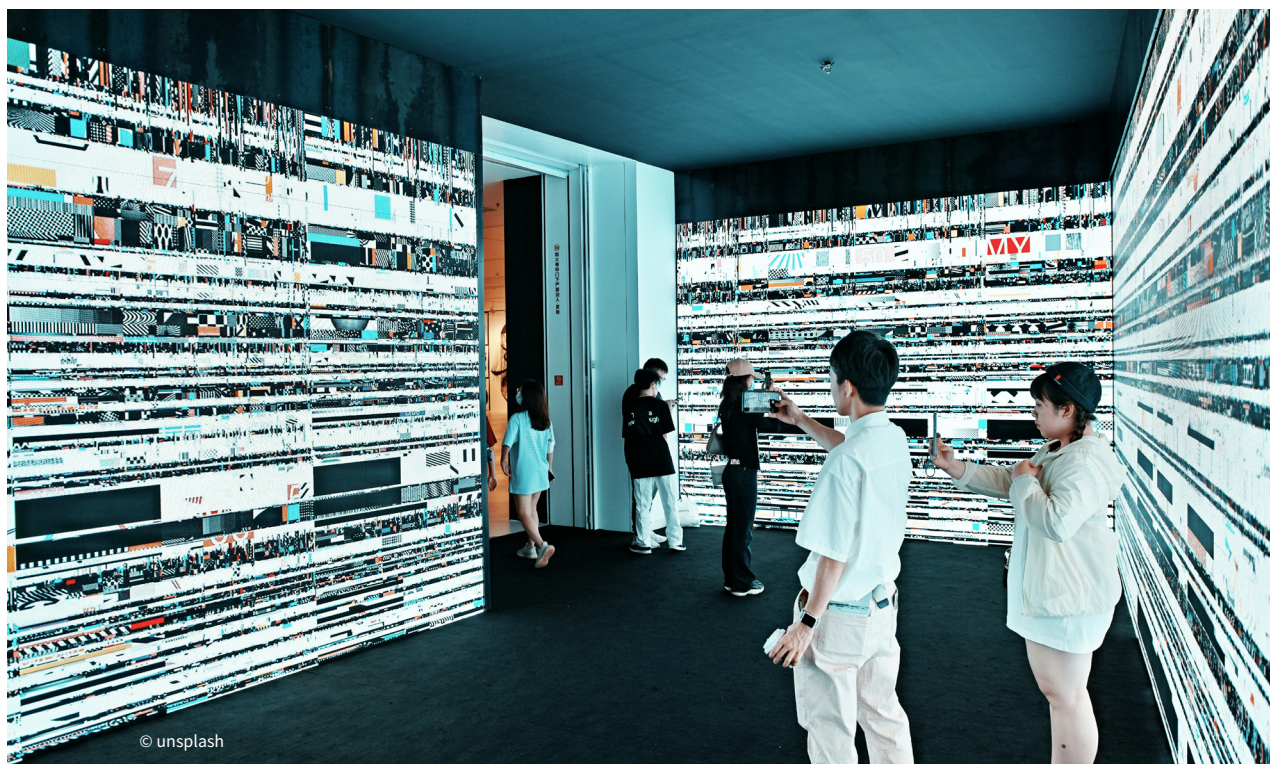
How Higher Education Can Advance Sustainable Development

The sustainable development agenda provides a strategic framework for action in higher education. Gong Ke argues that universities must directly address the threefold goals of the United Nations *2030 Agenda for Sustainable Development*: economic growth, social progress, and environmental protection. Institutions should move beyond slogans and principles, taking concrete actions and implementing structural reforms to “accelerate efforts” and “redouble commitments,” thereby delivering substantive solutions and technological reserves in support of the Sustainable Development Goals (SDGs).

The green (sustainability) transformation is an urgent global development imperative, while the intelligent (digital) transformation



Three dimensions of sustainability Source: Blue Bite



is an unstoppable societal trend. Gong envisions a new development model for higher education in which AI serves as the link between the two, enabling digital and green transformations to advance in synergy. In this process, universities bear a dual mission: to adapt proactively to transformative trends while guiding them through innovation; and to cultivate talent with sustainability literacy while shaping future development pathways through frontier research.

“Integrating intelligence and practising greening” is not only a benchmark for world-class universities, but also a defining historical mission for higher education in the new era. When digitalisation and greening are deeply integrated into campus life, what emerges is not merely an educational transformation, but the gradual unfolding of a sustainable and promising future.

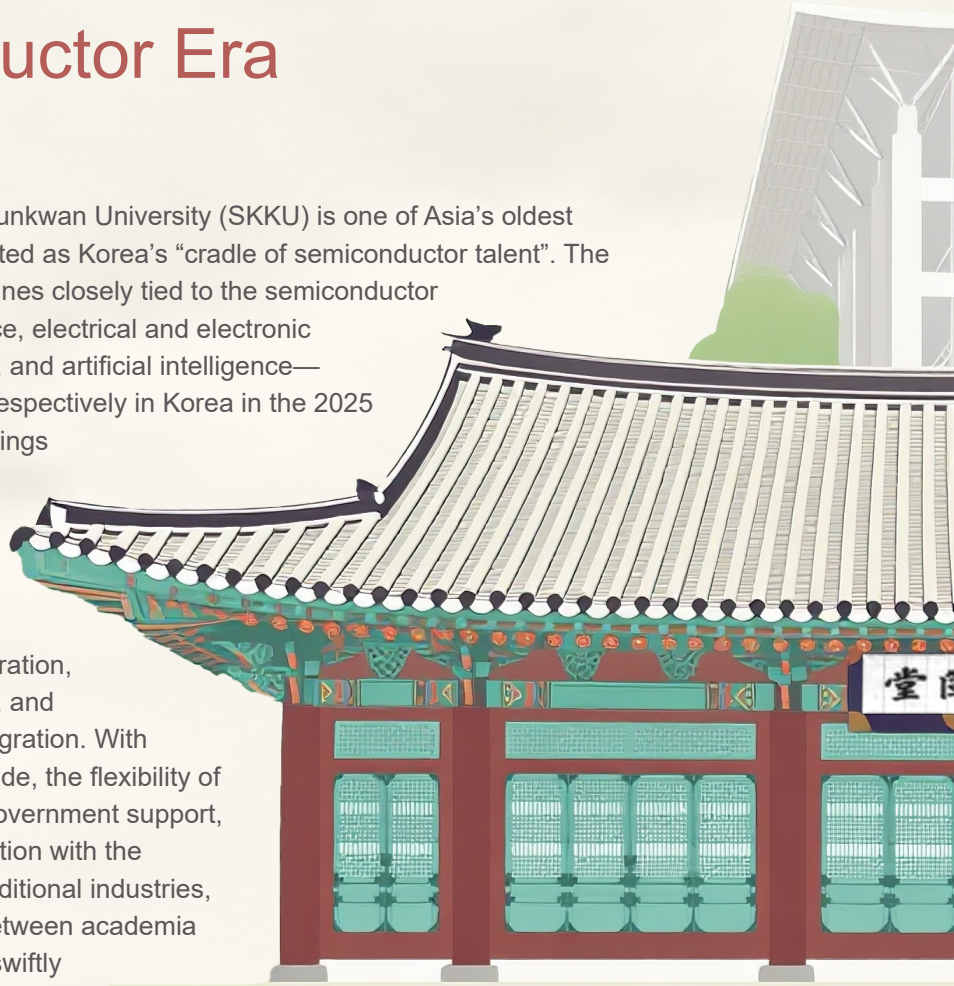
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Sungkyunkwan University: Shaping Talent for the AI Semiconductor Era

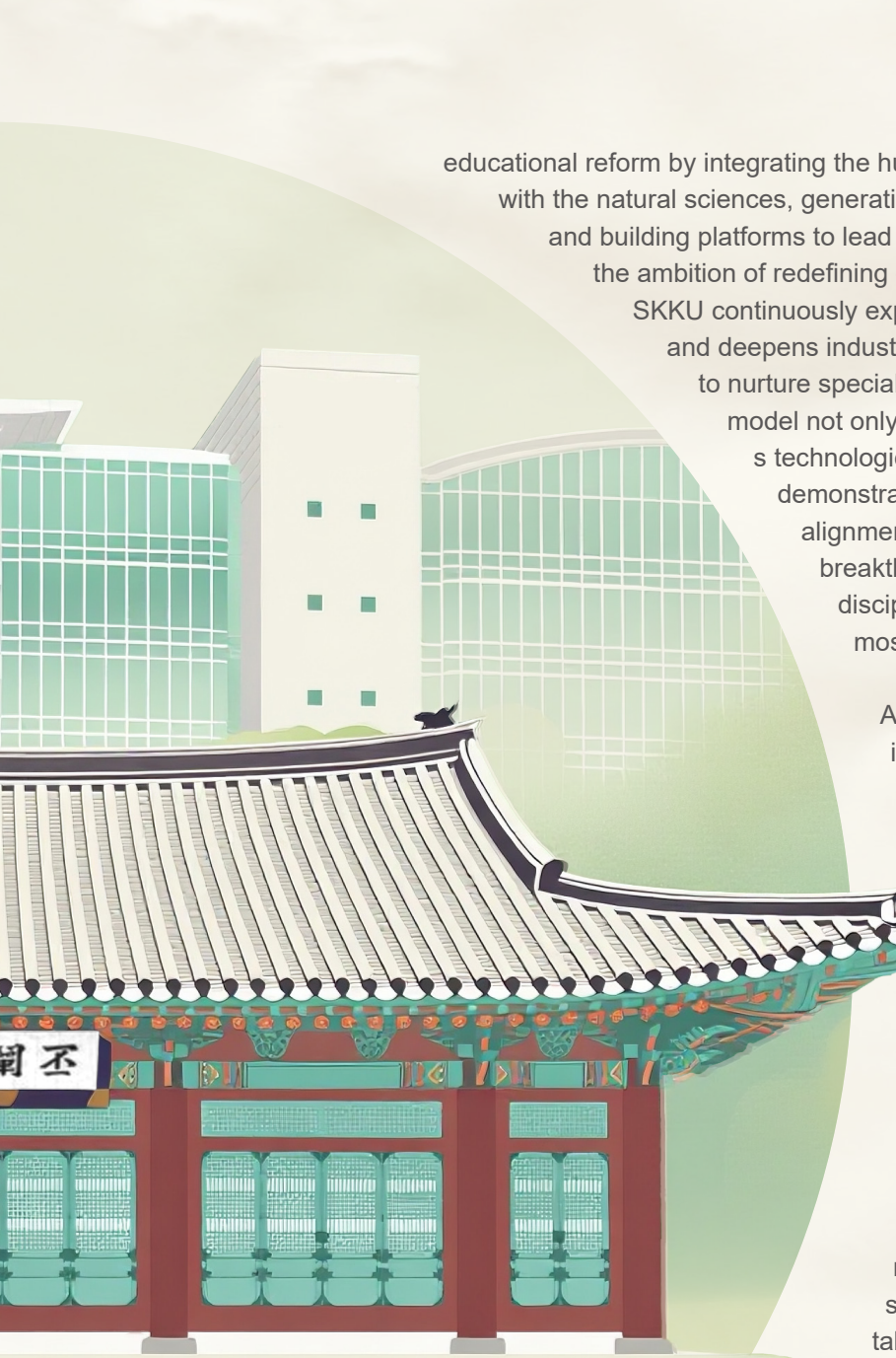
Founded in 1398, Sungkyunkwan University (SKKU) is one of Asia's oldest universities and is celebrated as Korea's "cradle of semiconductor talent". The university excels in disciplines closely tied to the semiconductor industry—materials science, electrical and electronic engineering, data science, and artificial intelligence—ranking 6th, 7th, and 4th respectively in Korea in the 2025 QS World University Rankings by Subject.[1] Confronting AI-driven industrial transformation, SKKU fosters semiconductor innovation talent through university-industry collaboration, interdisciplinary programs, and international resource integration. With industry demand as its guide, the flexibility of a private university, and government support, SKKU integrates AI education with the intelligent upgrading of traditional industries, aiming to close the gap between academia and production lines and swiftly convert talent into technological competitiveness.



Employment Upon Enrollment?

Since the appointment of President Ji-Beom Yoo, SKKU has embraced the educational philosophy of "tackling the Grand Challenge for the humanity and future society". The university is committed to





educational reform by integrating the humanities and social sciences with the natural sciences, generating new knowledge value, and building platforms to lead emerging industries. [2] With the ambition of redefining global academic leadership, SKKU continuously expands academic programmes and deepens industry-academic collaboration to nurture specialists in frontier fields. This model not only consolidates South Korea's technological strengths but also demonstrates how education–industry alignment can generate tangible breakthroughs. The semiconductor discipline stands as one of the most prominent examples.

As South Korea's "lifeline industry", semiconductors accounted for more than 20% of exports in 2023. The industry spans the entire value chain from materials, equipment, design, manufacturing, where AI applications such as virtual fabs and intelligent inspection systems are significantly improving chip design efficiency, production yields, and equipment automation, thereby lowering manufacturing costs. Yet this sector undergoes an acute talent shortage.

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According to the Korea Semiconductor Industry Association(KSIA), the industry will require 300,000 professionals by 2031, but current supply falls far short. At this pace, South Korea will face a shortage of 54,000 skilled workers by 2031.

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Recognising the strategic importance of specialised talent, South Korean semiconductor firms are investing heavily in education and training to reinforce their global leadership. Meanwhile, AI- and machine-learning-driven smart software has become central to consumer electronics and connected devices, enabling real-time responsiveness. For example, as a global ICT and mobile communications leader, Samsung Electronics integrates AI into semiconductors, smartphones, TVs, appliances, and networks, intensifying its demand for highly skilled AI professionals.

As a prestigious private university, SKKU leverages its flexible industry-academic collaboration mechanisms to respond swiftly to industrial needs. Its leadership includes seasoned experts from Samsung, SK Hynix, and other companies, giving the university a unique ability to anticipate industry trends and adapt curricula accordingly, ensuring that "what students learn is what they will use". Partnering with Samsung, SKKU has pioneered a new model of AI talent cultivation that goes beyond government-led industry-academia platforms or company-run training centres. From launching the Department of Intelligent Software to establishing the Department of Battery Science and Engineering, SKKU designs its programmes to directly meet industry demand.

In 2022, SKKU and Samsung Electronics jointly established the Department of

Intelligent Software, under the College of Computing and Informatics. [3] Operated on a contract-based model, the department guarantees graduates direct employment with Samsung Electronics, with tuition fully funded by the company. The five-year programme is designed to cultivate AI specialists through a systematic, high-level training framework. Covering both undergraduate and graduate coursework across ten semesters, the programme dedicates the first seven semesters to foundational theory in AI and software engineering, and the final three semesters to graduate-level practical training. Students gain comprehensive expertise in intelligent software development



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through internships, research visits to overseas institutions, and participation in international conferences. In this collaboration, SKKU provides the academic infrastructure to equip students with advanced AI skills, while Samsung secures a pipeline of elite talent tailored to its needs. Compared to state-led integration platforms or corporate in-house training, this company-driven model is more direct and systematic, injecting fresh vitality into Korea's intelligent software industry.

The scope of collaboration continues to expand. One of SKKU's newest departments, the Department of Battery Science and Engineering, was established in partnership with Samsung SDI. Its mission is to train next-generation battery technology experts to meet

the soaring demand of the global renewable energy market.

Blending the Virtual and the Real

While Sungkyunkwan University has built deep roots in domestic university-industry collaboration, it is also actively expanding its global partnerships. To alleviate the heavy financial burden that semiconductor laboratory equipment imposes on universities, SKKU has teamed up with global semiconductor equipment leader Lam Research to launch the "K-Semiconductor Talent Development Programme", aimed at cultivating highly skilled professionals for the chip industry. Lam Research, which entered the Korean market in 1989, is today a key player in the semiconductor cluster located in southern Gyeonggi Province.

This initiative, jointly promoted by Lam Research, SKKU's College of Engineering, and the Korea Semiconductor Industry Association, will begin with a one-year pilot in 2025 before expanding into a full programme



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spanning bachelor's, master's, and doctoral-level training. Lam Research has committed USD 5.2 million to the project, providing certified courses and professional training resources. The highlight of the programme is its Semiverse™ solution, a virtual fab system that leverages advanced digital twin technology to allow students to experience the entire semiconductor production process, from chip design to manufacturing, directly in the classroom. This approach overcomes the traditional spatial and technical constraints of semiconductor education. [4]

Through tools such as SEMulator3D, students gain immersive, hands-on training in chip design and manufacturing. This marks the first time Lam Research has introduced its Semiverse talent development platform in a Korean university, after implementing similar collaborations in the United States and India. SKKU notes that this "blended virtual-physical" teaching model fills critical gaps in conventional semiconductor education, significantly enhancing students' employability. Beyond strengthening SKKU's globalised talent development framework, the partnership also supplies South Korea's semiconductor industry with a new generation of practically skilled professionals. By incorporating a world-leading virtual training platform, the university is helping to deliver graduates with stronger real-world capabilities.

In 2024, SKKU further established the School of Applied Convergence, primarily targeting working professionals. The school offers two specialised tracks, AI Convergence Operations and Industrial AI, with a strong focus on practical skill development to address complex, real-world challenges across industries. This initiative consolidates SKKU's leadership in university-industry collaboration and further reinforces its role as a pioneer in practice-oriented AI education.

Igniting Regional Innovation

Sungkyunkwan University excels not only in corporate collaboration but also in working hand-in-hand with local governments, serving as a model for regional collaborative innovation. In 2024, SKKU and Seongnam City signed a strategic agreement to jointly establish "Seongnam-Sungkyunkwan University Fabrice and AI Innovation Research Centre". [5] This industry-academia-government research platform injects strong R&D momentum into the region's high-tech industries. Through the establishment of the Fabrice and AI Innovation Research Centre, the initiative further consolidates Seongnam's position as a leading hub for high-tech talent development in Korea, while fueling new drivers for regional economic growth.

National-Level Talent Development Programmes

In June 2025, South Korea's Ministry of Science and ICT officially designated SKKU and Yonsei University as the two core universities for the "Industrial-linked Artificial Intelligence Semiconductor Leading Technology Talent Cultivation Programme". [6] This national initiative, spanning six years and beginning with an initial investment of 1 billion KRW in its first year, aims to nurture master's and doctoral-level talent equipped with practical skills tailored to the AI semiconductor industry.

To achieve this, the two universities jointly established the AI Semiconductor Innovation Institute, which develops integrated industry-academia research and curricula. This

"government sets the stage, industry takes the lead" model has proven highly effective in accelerating progress. At SKKU, the initiative is spearheaded by Professor Sang-Hyun Lee of the Department of Semiconductor Systems Engineering, who focuses on four major research areas: Next-generation neural processing unit (NPU) development; System-on-chip (SoC) intellectual property strategy; Hardware–software co-design optimisation and AI computing platform construction.

To advance these goals, SKKU has established four dedicated research centres: the NPU Core Centre, NPU Infrastructure Centre, Physical AI Centre, and AI Computing Platform Centre. Each centre works closely with industry leaders such as Mobileint, Open Edge Technology, Boss Semiconductor, and Samsung Electronics, ensuring that research outputs remain tightly aligned with industrial needs.

Conclusion

Through deep collaboration between universities and enterprises, Korea has not

only accelerated the pace of technological innovation but also ensured a steady pipeline of highly skilled professionals for industry. This reflects a systematic approach driven by industrial demand, combining digital transformation in education with innovative talent cultivation mechanisms.

In the context of rapidly evolving artificial intelligence technologies, such "learning-by-doing" education models may prove to be critical strategies for securing and sustaining global competitiveness. For many developing countries, "virtual–real blended" training approaches, such as leveraging virtual simulation technologies to compensate for limited hardware, offer a practical pathway to delivering high-level engineering education despite resource constraints. Equally noteworthy is the model of mobilising direct corporate investment in education and deeply embedding industrial resources into academic ecosystems, which provides valuable insights for future global talent strategies.

This article was composed using publicly-available online sources. ■

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NetDragon: Building a Vibrant "AI + Education" Technology Ecosystem

▲ African Students Talking with NetDragon's Digital Human, the Rotating



"With artificial intelligence helping us, our learning efficiency will definitely improve," joked Adams Ibrahim, a doctoral student from Ghana. "If AI can understand me, it means my Chinese is pretty good; if it can't, I need more practice." At NetDragon's technology experience centre, international students explored cutting-edge technologies including motion capture, AI-generated art, and virtual broadcasting, experiencing firsthand how technology makes education more efficient, accessible, and engaging.

NetDragon, founded in 1999, initially focused on online gaming but has transformed over the past decade into a leading global provider of digital education solutions. Today, the company has positioned "AI + Education" as its core strategic focus. Through innovative initiatives such as developing AI-powered smart classrooms and leveraging artificial intelligence to enhance teacher training programs, NetDragon is deeply integrating

AI technology into educational digitalisation. These efforts contribute to promoting educational equity, improving learning outcomes, and expanding access to quality education.

Empowering Smart Education through Technology

Drawing on years of business expansion and practice in the digital education markets of multiple African and Asian countries, NetDragon has progressively advanced an "AI + Education" model as a pathway for developing countries to enhance both equity and quality in education. This approach is rooted in its STEM-oriented concept of *On-Demand Learning* and has given rise to a comprehensive digital transformation solution. The solution integrates three components: an AI content production hub that enables the automatic generation of educational

▲ VR Exploration Centre





Source: NetDragon

resources; interactive educational games designed to disseminate high-quality "3E" content (Effective, Efficient, Engaging); and the EDA educational metaverse platform, which aggregates these resources into an immersive learning ecosystem. The model's core strength lies in its ability to transform complex tasks into clear, step-by-step processes, each accompanied by essential background knowledge; embed learning within real-life contexts; align with the latest developments across industries; and provide deep localisation. In doing so, NetDragon delivers inclusive and practical STEM education tools.

At the foundation of this ecosystem is the intelligent content production engine. NetDragon's AI production hub can fully automate the generation of teaching resources, compressing workflows that traditionally required several days into just one hour, at minimal production cost. For instance, its self-developed AI Chinese teaching software, combining 3D modelling with advanced algorithms, addresses challenges such as heavy lesson preparation workloads, limited classroom interaction, lack of real-time feedback in after-class practice, and the high production costs of animated teaching videos. By significantly improving teaching efficiency, the software has been

well received by educators in countries such as Egypt. The second pillar is the gamified learning platform. By embedding the "3E" educational philosophy into interactive games, NetDragon makes knowledge transfer more engaging and dynamic. For example, scenario-based simulation games are used to teach STEM knowledge by breaking down complex concepts into actionable steps while embedding them in authentic application contexts. Aggregating these high-quality resources, NetDragon is driving the development of the EDA educational metaverse, where students can interact with teachers in real time through VR technologies, while teachers gain seamless access to localised AI-powered lesson preparation resources. The platform fosters co-creation of resources, technological inclusivity, and incentive mechanisms.

Global Practices

NetDragon's "AI + Education" ecosystem has flourished through local partnerships between universities and enterprises, with applications extending globally and across Belt and Road countries. In China, the company has collaborated with institutions such as The Hong Kong Polytechnic University and

Beijing Normal University to promote industry-education integration. These initiatives include jointly establishing industrial colleges, building teaching and practice bases, and conducting research on AI learning platforms. Such collaborations not only accelerate the implementation of NetDragon's educational ecosystem but also contribute to cultivating digital talent for the broader industry. Globally, the company's diverse digital education solutions have taken root in multiple countries and regions. Since 2020, NetDragon has advanced cooperation with Egypt, Nigeria, Kenya, and others under its "3E" philosophy, undertaking initiatives such as donating smart classrooms, developing educational service systems, and producing high-quality educational content. These efforts have both expanded its international presence and fostered global educational equity.

In Central and Eastern Europe, NetDragon has engaged in in-depth technical cooperation with Serbia, tailoring innovative and localised digital education solutions for the country.

In terms of infrastructure upgrades, NetDragon has partnered with Serbia to establish the Center for Robotics and Artificial Intelligence in Education (CRAIE), which includes virtual laboratories, smart classrooms, and Serbian-language educational robots. The centre also integrates cutting-edge technologies such as VR and digital simulations of global climate change, positioning it as a leading digital education and AI laboratory in the Balkans. From 2021 onwards, approximately 4,000 teachers across Serbia have participated in phased information technology training at this centre. For classroom capacity building, NetDragon has served as both a technical partner and course developer in Serbia's

"National Teacher Training Programme," equipping educators with enhanced pedagogical and digital competencies through its AI production hub. In teaching resource development, NetDragon has also supported Serbia's live remote education via its global online learning community Edmodo and e-learning platforms. By leveraging tools such as instant messaging (IM) and video-on-demand (VOD), the company has provided Serbia with an integrated training platform that combines teacher training, pedagogical research, and education management.

Multilateral Cooperation

While expanding its overseas business, NetDragon has also established a deep strategic partnership with UNESCO to jointly advance the global digital transformation in education. Africa served as the initial



testing ground for this collaboration. The COVID-19 pandemic forced 77% of African universities to suspend classes, with only

29% able to quickly transition to online learning (compared to 85% in Europe). Leveraging NetDragon's intelligent education solutions and UNESCO's expert resources, the partnership rapidly deployed mobile smart classrooms across Africa, supporting efforts to improve educational resource allocation in underdeveloped regions and promote equitable, quality education. As cooperation expanded, NetDragon and the UNESCO Institute for Information Technologies in Education (UNESCO-IITE) jointly developed the *E-Library*, an open resource platform serving more than 100,000 educators. In addition, NetDragon partnered with UNESCO-ICHEI on initiatives such as building smart classrooms and co-developing AI-based courseware, thereby driving the application and innovation of ICT in higher education.

These innovative practices demonstrate that building an open, systematic, and locally adaptive educational technology ecosystem, combined with frontier technologies such as artificial intelligence, big data, and the educational metaverse, not only enables the

efficient production of high-quality resources but also flexibly addresses the diverse needs of different countries and regions. In doing so, it supports comprehensive upgrades in teaching content, pedagogical models, and teacher capacity.

From traditional classroom learning to vocational training, enterprises are leveraging technology to reshape the possibilities of higher education. The future of education may well lie within the toolkits of companies that combine technological insight with educational vision. For developing countries in particular, bridging gaps in digital infrastructure and teacher training requires technological empowerment and cross-sector collaboration. NetDragon's "AI + Education" model, along with its global experience, exemplifies the value of aligning technology with policy and fostering synergies between industry and academia.

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Forging Future Skills for Vocational Education Youth: Practices of China POCY Group

The Imperative for Upskilling

Youth skills development has become a critical driver for achieving the Sustainable Development Goals (SDGs) of "Quality Education" and "Decent Work" by 2030. UNESCO highlights that approximately 450 million young people globally lack the skills required for labour market, with only one fifth of individuals aged 15 to 34 having received adequate training.[1] In the face of this tough

challenge, a consensus has been reached globally on the urgent need to establish an inclusive, resilient and forward-looking global skills system. Addressing the youth skills crisis is not merely an educational issue, but a global imperative concerning social equity, economic resilience and sustainable development.

To tackle this challenge, China POCY Group (hereinafter referred to as POCY) has established a dynamic ecosystem

centred on vocational education. Within this framework, professors, scholars, students and enterprises converge at the intersection of classroom learning and industrial practice, sparking innovation and upskilling for youth.

"Industry-Education-Society" integrated model

Vocational education frequently faces the challenge of teaching content lagging behind industry demands. The ILO's Quality Apprenticeships Recommendation highlights that collaborative efforts between enterprises, vocational education institutions, and other stakeholders are essential for cultivating a high-quality workforce.[4] To this end, POCY's Caofeidian College of Technology has partnered with Hebei Huaxun Technology to pioneer a "dual-qualified" education model involving both the college and the enterprise. This approach integrates cutting-edge technology deeply into the entire process of vocational education, with a strong focus on enhancing students' digital skills.

Together, they have established a full-process digital development training base that simulates real-world enterprise projects, covering the entire teaching spectrum from coding and software design to product testing and project management. Industry professionals bring their experience and insights directly to students, bolstering their practical skills. Similarly, Tangshan Maritime Institute, also a POCY subsidiary, has collaborated with enterprises such as Tangshan Reafon Steel Group to establish an industry-education consortium focused

WIDE ANGLE

According to the International Labour Organisation's report *World Employment and Social Outlook: Trends 2025*, global youth unemployment has reached 12.6%—more than double the overall unemployment rate of 5%.[2] Additionally, 20.4% of young people worldwide fall into the "NEET" category (Not in Education, Employment or Training). The situation is particularly severe in low-income countries, where the NEET rate among young women reaches as high as 37%.[3]

This youth employment crisis is no coincidence—it stems from multiple interconnected factors. The Fourth Industrial Revolution has unleashed a wave of digitalisation and automation that is reshaping labor markets in unprecedented ways, rendering traditional skills obsolete while creating demand for new competencies that educational systems struggle to provide. Moreover, the global economic slowdown has severely limited job creation, further constraining opportunities for young workers.

▼ ILO Flagship report, *World Employment and Social Outlook: Trends 2025*



International
Labour
Organization

► ILO Flagship Report

► **World
Employment
and Social Outlook**

**Trends
2025**

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on emerging fields including low-altitude economy, digital security, and Artificial Intelligence (AI), with the aim of cultivating talent aligned with sectoral needs.[5][6]

The "University + Community" Industry-Education Retirement Community (IERC) home-based eldercare model is another prime example of the group's integration of education and urban development. Located in the Beijing-Tianjin-Hebei International Health Valley, this model integrates POCY's School of Medicine, the University for the Elderly, the Healthcare and Wellness Centre, and expert residences to build an ecosystem combining education and eldercare services. Students gain practical experience in real community contexts, enhancing their skills while simultaneously serving society.

This model systematically and deeply links education, industry, and society. It effectively



China POCY Group Attended 2025 High-Level Policy Dialogue in East Asia

breaks down the traditional barriers between theory and practice, benefiting young people in vocational education while also enhancing its inclusivity and social value.

In developing countries, skills development and entrepreneurship training are far more effective at promoting youth employment than job placement services and subsidies. AI is a key tool for this kind of training, as it supports job creation and raise productivity sustainably and effectively.[7] To this end, POCY has made AI a core subject in its curriculum, launching "star programmes" such as AI, drones, and e-sports at the Caofeidian International Vocational Education City.

In addition, POCY has also invested in cutting-edge technologies like Virtual Reality (VR) to introduce hands-on safety training programmes. The programme not only provides advanced equipment but also creates an immersive, practice-oriented training environment, which allows students to repeatedly hone their skills in safe, controlled,

This year's theme correctly highlights the growing importance of digital and AI skills. From basic digital literacy to advanced data science, these capabilities are ever more vital for young people to thrive in today's world and lead the future.

——António Guterres, The UN Secretary-General, Message on World Youth Skills Day

and simulated scenarios, bridging the gap between traditional textbook knowledge and practical application.

Keeping Faculty Development Up to Date

In the face of the rapid development of AI and digital technologies, teacher readiness is another key focus for driving the transformation of vocational education. POCY has launched the "Excellent Teacher Programme" to support faculty members in study visits to countries such as the United Kingdom and Germany, bringing back advanced educational concepts and practices. Additionally, domestic and international scholars and industry experts are invited to the classroom to give a series of lectures on cutting-edge technologies, their applications, and innovations in teaching, which helps spark teachers' creativity. Through this combination of overseas training and the introduction of international ideas, the programme highlights the priority of building teachers' digital skills.

Bridging Skills Across Borders

Beyond local innovation, POCY's commitment to international cooperation makes it a proactive force in promoting global educational equity and skills

development. The youth skills crisis is particularly acute in developing countries, and POCY is addressing this by deepening its collaboration with various nations, regions, and international organisations to provide localised skills training programmes for young people in low- and middle-income countries.

Since POCY's participation in the *Tangshan Declaration* at the International Vocational and Technical Education Conference in 2017, POCY has continuously deepened its collaboration with UNESCO. [14] The UNESCO *Strategy for Technical and Vocational Education and Training (TVET) 2022-2029* emphasises the development of digital, green, and generic skills.[15] As a flagship project of this strategy, the Global Skills Academy (GSA) and the Global Education Coalition (GEC) initiatives mobilise various resources to provide skills training to 10 million young people. In active response, POCY proposed a goal at the March 2025 GEC annual meeting in Paris to provide employment and skills training for one million young people. POCY's "China Craftsman Valley 100,000 Youth Training and Employment Plan" integrates high-quality resources to help young people secure a place in the future job market. At the same time, through GSA and in collaboration with International Centre for Technical and Vocational Education and Training (UNESCO-

▼ Students from Caofeidian College Of Technology during practical training in the smart classroom.



UNEVOC), POCY provides one-stop training services for youth in developing countries at over 250 vocational centres across 16 countries and regions.

Gender equality has become a key focus of the global skills development agenda. The UNESCO-UNEVOC explicitly states that providing equitable lifelong learning opportunities for all is a critical goal of TVET.[8] POCY has actively embraced this mission, firmly believing that vocational education in the digital economy era opens up opportunities for women, helping them secure employment, economic independence, and social value. This philosophy is integrated into POCY's teaching practices and its "Global Youth Skills Scholarship Programme," which prioritises digital technology and AI training for young women in developing countries. In its daily teaching, POCY fosters an inclusive learning environment, encouraging female students to specialise in high-tech fields and participate equally with men in the digital transformation wave. These efforts not only empower individual growth but also enhance

social inclusivity and resilience by boosting women's social participation and economic self-reliance.

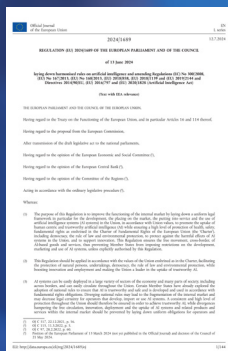
These efforts underscore a clear positioning: vocational education should not be confined to a single market but should serve as a bridge in the global education ecosystem, advocating for equity, gender equality, and international vision, while ultimately contributing to the construction of an inclusive and resilient global vocational education community. As we look ahead, vocational education holds the key to shaping a new global ecosystem for youth employment. In the future, up-to-date skills and cross-cultural communication will be the most valuable assets. By creating a bridge between local colleges and multinational corporations, POCY equips young people with the skills they need to succeed while also helping them understand international standards and embrace diverse cultures, fully preparing them for the global workforce.

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AI in Higher Education: Lessons from the EU



► EU Artificial Intelligence Act

The recent adoption of the European Union's Artificial Intelligence Act (AIA, entry into force on August 1, 2024, and full application expected by 2027) has garnered worldwide attention as the first comprehensive regulatory framework for AI. Given its cross-sectoral approach, the AIA is poised to shape the development and use of AI tools in education. While it is premature to assume the AIA will serve as a global model, particularly in different socioeconomic contexts, its choices represent a stake in the ground that is likely to shape the ensuing debate. Considering the raising usage of Generative AI and other AI driven tools in the educational context, it is of great importance to understand the AIA and its impact. This article offers high-level regulatory insights from the AIA to help institutional leaders and policymakers better grasp the issues at stake.

How AIA Treats Education

The AIA employs a risk-based framework, categorising AI systems based on the risks they pose to health, safety, and fundamental rights. It places high-risk applications, including those in education, under stricter scrutiny while prohibiting systems that pose an unacceptable risk of harm.

Two prohibitions will most directly impact the education sector: the bans on AI for emotional recognition and biometric categorisation.

The AIA prohibits the use of AI to infer a person's emotions in educational institutions, citing concerns about the scientific validity of such systems and the inherent power

imbalance in educational settings. While there is an exception for medical and safety reasons, the ban is broad and may prevent the deployment of potentially beneficial technologies. For instance, the law does not make an exception for tools that can be shown to improve learning outcomes, such as those that detect a student's engagement or frustration to help an instructor adjust their pacing or clarify confusing concepts. An AI system that notes a student's confusion during a difficult math lesson and prompts the teacher to offer one-on-one help would likely be prohibited.

The AIA also bans biometric categorisation that uses AI to deduce sensitive attributes like a person's race, political opinions, or religious beliefs. This prohibition addresses

EU AI Act: Educational & Vocational Training as High Risk Industry

Risk Classification	High Risk AI Systems	Requirements for High Risk Providers*	Predictions
Unacceptable Risk	1. AI for Admissions Determine access or admission or to assign to educational and vocational training institutions	 Risk and Quality Management System	- Compliance requirements may be too complex and resources-intensive for smaller companies, hindering their ability to compete and innovate - Restrictions on how student data can be collected and used could limit the potential of personalised and adaptive tools, impeding the development of edtech solutions relying on customisation - Complexity of regulation may induce fear of violation, discouraging companies from taking risks and innovating
High Risk 8 areas including Educational & Vocational Training	2. AI for Evaluation Evaluate learning outcomes, including when those are used to steer the learning process	 Conduct Data Governance	
	3. AI for Assessment Assessing the appropriate level of education that individual will receive or will be able to access	 Technical Documentation & Record Keeping	
	4. AI for Proctoring Monitoring and detecting prohibited behaviour of students during tests	 Instruction Guide	
Limited Risk		 Human Oversight	
Low and Minimal Risk		 Appropriate level of Accuracy, Robustness, and Cybersecurity	

*Providers: those intending to place on the market/put into service high-risk AI systems in the EU.

Source: Digital Education Council

the widely discussed risk of AI perpetuating biases by detecting subtle patterns in data, leading to discriminatory outcomes. However, simply omitting sensitive attributes—like language background or disability—does not guarantee fairness. In fact, this data can be crucial for contextualising student work. For example, an AI essay-grading tool that penalises for time spent or grammatical errors could systematically disadvantage non-native English speakers or students with fewer resources. Research increasingly shows that ignoring sensitive attributes may unintentionally widen disparities.

Beyond these prohibitions, the AIA classifies most other education-related AI as "high-risk," reflecting the significant impact these tools can have on students' futures. Under Annex III of the Act, several educational use cases are designated high-risk:

Admissions: AI systems used to determine student access or admission.

Evaluation: AI tools that evaluate learning outcomes, such as automated exam scoring systems.

Student Placement: AI systems that assess the appropriate educational level or track for a student.

Monitoring: AI proctoring tools that detect academic misconduct during tests.

Classifying these systems as high-risk means they must comply with strict requirements. Providers, which can be edtech companies or even universities that develop their own AI, are obligated to implement, among others, robust risk management, ensure high-quality and bias-free data, provide detailed technical documentation, and guarantee human oversight. In effect, a university that develops an AI to automate grading becomes a high-risk AI provider and must establish comprehensive governance to meet the AIA's standards. If, however, a university purchases

a compliant solution from a third party, it acts as a “deployer” and incurs fewer obligations.

Finally, for systems that are neither prohibited nor high-risk, transparency obligations apply if the system is intended to interact directly with individuals. This requires designing systems so that users know they are interacting with an AI.

The AIA also dedicates a specific chapter to General-Purpose AI (GPAI), which refers to models, like large language models, that can perform a wide range of tasks. While this chapter does not explicitly target education, its rules will have significant implications for the sector, as future educational AI tools will increasingly be built on these regulated general-purpose models.

A key limitation of the AIA's regulatory approach is that modern large language models can be easily adapted for a plethora of uses without technical expertise. For example, an educator could use an off-the-shelf LLM to grade assignments—a high-risk application. In this scenario, the full weight of

the AIA's compliance obligations may apply, making it practically infeasible for individual educators to customise AI tools. This could force them to rely on solutions from large commercial providers with the resources to ensure compliance.

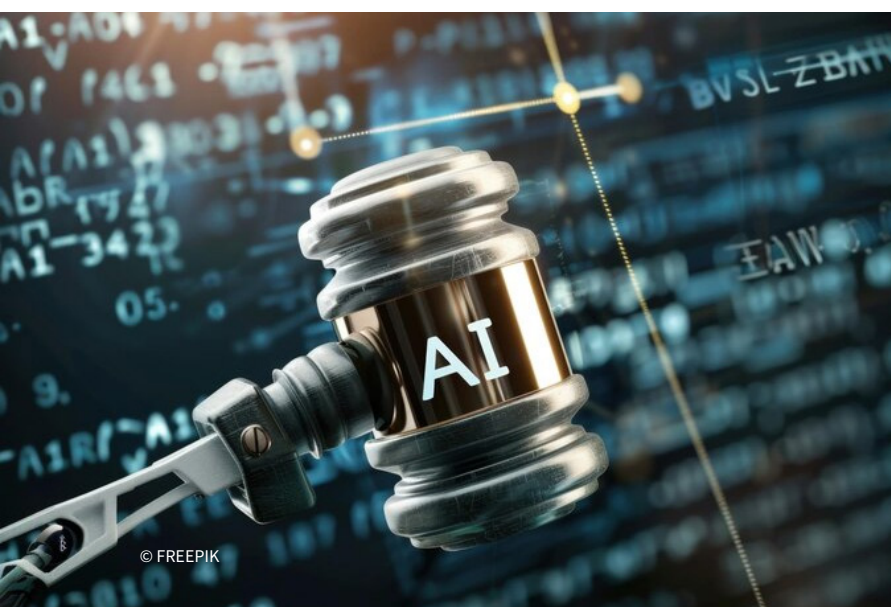
Potential Shortcomings of the AIA for Advancing Education

While the AIA rightfully seeks to mitigate AI's risks and to advance fundamental rights by defining a risk-based approach, some requirements and prohibitions may inadvertently hinder educational innovation.

A significant concern is that treating many learning-support AI tools as uniformly “high-risk” can stifle experimentation. The Act does not conduct an application-specific risk-benefit assessment, weighing a tool's potential benefits against its risks before subjecting it to stricter oversight. Instead, it classifies applications as high-risk based on their

“intended purpose” as declared by the provider.

This approach is sensible in that it aligns with existing EU regulatory frameworks like product safety legislation. However, the AIA's descriptions of high-risk applications in Annex III are often abstract and overly broad, causing the classification to be too comprehensive. For instance, an AI tutoring system providing private, real-time feedback to students without impacting



their grades falls under the same "high-risk" umbrella as an AI system that decides university admissions. Regulating solely by presumed risk, absent a public-benefit analysis, could obstruct the use of highly beneficial AI tools in education.

This broad-brush approach can likely be explained by the sheer difficulty of conducting a granular risk-benefit evaluation within a horizontal piece of legislation like the AIA. Such an exercise would have required a massive repository of risks and benefits and a complex evaluation methodology, demanding deep sectoral expertise. As a consequence, while the Act's risk classification is useful for mitigating certain dangers like illegal discrimination, its implementation may undermine beneficial innovations.

Furthermore, the AIA has a strong preventative focus on risk mitigation. This inevitably leaves less ground for experimentation and the collection of data on actual use, which would be necessary to perform a more nuanced risk classification over time. Policymakers outside the EU could opt for a different approach where additional regulatory scrutiny is triggered only when there is sufficient evidence that a risk materialises to a significant degree.

The AIA's specific prohibitions also risk constraining valuable pedagogical strategies. Banning emotion-sensing altogether may eliminate potentially useful tools for detecting student interest, stress, or other factors critical for learning. Such insights could help educators identify students who need extra support before they fall behind or recognise those who are highly engaged and ready for more challenging material. By precluding all forms of emotion inference, the ban stifles innovation aimed at creating responsible,

privacy-preserving ways to leverage these insights. Although research is not directly subject to the AIA, these restrictions could also create a chilling effect on academic research in these areas.

With its core focus on risk avoidance, the AIA is also unlikely to encourage systems designed to foster creativity, critical thinking, and adaptive teaching methods. Moreover, the compliance burden for high-risk applications may stifle educational innovation, especially for smaller EdTech developers and academic institutions. The laundry list of obligations—from risk assessments and data governance to detailed record-keeping and quality management—is both complex and resource-intensive. Many universities and smaller firms may lack the resources to comply, potentially limiting the diversity of educational tools and concentrating the market in the hands of a few large providers.

Recommendations for Balancing Innovation and Ethics in Higher Education outside the EU

Understanding the intentions and challenges of the AIA presents an opportunity for leaders and policymakers in other jurisdictions to experiment with alternative approaches.

Higher Education Leaders

To avoid top-down implementation, leaders should engage both educators and students in AI-related decision-making from the very beginning. This means creating inclusive processes where faculty, administrators, and learners can collaboratively evaluate

AI systems, conduct thorough risk-benefit analyses, and ensure that any adopted tool aligns with institutional values and pedagogical goals.

At the institutional level, leaders should consider a “regulation by design” approach. Rather than relying solely on external compliance mechanisms, they should embed safeguards and accountability directly into the AI systems. For instance, a university could provide access to customised AI tools that have its specific academic integrity policies built-in, which could help detect when systems are being misused. By integrating responsible design and oversight into technical designs, higher education leaders can foster an environment that harnesses AI’s strengths while minimising unintended consequences.

Crucially, general-purpose AI tools provide an unprecedented opportunity for individual educators to leverage powerful technology themselves, without needing technical or coding skills. For example, a history professor could develop a custom writing coach that provides feedback on student essays using an off-the-shelf large language model. While the AIA’s rules might make such educator-led innovation difficult in the EU, other jurisdictions may pursue a path that broadens access and improve the quality of education, while still ensuring proper caution and oversight.

Policy Makers

Effective AI governance in education requires a shift away from imposing rigid, top-down restrictions and toward building a smarter framework founded on partnership and trust.

First, it is crucial to clarify the division of roles. Regulators should focus on their core

mandate: advancing fundamental rights and equity by ensuring that AI tools are unbiased, protect student data, and are safe. Educators, in turn, must remain in control of instructional practice—deciding which tools best serve their students and how to integrate them into the curriculum. This separation ensures that safety and equity are prioritised without stifling classroom innovation.

Second, policymakers should recognise that a one-size-fits-all approach is ill-suited for AI. To address the distinct needs of higher education, sector-specific AI regulations would be more effective. The context of a large research university is vastly different from that of a K-12 school or a tech startup. Rules should be tailored accordingly. This could mean creating specific regulations for higher education or implementing a flexible “public-interest test” for new tools, which would weigh their demonstrated educational benefits against potential risks to students.

Finally, policy should emphasise support over punishment. Rather than only penalising misuse, the primary goal should be to help schools and developers adopt AI responsibly. This can be achieved by offering flexible compliance pathways—such as simplified checklists or phased deadlines—that keep costs manageable, particularly for smaller organisations. Pairing new rules with robust training programmes and collaborative initiatives would further guide the education community in using these powerful tools safely and effectively.

Final Thoughts

No single regulatory framework can ensure the responsible adoption of AI in higher

education. While broad prohibitions and abstract risk classifications may provide strong safeguards, they also risk stifling the innovation needed to equip students for the future—especially in under-resourced settings where AI could be a powerful equaliser. The legitimate goal of protecting fundamental rights like privacy and non-discrimination should not preclude the advancement of another fundamental right: education.

The rise of AI challenges educators to proactively harness its potential in the classroom while guarding against abuse. AI literacy—among students, educators, and administrators—will be crucial for fostering an academic culture that values genuine engagement and integrity. As AI literacy

becomes a key skill in many sectors, it is something educators must seek to foster in their students.

In contexts outside the EU where policy frameworks are still developing, flexible regulations that balance oversight with innovation may better serve local needs. Such approaches can protect individual rights while recognising AI's promise to expand access to high-quality learning. Coupled with training, collaboration, and clear guidelines, this balanced approach can empower educators to harness new technologies in ways that advance equity and improve student outcomes without sacrificing core educational values.

About Authors



Gabriele Mazzini is a pioneer and leading expert in Artificial Intelligence governance and regulation and a sought-after advisor, lecturer and public speaker across the world.

Former Team Leader at the European Commission, he designed and led the drafting of the Commission EU AI Act and was the principal advisor during the legislative negotiations with the Parliament and the Council. He also shaped earlier policy work on the European approach to AI since 2017, including the White paper on the ecosystem of excellence and trust for AI and the work on liability for emerging technologies.



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Robert Mahari is the Associate Director of Stanford's CodeX Centre and holds a JD-PhD in Legal Artificial Intelligence from Harvard Law School and the MIT Media Lab. His research focuses on Computational Law, using technology to analyse and enhance legal systems, improve practice, expand access to justice, and increase judicial efficiency. He collaborates with public and private organisations globally to develop and apply computational legal solutions in real-world settings.





Programme Updates

All pictures in Programme Updates are based on real photographs and have been stylised using AI technology.

INP-HB, UNESCO and UNESCO-ICHEI Promoted Multilateral Cooperation



On 7 May 2025, the Côte d'Ivoire Félix Houphouët-Boigny National Polytechnic Institute (INP-HB), UNESCO Abidjan, and UNESCO-ICHEI co-organised a multilateral exchange and cooperation event, as well as an International Institute of Online Education (IIOE) training session for higher education professionals at INP-HB.

UNESCO-ICHEI Visited Côte d'Ivoire to Strengthen HE Cooperation

From 8 to 9 May 2025, Ms. BI Xiaohan, Deputy Director of UNESCO-ICHEI, and Mr. CAO Zian, Chief of the Global Partnership and Programme Office of UNESCO-ICHEI, visited the Université Virtuelle de Côte d'Ivoire (UVCI), the UNESCO Office in Abidjan (UNESCO Abidjan), and Université Félix Houphouët-Boigny (UFHB) to have in-depth exchanges on the topics of capacity building of higher education professionals and digital transformation of higher education institutions.



UNESCO-ICHEI and IIOE Zambia National Centre Pioneer HE Development

On 12 May 2025, UNESCO-ICHEI and Mulungushi University (IIOE Zambia National Centre) jointly organised the “AI-Driven Higher Education: High-Level Training and Memorandum of Understanding (Mou) Signing Ceremony”. Eight Zambian HEIs joined the IIOE network, and a Smart Classroom Project agreement was signed. The deepened partnership will offer good practices for digital education in Southern Africa.



UNESCO-ICHEI Fosters Stronger Collaboration with Egyptian Partners

From 13 to 15 May 2025, Mr. PAN Feng, Deputy Director of the UNESCO-ICHEI, and Ms. LI Ruoyu, Programme Officer of the GPPO, visited Egypt for meetings with the IIOE Egypt National Centre, UNESCO Cairo, and the Egyptian National Commission for UNESCO. They engaged in in-depth discussions on projects including Smart Classroom, co-development of IIOE Micro-Certification courses, and localised teacher training. Since its establishment at Ain Shams University in 2022, the IIOE Egypt National Centre has been a national hub driving the country's digital education ecosystem, with its local network covering 23 universities.



UNESCO-ICHEI Hosted A Discussion at the 2025 World Digital Education Conference

From 14 to 16 May 2025, the World Digital Education Conference was held in Wuhan, China, under the theme “Education Development and Transformation: The Era of Intelligence.” The conference aimed to advance global education transformation in response to

UN initiatives. Mr. JIN Li, Director of UNESCO-ICHEI, moderated the session on “Building a Shared Vision for Global Educational Transformation” and highlighted IIOE’s work to build a multilateral ecosystem that helps HEIs enhance AI capacity and localise practices to meet urgent needs and future challenges.



UNESCO-ICHEI at IIOE Egypt National Centre Meeting on Quality Education



On 14 May 2025, the Third Annual Conference of the Measurement and Evaluation Scientific Association was held in Cairo, Egypt. It was jointly organised by the IIOE Egypt National Centre and the Measurement and Evaluation Scientific

Association (MESA) of the Association of Arab Universities. The conference, themed “Quality Education in Action: Innovative Pathways toward Educational Excellence”, aimed to bring together global educational leaders, researchers, policymakers, and technology experts to explore inclusive, equitable, and high-quality educational innovation strategies.

Launch of MAXHUB Smart Classroom at UPM



On 27 May 2025, the MAXHUB Smart Classroom Launching Ceremony was successfully held at Universiti Putra Malaysia (UPM). UNESCO-ICHEI has partnered with MAXHUB and other partners to provide a wealth of course resources on the IIOE platform, covering vocational and technical education and training, with the aim of enhancing the digital skills and artificial intelligence literacy of higher education professionals.

UNESCO-ICHEI Fostered Collaboration with NetDragon & WisdomGarden

On 12 June 2025, UNESCO-ICHEI signed strategic cooperation framework agreements with Fujian NetDragon Websoft Inc.

(NetDragon) and Xi'an WisdomGarden Co., Ltd. (WisdomGarden). Partnerships with NetDragon will focus on smart classrooms, AI micro-certification course development, and digital human technologies; with WisdomGarden, on smart classroom software upgrades and micro-certification courses. These agreements allow all parties to combine expertise and technology to advance higher education's digital transformation in developing countries.



UNESCO-ICHEI and ITC Jointly Conducted AI Training for CCUN



On 25 June 2025, UNESCO-ICHEI and the Institute of Technology of Cambodia (ITC) jointly hosted an online training session for members of the Cambodian Cyber University Network (CCUN), themed “Using AI Tools to Support Teaching and Learning in HEIs”. This training aimed to provide a systematic introduction to the functions and course resources of the IIOE platform, and help

participants master the application of AI tools in teaching and research through hands-on demonstrations. More than 150 higher education professionals from 15 Cambodian universities took part in the training.

UNESCO-ICHEI Explored New Partnerships in Republic of Korea



To advance multilateral cooperation under the framework of the IIOE, Ms. BI Xiaohan, Deputy Director of the UNESCO-ICHEI, led a delegation to visit leading higher education institutions and other organisations in the Republic of Korea, including Seoul National University (SNU), Kyung Hee University, Sungkyunkwan University, UNESCO Asia-Pacific Centre of Education for International Understanding (APCEIU), and Best Tech. Inc. The delegation explored opportunities in partnership network expansion, course co-development, university–industry collaboration, and research cooperation, reaching constructive consensus.

UNESCO-ICHEI and IUCEA Launched AI Training-of-Trainers Program

On 30 July 2025, UNESCO-ICHEI and the Inter-University Council for East Africa

(IUCEA) jointly launched the AI Training-of-Trainers Programme for the East Africa region during the 16th IUCEA Annual Conference. Leveraging the IIOE platform and its course resources, the programme provides systematic support for building digital and AI application competencies among faculty members of IUCEA member universities. It focuses on enhancing teachers' AI literacy and practical teaching capabilities, thereby promoting localised exploration and practices in the digital transformation of education.



UNESCO-ICHEI and UNC Signed IIOE Cooperation Framework Agreement



On 30 July 2025, a delegation from the Universidad Nacional de Ciencias Dr. Humberto Fernández-Morán (UNC), led by its rector Gabriela Jiménez Ramírez, visited the UNESCO-ICHEI and the Southern University of Science and Technology (SUSTech). UNESCO-ICHEI and UNC signed

a Cooperation Framework Agreement on IIOE, underscoring a shared commitment to advancing higher education development in Venezuela and the Latin American region through international cooperation.

Smart Classroom & IIOE Ghana National Centre Launched

On July 31, 2025, the Smart Classroom jointly established by the UNESCO-ICHEI, Southern University of Science and Technology (SUSTech), the University of Cape Coast (UCC), the Institute for Educational Planning and Administration under the auspices of UNESCO (IEPA), and Wuhan OS-EASY GROUP HOLDING LTD. was officially inaugurated at the University of Cape Coast. The IIOE Ghana National Centre was formally launched, becoming the 13th National Centre worldwide.



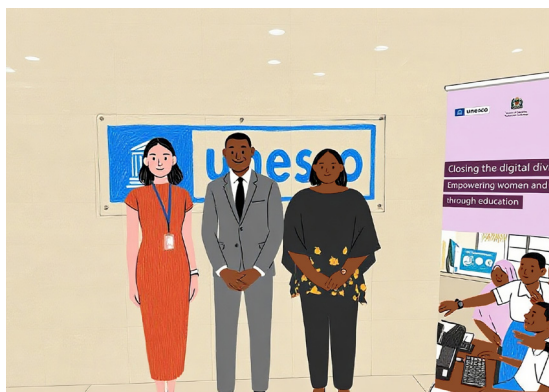
UNESCO-ICHEI and IIOE Indonesia National Centre Launched Joint Training

On August 4, 2025, the UNESCO-ICHEI, together with the Indonesia Cyber Education Institute (ICE-I), host of the IIOE) Indonesia National Centre, officially launched the "Capacity Building Programme for Lecturers in Digital Transformation" during the International Seminar on Strengthening the Micro-Credential Ecosystem in Indonesia. The programme aims to empower educators with digital skills through micro-certification training and support them in conducting effective teaching practices in the evolving digital environment.



UNESCO-ICHEI Visited Tanzania Fostering Collaboration with HEIs

From 4 to 6 August 2025, Ms. YUAN Xin, Programme Officer of the Global Partnership and Programme Office at the UNESCO-ICHEI, visited Tanzania. During the visit, she had discussions with representatives from UNESCO Dar es Salaam Office, University of Dodoma, University of Dar es Salaam, and State University of Zanzibar. This visit marked a significant step forward in UNESCO-ICHEI's cooperation efforts in Tanzania and represented important progress in expanding the IIOE network in East Africa.



Ministry of Higher Education of Egypt visited UNESCO-ICHEI and SUSTech



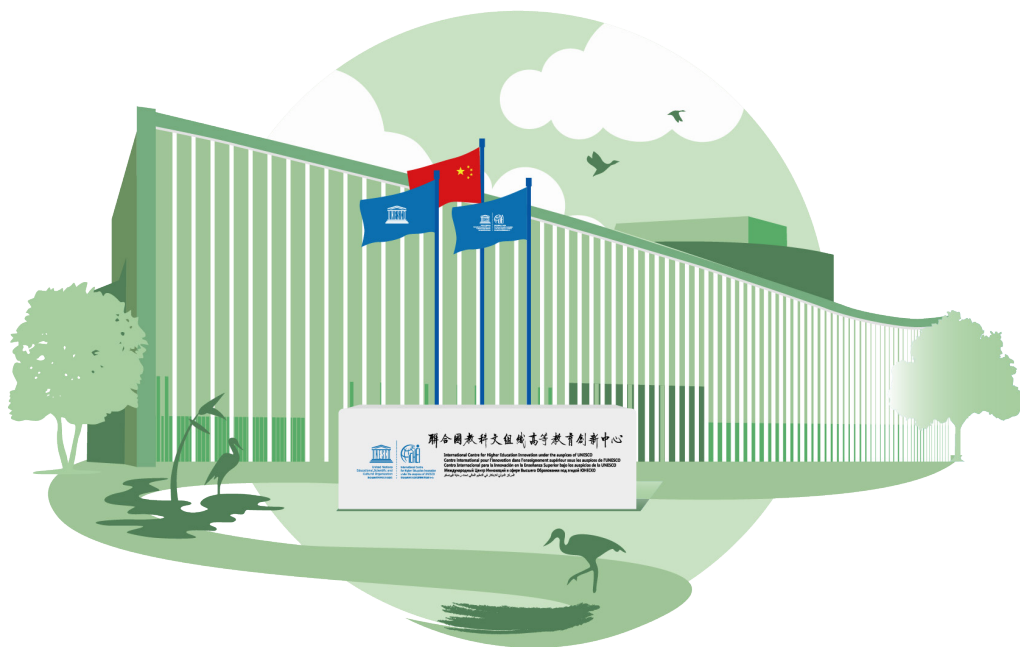
On 22 August 2025, a delegation from the Ministry of Higher Education and Scientific Research of Egypt, led by Dr. Sherif Kishk, Assistant to Minister for Smart Governance, visited UNESCO-ICHEI and SUSTech. Professor JIN Li, Director of UNESCO-ICHEI and Vice President of SUSTech, representatives from UNESCO-ICHEI and SUSTech, and representatives from Huawei Technologies Co., Ltd. attended the meeting. The parties held in-depth discussions on topics including the digital and AI competency development of university faculty, talent cultivation, joint research, and student exchanges, and explored potential directions for future collaboration.

Knowledge Sharing

Digital Leap in East Asia: A Regional Synthesis on Higher Education Transformation

The report is based on case studies from countries such as China, Japan, Mongolia, and South Korea, and brings together a large amount of data and practical cases to showcase the profound changes taking place in the digital transformation of the higher education sector. It highlights the successes and challenges faced by higher education institutions in their journey towards digitalization, providing valuable insights into the impact of these changes on pedagogical processes, knowledge networks, and the development of digital competencies among educators and students. This report is a call to action for policymakers, educators, and stakeholders to embrace digital transformation, to leverage the power of technology to enhance teaching and learning, and to prepare our youth for the challenges of the twenty-first century.





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