UNESCO

Digital Leap in East Asia:

A Regional Synthesis on

Higher Education Transformation

Education
2030

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Acknowledgement

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Forewords

Dear Readers,

UNESCO is proud to present the research report on the digital transformation of higher education institutions in East Asia, a project that has been undertaken with the unwavering commitment and collaboration of UNESCO and our esteemed partners from the East Asia countries.

The digital revolution has ushered in a new era of opportunities and challenges for higher education, and East Asia, with its vibrant technological landscape, stands at the forefront of this transformation. This report, the culmination of a year-long endeavour, delves into the heart of this transformation, providing an in-depth analysis of the integration of digital technologies and artificial intelligence (AI) within the higher education sector across four countries: China, Japan, Mongolia, and Republic of Korea.

Our mission at UNESCO is to ensure inclusive and equitable quality education for all, and this report aligns with our strategic objectives, which emphasize the importance of digital literacy and competencies in the context of sustainable development. The findings and recommendations presented herein are not only critical for the higher education institutions in East Asia but also for our global community as we strive to achieve the United Nations Sustainable Development Goal 4 (SDG 4) by 2030.

Hence the importance of this report, which is a call to action for policymakers, educators, and stakeholders to embrace the 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. 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.

The report is based on the country cased studies and a large amount of data and cases showing the changes have been occurring in the digitalization transformation in the higher education sector. We have noted profound transformations in the field, which is making progress in certain areas, but losing ground in others.

I acknowledge all our partners involved in the preparation of this report, including the team of researchers, consultants, and all those who have contributed to this report. Your dedication and expertise have been instrumental in bringing this project to fruition. I would like to extend my heartfelt gratitude to the International Centre for Higher Education Innovation under the auspices of UNESCO (UNESCO-ICHEI) for its funding.

To our member states and partners, I encourage you to use the evidence-based guidance and recommendations provided in this report to inform your policies and strategies, and to continue the dialogue on the digital transformation of higher education.

As we look to the future, let us seize the opportunities presented by digital technologies to create a more inclusive, equitable, and effective higher education system. Together, we can shape the future of education in alignment with the global vision for sustainable development.

Sincerely,
Prof. Shahbaz Khan
Director
UNESCO Regional Office for East Asia

In recent years, the rapid advancement of digitalization, networking, and intelligent technologies—driven by the new wave of scientific and technological revolution and industrial transformation represented by information and communication technologies (ICTs) — has profoundly reshaped the ways we live, work, and learn. In higher education, the swift development of digital technologies has transformed traditional education by offering personalized and flexible teaching and learning methods, and prompting systemic innovation across talent cultivation concepts, education models, and governance frameworks. This transformation has also posed challenges in governance, adaptability, and educational equity. However, by expanding learning opportunities, promoting global collaboration, and equipping learners with critical 21st-century skills, the digital transformation of higher education has become a pivotal force in achieving Sustainable Development Goals.

In East Asia, propelled by rapid economic growth, globalization, and technological innovation, countries have made significant progress in the digital transformation of higher education. China, Japan, Mongolia, and the Republic of Korea have leveraged robust policy support and investments in digital infrastructure to actively explore technological integration in education. From China's Digital China initiative and its Artificial Intelligence + Education Action Plan, to Korea's Artificial Intelligence Education Promotion Plan, Japan's vision of Society 5.0, and Mongolia's E-Mongolia program, each country has showcased how technology empowers education through innovative practices. However, this progress has also highlighted challenges such as the digital divide, data privacy, and balancing the roles of artificial intelligence and human educators.

It is against this backdrop that Digital Leap in East Asia: A Regional Synthesis on Higher Education Transformation was conceived. Jointly authored by the UNESCO Regional Office for East Asia and the International Centre for Higher Education Innovation under the auspices of UNESCO (UNESCO-ICHEI), this report synthesizes insights from China, Japan, Mongolia, and the Republic of Korea, documenting their digital education practices. It provides a comprehensive analysis of policy frameworks, digital ecosystems, capacity building for teachers and students, and innovative case studies. Anchored in practice, the report comprises a policy-level analysis, institutional case studies, and a study of the critical training needs of educators and learners, forming a systematic framework that links policy, practice, and demand. The report aims to provide valuable guidance and recommendations for education transformation efforts globally.

Aligned with UNESCO's Higher Education Roadmap 2030: Beyond Limits – New Ways to Reinvent Higher Education, this report emphasizes a human-centered and technology-enabled pathway for educational transformation. We hope that through the deep integration of technology and education, East Asia will set a global example in advancing equitable and sustainable education, fostering the creation of inclusive, resilient, open, and high-quality higher education systems.

Jin Li
Director of UNESCO-ICHEI

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List of contents

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List of tables

List of figures

Acronyms and abbreviations

AI	Artificial Intelligence
AR	Augmented Reality
AIEDAP	Artificial Intelligence Education Alliance Policy Lab
BNU	Beijing Normal University
CCNU	Central China Normal University
CDGDC	China Academic Degrees and Graduate Education Development Center
CDU	Chengdu University
COSS	Convergence and Open Sharing System
CRT	Country Research Team
DT/DX	Digital Transformation
EAS	East Asia Summit
EdUHK	The Education University of Hong Kong
ESD	Education for Sustainable Development
GCA	Global Cybersecurity Index
GEIS	Global Education and Innovation Alliance
GIGA	Global and Innovative Gateway for All
GSENET	Global Smart Education Network
HEIs	Higher Education Institution(s)
ICHEI	International Centre for Higher Education Innovation
ICTs	Information and Communication Technologies
IITE	UNESCO Institute for Information and Technologies in Education
ITT	International Telecommunication Union
ISST	ICT Skill Standard for Teachers
JUAA	Japan University Accreditation Association
KAIST	Korea Advanced Institute of Science & Technology
KERIS	Korea Education and Research Information Service
LMS	Learning Management System
MDDC	Ministry of Digital Development & Communications
MEXT	Ministry of Education, Culture, Sports, Science and Technology

METI	Ministry of Economy, Trade, and Industry
MOES	Ministry of Education and Science
MNUMS	Mongolian National University of Medical Sciences
MOOCs	Massive Open Online Courses
MUST	Mongolian University of Science and Technology
MU	Mandakh University
NCEA	National Council for Education Accreditation
NIAD-QE	National Institution for Academic Degrees and Quality Enhancement of Higher Education
NUM	National University of Mongolia
ODL	Open and Distance Learning
PKU	Peking University
PISA	Programme for International Student Assessment
PPP	Public-Private Partnerships
PRC	People's Republic of China
QA	Quality Assurance
ROK	Republic of Korea
SDGs	Sustainable Development Goal(s)
SIS	Student Information System
STEAM	Science, Technology, Engineering, Arts, and Mathematics
STEM	Science, Technology, Engineering, and Mathematics
TALIS	Teaching and Learning International Survey
TOR	Terms of Reference
UN	United Nations
UNGA	United Nations General Assembly
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO IISTEM	UNESCO International Institute for STEM Education
UFE	University of Finance and Economics
VR	Virtual Reality

Executive summary

Context

This regional synthesis report consolidates findings from four country reports on digital transformation in higher education, specifically China, Japan, Mongolia, and South Korea. It examines policy and institutional contexts, digital ecosystems, and digital competencies for students and faculty, highlighting innovative practices and challenges. A collaboration between UNESCO Beijing and ICHEI, the project involved desk reviews and case studies, culminating in the regional synthesis. The report provides an insightful overview of East Asia's digital transformation journey and offers valuable policy recommendations to enhance accessibility, quality, and efficiency in higher education. Drawing on the four country studies, key highlights and takeaway messages are summarized in this Executive Summary.

Key findings

Policy context of digital transformation

National digital strategies: East Asian nations have implemented comprehensive national digital strategies to drive the transformation of higher education, seamlessly integrating technological innovation with their wider economic and social objectives. Examples include China's *Digital China* initiative, South Korea's *Digital New Deal*, Japan's *Society 5.0*, and Mongolia's *E-Mongolia*. These strategic frameworks establish a conducive environment that nurturers the digital transformation of higher education throughout the region.

Digital policies in education: East Asian countries' digital education policies aim to integrate digital technologies into higher education to enhance learning outcomes and prepare students for the future. These policies focus on ensuring universities have reliable Internet access and modern digital tools, providing digital literacy training for educators and students, promoting the development and use of innovative digital learning resources, bridging the digital divide to guarantee equitable access, and fostering partnerships between governments, educational institutions, civil society, and the private sector. This holistic approach fosters continuous improvement and inclusivity in the higher education sector.

Governance and institutional mechanisms: Countries in the region have developed robust national governance mechanisms and institutional frameworks. These structures provide strategic direction, enforce quality standards, promote inclusivity, facilitate capacity building, foster collaboration, and support innovation, laying a foundation for sustainable digital education.

Funding: Funding for digital education often comes from a combination of government support, public-private partnerships, university's internal sources, and international collaborations. Major digital transformation initiatives are typically funded from education budgets, although this is not always the case across all institutions.

Public-Private Partnerships (PPPs): East Asian governments encourage public-private partnerships (PPPs) to mobilize resources, integrate technological expertise, and foster innovation, enabling universities to implement advanced digital tools and platforms efficiently.

Regional and international digital cooperation: Universities in the region are actively engaged in regional and international digital cooperations. These collaborations with regional and global institutions promote best practices, enable joint research, and enhance knowledge sharing to advocate for the digital transformation of higher education.

The State of Digital Transformation in Higher Education in East Asia

Digital ecosystems in higher education: Case study universities in East Asia feature advanced digital ecosystems, encompassing high-speed Internet, AI-enabled platforms, Learning Management Systems (LMS), and digital libraries. Initiatives emphasize personalized learning through AI, MOOCs, and virtual classrooms. These initiatives also aim to promote active learning pedagogy and supplement traditional teaching methods. While collaboration

with private enterprises fosters innovation, translating these efforts into improved teaching and student outcomes remains a priority.

Digital competencies of teachers and students: Digital skills are critical for personal, academic and professional success. Governments and higher education institutions invest in digital literacy programmes. However, varying levels of proficiency persist, necessitating continuous improvement. The COVID-19 pandemic accelerated digital adoption, reinforcing the need for equitable digital education.

Innovative practices: Unique digital initiatives characterize each country. China hosts the world's largest MOOCs pool for access and equity. Japan employs localized strategies, such as Kagawa University's approach. South Korea emphasizes AI competencies for teachers, while Mongolia prioritizes digital infrastructure and inclusion. These all align with national priorities, address access gaps, and enrich learning.

Key enablers and barriers: East Asia's digital transformation is supported by strong government policies, strategic investments, innovation hubs, and a cultural emphasis on education. Enablers include digital literacy programs, R&D, STEM education, and global collaboration. Barriers include inconsistent policies, limited funding, capacity constraints, the digital divide, and privacy concerns.

Recommendations for advancing digital transformation in higher education

Policy reform

- Recognize digital transformation as a driver of societal and economic progress, emphasizing its pivotal role in fostering innovation, enhancing productivity, and creating new opportunities.
- Unify digital ecosystems with a comprehensive, integrated, and coordinated strategy to ensure sustainable and responsive higher education, maximizing synergy and impact.
- Prioritize the development and maintenance of adaptable, robust digital systems to ensure a strong, reliable technological foundation for supporting teaching, learning, research, and administrative functions in higher education institutions.
- Recognize virtual learning spaces as a public good and human right, ensuring accessibility, especially for marginalized groups.

Digital infrastructure

- Ensure equitable access to connectivity and devices through rural broadband, loan programs, and PPPs.
- Invest in Open Educational Resources (OER) to improve accessibility and learning outcomes.
- Address all forms of digital divides with infrastructure investments, digital literacy programmes, and equitable technology access.
- Leverage culturally relevant OER and credit-bearing MOOCs aligned with labour market demands to ensure graduates' career readiness.
- Conduct comprehensive self-assessments of digital ecosystems of universities, using standardized frameworks and stakeholder engagement to identify and address gaps.

Digital Capacity Building

- Invest in leadership training to drive digital innovation and facilitate the adoption of new technologies in higher education.
- Develop educators' digital competencies and incentivize their participation in digital pedagogy development. Offer flexible, demand-driven training to help educators upskill at their own pace.
- Strengthen collaborations with tech companies to prepare students and educators for digital challenges.
- Involve educators in co-developing AI-driven educational tools to align with learning needs.

- Equip students with essential digital competencies by integrating digital skills training across curricula, offering targeted workshops, enhancing access to technology, promoting active learning with digital tools, and encouraging interdisciplinary approaches, ensuring they are not only proficient but also adaptable and innovative.

Pedagogy, Learning, and Assessment

- Integrate AI tools to improve learning outcomes, ensuring ethical use, transparency and equity.
- Ensure national teacher competency frameworks and regulations are aligned with global digital guidelines and standards.
- Promote personalized learning through AI-driven tools and data analytics.
- Support student and educator well-being with mental health resources and professional development.
- Invest in advanced LMS platforms to provide personalized insights and foster interactive, collaborative learning environments.

Governance and system building

- Establish national guidelines to standardize digital systems, ensuring seamless data sharing and integration across educational platforms.
- Implement change management strategies to support the transition to digital education, including clear communication and stakeholder engagement.
- Implement robust data governance frameworks to ensure privacy, data security and ethical data use and to oversee the management and implementation of digital systems.
- Conduct regular monitoring and evaluation of digital solutions to ensure their continued relevance and effectiveness, fostering a cycle of continuous improvement.

Digital cooperation

- Foster partnerships, joint initiatives, research collaborations, and resource sharing among governments, universities, civil society, and the private sector to enhance digital teaching and learning.
- Utilize virtual internationalization to expand global accessibility and inclusivity in higher education.

Chapter I

Introduction

This first chapter sets the stage by providing the background and rationale for the study, outlining the key objectives, and detailing the methodology employed. It also examines the scope and limitations of the research, providing an important context for understanding the findings and insights that follow.

1.1 Background and rationale

SDG 4 and digital transformation of higher education

The global community adopted Sustainable Development Goal 4 (SDG 4) in September 2015 as part of the 2030 Agenda for Sustainable Development, aiming to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all[1]. It sets ambitious targets to ensure universal access to education, eliminate different forms of disparities, and improve the quality of education at all levels, from early childhood to higher education. SDG 4 also stresses the importance of education in fostering global citizenship and sustainable development, preparing individuals not only for the workforce but also for their roles as informed, responsible members of society. Achieving these goals requires addressing barriers like unequal access to education, lack of resources, and regional disparities, while ensuring that education systems are inclusive and responsive to the changing needs of the world (UNESCO, 2015)[2].

The digital transformation of higher education is critical to achieving SDG 4 goals because it helps expand access to quality education, enhance learning outcomes, and ensure equity across educational systems. By leveraging digital tools and technologies such as online learning platforms, virtual classrooms, and open educational resources (OERs), higher education can reach underserved populations, including those in remote areas and marginalized communities, thus supporting SDG 4's commitment to inclusivity (UNESCO, 2015)[3]. Moreover, digital transformation enables universities to offer flexible, lifelong learning opportunities through online courses and micro-credentials, helping individuals continuously develop the skills needed to thrive in an ever-evolving global economy. Digital tools also enhance the quality of education by fostering innovation, enabling personalized learning experiences, and facilitating global collaboration in research and knowledge-sharing. As higher education institutions integrate digital strategies, they become better equipped to meet the broader targets of SDG 4, advancing sustainable development through more accessible, inclusive, and effective education systems.

Digital transformation is crucial for achieving SDG 4, which, in turn, accelerates the advancement of digitization efforts. SDG 4 is critical to driving digital transformation in education because it provides a clear framework to ensure all learners, regardless of background, have access to quality, equitable, and inclusive education. Digital technologies can break down traditional barriers to learning by offering flexible, affordable, and innovative solutions. However, without SDG 4's guiding principles, digital transformation risks deepening inequalities and leaving marginalized groups behind. By focusing on access and equity, SDG 4 ensures that the benefits of digital education are more

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1   United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development.* https://sdgs.un.org/2030agenda

2   UNESCO. (2015). *Education 2030: Incheon Declaration and Framework for Action.* https://unesdoc.unesco.org/ark:/48223/pf0000245656/PDF/245656eng.pdf.

3   UNESCO. (2015). *Qingdao Declaration: Seize digital opportunities, lead education transformation.* https://unesdoc.unesco.org/ark:/48223/pf0000233352

evenly distributed, aligning with its commitment to "Leave No One Behind."

Moreover, SDG 4 emphasizes quality education, which is fundamental in leveraging digital tools effectively. Digital transformation can enhance learning experiences, foster learner engagement, and provide tailored education solutions. But for these tools to truly uplift education systems, they must be integrated thoughtfully and equitably, with a focus on improving learning outcomes and teacher training. SDG 4's emphasis on quality ensures that the digital shift is not just about technology but also about raising educational standards globally.[4]

Finally, SDG 4's promotion of lifelong learning, global citizenship, and education for sustainable development underlines the need for a continuous, forward-thinking approach to education in the digital age. As economies and societies evolve, so too must educational systems, enabling learners of all ages to gain new skills, adapt to global challenges, and become responsible global citizens. By embedding sustainability, global citizenship, and lifelong learning into education policies, SDG 4 supports digital transformation in creating resilient, future-proof systems that equip individuals with the tools to contribute to a more sustainable, inclusive, and equitable world.

SDG 4 and digital transformation of higher education as drivers in achieving SDGs

Both SDG 4 and the digital transformation of education are essential drivers in achieving the broader Sustainable Development Goals (SDGs) as they lay the foundation for an informed, skilled, and empowered global population (Miao & Zhang, 2020)[5]. SDG 4 ensures that individuals receive quality, inclusive, and equitable education, which is critical for addressing issues like poverty (SDG 1), gender equality (SDG 5), and decent work (SDG 8). An educated society is better equipped to make decisions that promote sustainable development, reduce inequalities, and drive economic growth. By emphasizing lifelong learning and skills development, SDG 4 creates a population capable of responding to emerging global challenges, directly contributing to the achievement of other SDGs.

The digital transformation of education accelerates progress toward the SDGs by enhancing access to knowledge, fostering global collaboration, and equipping learners with the digital and critical thinking skills necessary for the 21st century. Digital tools enable education systems to be more flexible, personalized, and efficient, helping to overcome barriers to education in remote or underserved areas, which supports SDG 10 (reduced inequalities). Additionally, digital platforms can incorporate content focused on sustainability, climate action (SDG 13), and responsible consumption (SDG 12), embedding these principles into education systems worldwide. By integrating digital education, it is possible to scale up learning opportunities, create a more informed citizenry, and support the global shift toward sustainable development across all sectors.

UNESCO's role in promoting digital transformation

UNESCO, as the specialized UN agency for education, plays a central role in shaping the integration of digital transformation into global education systems. Through initiatives like the Global Education Coalition, launched during the COVID-19 pandemic, UNESCO has been instrumental in creating remote learning solutions and digital platforms to reach students in under-resourced areas.[6] In higher education, UNESCO promotes the use of open educational resources (OERs) and open access policies, which make educational materials and research freely

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4   Fagge, J., & Junaid, M. (2020). Quality education and the role of digital technologies in achieving SDG 4. *International Journal of Educational Development, 79,* 102214. https://doi.org/10.1016/j.ijedudev.2020.102214

5   Miao, J., & Zhang, Z. (2021). The role of digital transformation in achieving the Sustainable Development Goals: A systematic literature review. *Sustainability, 13*(10), 5463. https://doi.org/10.3390/su13105463

6   United Nations Educational, Scientific and Cultural Organization (UNESCO). (2021). *Responding to COVID-19 and beyond, the Global Education Coalition in action.* https://unesdoc.unesco.org/ark:/48223/pf0000374364?posInSet=4&queryId=b640c804-fd23-441e-bcd9-28c2e755ccbd

available, helping universities and learners overcome traditional barriers to accessing high-quality education. UNESCO's Futures of Education initiative also explores how digital tools can support lifelong learning and more personalized educational experiences in the years to come.[7]

UNESCO's Global Convention on Recognition of Qualifications concerning Higher Education provides a framework for fair, transparent, and non-discriminatory recognition of qualifications, facilitating international cooperation and academic mobility.[8] It also emphasizes the importance of digital credentialing and OERs to ensure that learners worldwide have access to quality education. These guidelines ensure that qualifications acquired through digital platforms are acknowledged and valued globally.

The UN's initiatives, such as the Digital Cooperation Roadmap, emphasize the need for universal access to technology, focusing on ensuring that every individual has affordable and reliable digital connectivity by 2030.[9] Programmes like Generation Unlimited and Giga aim to connect every school to the Internet and equip young people with essential digital skills. These efforts align with the broader goals of the 2030 Agenda for Sustainable Development, particularly SDG 4 on quality education.

The UN's Transforming Education Summit held in 2022 highlighted the critical role of digital education in transforming global education systems.[10] It emphasized leveraging digital technologies to enhance access and quality of education, ensuring equity and inclusion by providing digital devices and Internet access to underserved communities. The summit also stressed the importance of continuous professional development for teachers to effectively use digital tools and the development of innovative learning models that create engaging and personalized learning experiences. Global collaboration among governments, the private sector, and civil society was encouraged to share best practices and resources, aiming to build resilient and inclusive education systems for the 21st century.

The Global Digital Compact, adopted during the UN General Assembly (UNGA) as part of the Pact for the Future, aims to enhance global digital cooperation and governance (UNGA, 2024)[11]. It focuses on ensuring that digital technologies are accessible and beneficial to all, with commitments to connect all people, schools, and hospitals to the Internet. The compact emphasizes the importance of digital inclusion, data privacy, and the ethical use of AI, promoting a collaborative approach to harnessing digital advancements for sustainable development and global well-being.

The United Nations and UNESCO emphasize a human-centred approach to digital transformation, with a strong focus on inclusivity and equity. Central to this vision is the effort to bridge the digital divide, ensuring that marginalized populations, including those in rural areas, low-income countries, and refugee communities, have access to digital education tools. This approach aims to enhance the quality of education by fostering the development of digital content and innovative teaching methodologies designed to improve learning outcomes. Additionally, a key priority is capacity-building for teachers, facilitated through digital platforms that offer

7   United Nations Educational, Scientific and Cultural Organization (UNESCO). (2021). *Reimagining our futures together: a new social contract for education*. https://unesdoc.unesco.org/ark:/48223/pf0000379707?posInSet=1&queryId=da586bfa-087c-485b-88d6-7681a7d11e8a

8   UNESCO (2020). *Global Convention on the Recognition of Qualifications concerning Higher Education*. https://unesdoc.unesco.org/ark:/48223/pf0000373602.

9   United Nations. (2020). *Roadmap for Digital Cooperation: A global commitment to connect, respect, and protect*. https://www.un.org/en/content/digital-cooperation-roadmap/

10   United Nations. (2022). *Transforming education summit: Summary of outcomes*. https://www.un.org/en/transforming-education-summit

11   United Nations. (2024). *Global Digital Compact: A shared vision for an inclusive digital future*. https://www.un.org/en/global-digital-compact

continuous professional development opportunities, enabling educators to effectively integrate and utilize new technologies in their teaching practices.

Ultimately, the United Nations and UNESCO seek to advance a digital transformation in education that is both sustainable and future oriented. This vision involves embedding principles of global citizenship, sustainability, ethics, and 21st-century skills into digital education systems to prepare learners for the evolving challenges of the modern world, including climate change and shifting economic demands. By fostering lifelong learning through digital platforms, the aim is to create education systems that are resilient, adaptive, and capable of empowering individuals throughout their lives.

The relevance of SDG 4 and digital transformation for East Asia

The significance of SDG 4 in East Asia lies in its focus on sustaining and improving the quality of education as the region transitions beyond the initial challenges of access. Over the past few decades, countries such as China, Japan, South Korea, and Mongolia, have all made significant strides in expanding access to education. However, persistent challenges related to quality, equity, and relevance underscore the continued importance of SDG 4. This goal highlights the need for inclusive and equitable quality education while promoting lifelong learning opportunities for all. Such a focus is crucial for supporting economic growth and social development, particularly in the face of an increasingly complex global environment and ongoing demographic shifts.

Building on its success in expanding educational access, East Asia now faces the critical task of aligning its education systems with the diverse needs of learners and the rapidly changing demands of the labour market. The region's dynamic economies require a workforce proficient in advanced skills, digital literacy, and critical thinking to drive innovation and adapt to technological advancements. SDG 4 provides a framework for achieving this by emphasizing the integration of quality education with relevant, future-oriented learning experiences. Moreover, its focus on equity highlights the necessity of addressing disparities through targeted support for marginalized groups, such as women, rural populations, and ethnic minorities. By advancing these priorities, East Asia can optimize its educational systems to support sustainable development, reaffirming that both SDG 4 and digital transformation are central to the region's agenda.

East Asia's advances in digital transformation of higher education

East Asia has emerged as a leader in the digital transformation of higher education, showcasing remarkable progress that can serve as a model for the rest of the world.[12] Countries like China, Japan, and South Korea have implemented innovative strategies that integrate advanced technologies into their educational frameworks, significantly enhancing access and quality. By investing in digital infrastructure and creating online learning platforms, these nations have not only broadened educational opportunities for diverse populations but have also ensured that graduates possess the necessary skills to thrive in a rapidly evolving global economy.

The successes observed in East Asia highlight the importance of comprehensive strategies that combine government support, technological innovation, and a commitment to educational quality. The region's focus on lifelong learning, digital literacy, and collaborative learning environments demonstrates how effectively leveraging technology can lead to improved learning outcomes and a more skilled workforce. As other regions grapple with their own educational challenges, the experiences of East Asian countries provide valuable insights and practical examples of how to harness digital transformation in higher education to drive sustainable development and

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12   Lee, J., & Kim, H. (2021). Digital transformation in higher education: The case of East Asia. *Higher Education, 81*(1), 1-15. Retrieved from https://doi.org/10.1007/s10734-020-00651-7

economic growth.

East Asia offers valuable policy insights into digital transformation in education, shaped by its rapid economic growth, technological innovation, and diverse educational contexts. With strong government support and investments in digital infrastructure, countries like China, Japan, and South Korea have successfully integrated digital technologies into higher education, achieving widespread access and fostering a highly skilled workforce. These advancements position the region as a model for effective digital transformation in education.[13].

The challenges and successes encountered by East Asian countries in their digital education initiatives provide valuable lessons for nations worldwide. The region's efforts to adopt and integrate digital technologies in higher education, design and innovate to reform pedagogy, and support learning underscore the importance of inclusive and comprehensive policy frameworks. As countries navigate an increasingly digital landscape, East Asia's experiences offer critical insights into effective strategies for policy design and implementation. These lessons can help policymakers and educators around the world leverage technology to drive innovation, equity, and quality in education, contributing to global efforts to achieve Sustainable Development Goal 4 (SDG 4).

In this context, UNESCO Beijing, in collaboration with the International Centre for Higher Education Innovation (ICHEI), a Category II Centre under the auspices of UNESCO based in Shenzhen, China, launched an initiative to develop four case studies documenting the experiences and strategies of East Asian countries in the digital transformation of higher education. Acknowledging the region's progress and the lessons learned from their unique approaches, these case studies aim to offer valuable insights into effective policies and practices that can guide educational reforms in other nations. This regional synthesis report consolidates findings from these four country case studies, providing a thorough analysis of the region's achievements, challenges, and key lessons learned. This report offers important insights that can inform global education policy and practice, serving as a resource for understanding how East Asian countries are navigating digital transformation. It also presents a framework for other regions to adapt similar strategies to their own contexts.

1.2 Objectives

The overarching objective of this regional synthesis report is to consolidate and analyse the key findings, trends, practices, and insights drawing from the country reports on digital transformation of higher education in East Asia. More specifically, it aims to accomplish the following objectives:

(i)   Document and analyse the existing policies and institutional frameworks supporting digital transformation in higher education across East Asia.

(ii)   Examine the approach to and current state of digital transformation in higher education institutions in East Asian countries.

(iii)   Document and assess major innovative initiatives undertaken by universities to drive digital transformation and highlight best practices that can potentially serve as models for other institutions within and beyond the region.

(iv)   Analyse the current state of digital competencies of teachers and students, and investigate the competencies required to effectively engage with evolving digital learning technologies and environments.

(v)   Identify key enablers facilitating digital transformation in higher education in East Asia, and analyse bottlenecks and challenges hindering progress as countries aim to advance further.

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13   Asian Development Bank (ADB). (2021). *Digital transformation in Asia: Trends and outlook.* https://www.adb.org/publications/digital-transformation-asia-trends-outlook

(vi)   Provide comprehensive policy recommendations that can guide policymakers, educational institutions, and other stakeholders in making informed decisions to accelerate and enhance digital transformation in higher education.

1.3 Methodology

The background for this regional synthesis report, along with the preceding case studies, stems from a voluntary agreement between UNESCO Beijing and ICHEI. The project focused on studying digital transformation in higher education across East Asia. Funding for the study was provided by ICHEI, while the project was executed by UNESCO Beijing.

The study was conducted during August 2023 and November 2024 and was divided into two phases. The first phase involved assessing the status of digital transformation of higher education in East Asian countries, resulting in the development of four country reports covering China, Japan, Mongolia, and South Korea. These case studies documented each country's current state of digital transformation, identifying relevant national experiences, patterns of transformation, key enablers, and challenges. A brief description of the methodology used in preparing the case studies is provided below.

Preparatory work for the study

Preparation of a joint Terms of Reference (TOR): Through joint discussions between UNESCO Beijing and ICHEI, a TOR was developed to define the scope and objectives of the digital transformation project for higher education in East Asia. This TOR outlined the key tasks to be completed and the deliverables to be produced.

Establishment of Country Research Teams (CRTs): A CRT was established in each participating country, with members selected based on prior collaboration and expertise in their field. The size of each CRT varied, ranging from two to ten (Mongolia, 2; Japan, 3; Korea, 4; and China, 10). Members were selected either from the same university/institution where the case study was conducted or from other universities.

Development of study framework and methodology: Each country was provided with a TOR, which guided the respective teams in developing their own study frameworks for the assignment. The TOR specified that each research team would be responsible for formulating specific research questions tailored to their country's context, in alignment with the project's objectives. As a result, the teams convened to discuss their approach, data requirements and sources, methodology, the scope of the country report, and other related issues. These meetings helped clarify the expectations outlined in the TOR and fostered a common understanding among team members.

Organization of virtual meetings with the CRTs: The UNESCO Beijing team organized three virtual meetings with the country team members to orient them to the scope and objectives of the study and review progress midway through the study period. Additionally, UNESCO Beijing provided a style template for the country report, which included examples of the front matter, general formatting, manuscript style, references, appendices, and other relevant components.

Methods of country case preparation employed by CRTs

Desk review: First, a comprehensive desk study was conducted, analysing policy documents, national plans, legislative frameworks, webpages of relevant agencies, press releases, and statements from ministries of education, as well as various documents prepared by universities selected for detailed case studies. Additionally, academic journals, reports from university associations, EdTech companies, and Non-governmental Organizations (NGOs) were reviewed. This phase aimed to gather a broad understanding of the strategic directions and the current state

of digital environments in higher education institutions in China, South Korea, Mongolia, and Japan, providing foundational context for the subsequent detailed analyses.

For the China country report, for example, secondary data collected from the Department of Science, Technology, and Informatization was utilized. This department tracks the digital status of higher education in China through annual surveys., with the results published in the *China Education Informatization Development Report*. The Chinese country report conducted a comparative analysis of data over a two-year period, focusing on areas such as digital infrastructure, digital educational resources, digital teaching applications, digital management, and digital security.

Selection of universities for case studies: Each participating country selected two to five universities that had actively pursued or demonstrated success in digital transformation (see Table 1). The selection process emphasized not only best practices in digital transformation but also geographic diversity to ensure representation from different regions, as well as a variety of digital innovations showcasing different features. Furthermore, the universities were chosen to represent a spectrum of sizes, including large, midsize and small institutions.

Preparation of case studies of selected universities: Case studies of the selected universities were prepared to examine their strategic digital plans, digital infrastructure, teaching and learning environments, faculty and student digital competencies, innovations, and more. These case studies provided in-depth insights into how these institutions have integrated digital technologies into their educational practices, highlighting best practices and innovative approaches from each country. The case studies are descriptive in nature, primarily focusing on the institutional digital initiatives.

Field surveys and interviews: Due to time constraints, some countries primarily relied on desk reviews, while others conducted limited field observations, focus group discussions (FGDs), and interviews with policymakers from Ministries of Education, university administrators, professors, and students to gather supplementary data beyond the desk study findings. In Mongolia, however, comprehensive surveys of students and teachers were conducted to examine their perceptions, digital readiness, and teaching and learning practices. These surveys provided valuable insights into on-the-ground realities and user experiences, enhancing the overall analysis of digital transformation in higher education. Nearly 1,500 students from four universities of Mongolia participated in the student survey, while 264 instructors responded to the instructor survey. The surveys used a questionnaire method to assess the level of digital competencies of university teachers and students. These methods provided human perspectives and insights into the practical implementation of digital transformation strategies in respective countries.

Preparation of country reports: The individual case studies of universities were integrated into the country reports, allowing for a holistic analysis that highlighted the unique practices and innovations of each university within the broader national context. This approach ensured that the individual case studies informed the preparation of the country reports. By combining the policy context with the institutional framework where digital solutions are implemented, the country reports provided a rich and detailed perspective on the landscape of digital transformation in higher education. The Japanese country team confirmed that they held informal online meetings with relevant stakeholders to validate the study's findings.

Table 1. Methods of study and universities selected for case study preparation

Country	Method of study used	Name of university selected for case study
China	Analysis of MOE survey data Case study	Peking University (PKU) The Education University of Hong Kong (EdUHK) Chengdu University (CDU) Central China Normal University (CCNU) Beijing Normal University (BNU)
Japan	Literature review FGDs Case study Validation meetings	Hosei University (HU/J) Miyagi University of Education (MUE) Kagawa University (KU)
Mongolia	Desk study Interview Observation Survey (professors and students) Qualitative case study	Mongolian University of Science and Technology (MUST) National University of Mongolia (NUM) University of Finance and Economics (UFE) Mandakh University (MU)
South Korea	Case study method	Hanyang University (HU/K) Yonsei University (YU) Seoul National University (SNU)

Source: Draft country reports from China, Japan, Mongolia, and South Korea (2024)

Reviews of country reports: The country reports were presented as meta-studies, integrating case descriptions, field data, institutional profiles, national policy documents, research papers, academic articles, and policy reviews. Initial drafts of country reports underwent peer review to gather feedback and comments. Country teams convened multiple times, both virtually and in-person, to compile, analyse, and refine their reports. UNESCO Beijing also reviewed the reports and provided feedback. The reports were then finalized by the respective teams.

Preparation of regional synthesis report

This stage of the work focused on the preparation of the synthesis report, which consolidated the findings and national experiences of the four case studies. It assessed the processes and approaches to digital transformation, identified variations and common approaches where relevant, drew conclusions, and highlighted policy options for further improvement. The country reports served as the foundation for this synthesis, providing primary sources of information on the state of digital transformation in each country.

The methodology adopted for the preparation of this synthesis report included the following elements:

Desk Review: The methodology began with an in-depth desk review of the four case studies on digital transformation of higher education from China, Japan, Mongolia, and South Korea. Relevant policy documents, research papers, and reports related to higher education and digital education in these countries were also reviewed to supplement the information from the country reports. Additionally, experiences from other countries in the region and beyond, particularly OECD countries, were considered.

Review of UNESCO publications: UNESCO has been instrumental in advancing the integration of Information and Communication Technology (ICT) into education globally. Through initiatives such as the ICT Competency Framework for Teachers, UNESCO has provided comprehensive guidelines to enhance digital skills and teacher capacity. In the Asia-Pacific region, UNESCO's ICT in Education Programme has been instrumental in embedding ICTs into national education policies across numerous countries. Key UNESCO publications, such as the *Recommendations on the Ethics of Artificial Intelligence* adopted in 2021, have also established global standards for the ethical application of AI in education and beyond. These resources, along with other relevant guidelines and frameworks, were reviewed, and served as foundational references during the preparation of the synthesis report.

Thematic analysis: A chapter plan was developed in alignment with the study's objectives and organized thematically. This plan was shared with UNESCO Beijing for feedback. Following this, a thematic analysis of the country reports was conducted to identify common themes, unique practices, trends, and challenges across. This process involved thorough examination of the reports, uncovering patterns in national approaches to digital transformation in higher education, including policy initiatives, innovative practices, and obstacles encountered.

Development and administratial of a supplemental questionnaire: To address information gaps and clarify unclear details identified in the country reports, a supplemental questionnaire was designed and distributed to the CRTs. Team leaders responded promptly, providing additional insights that were critical for preparing the synthesis report.

Consolidation of Information into a Synthesis Report: The collected data were integrated into a coherent narrative organized around key themes, including policy and institutional frameworks, the current state of digital transformation, innovative initiatives, faculty and student digital competencies, enablers and bottlenecks, and policy recommendations. Highlights from individual case studies were incorporated to showcase best practices and notable achievements, demonstrating how specific universities and initiatives advanced digital transformation.

1.4 Scope of the study

For this study, East Asia is defined as comprising China (including Hong Kong), Japan, Mongolia, and South Korea, though it is acknowledged that this definition may vary in other contexts.[14] While the primary focus is on digital transformation in higher education, the report recognizes that digital policies and strategies often span multiple educational levels. Since digitization efforts in higher education are often rooted in developments at the primary and secondary levels, the report occasionally includes policies and programmes that address issues holistically. As a result, the country serves as the unit of analysis, extending scope and significance of the findings beyond higher education.

1.5 Limitations

While this regional synthesis report provides valuable insights and a comprehensive analysis, several limitations should be considered when interpreting the findings and their generalizability.

First, the availability and quality of data varied significantly across countries, influencing the depth and accuracy of the synthesis. The desk review utilized both primary sources, such as data gathered through field observations, FGDs, and surveys, and secondary sources, including research papers and reports from various organizations. However, inconsistencies in the detail and reliability of these sources restricted the potential for direct cross-country comparisons.

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14   In this report, the countries are listed without following any specific order.

Second, methodological differences, varying definitions, and diverse metrics in the country reports and case studies further complicated consistent integration and comparison of findings. Each country adapted the TOR to fit its context, resulting in unique research focuses and types of data collected. As a result, the analysis emphasizes key findings from each country rather than detailed comparative assessments.

Third, while the TOR aimed for a comprehensive examination of digital transformation in higher education, some countries explored fewer topics in less depth. Some country reports mostly relied on government documents and a few initiatives reported by universities, potentially missing critical insights.

Fourth, in cases such as Mongolia, reliance on teachers' and students' self-reported perceptions may have led to overestimations of digital competencies, reflecting a possible disconnect between reported abilities and actual practices.

Lastly, a lack of robust empirical research in some areas of the analysis meant that certain national policies were reported without critical evaluation of their intentions or effectiveness.

Despite these limitations, the report offers an important overview of the digital transformation of higher education in East Asia. By highlighting specific examples from countries integrating digital technologies, it provides insights into the current state, innovative practices, challenges, and solutions. The case studies serve as a resource for policymakers, educators, and stakeholders interested in advancing access, equity, and quality in higher education through digital transformation.

1.6 Structure of the report

This report comprises eight chapters. Chapter I outlines the background, objectives, methodology, and limitations of the regional analysis. Chapter II examines the context of higher education in East Asia. Chapter III discusses the policy landscape driving digital transformation in the region. Chapter IV examines the current state of digital transformation in East Asian higher education. Chapter V discusses essential digital competencies among stakeholders critical for successful transformation . Chapter VI introduces key national initiatives drawn from the country reports. Chapter VII identifies enablers and barriers to digital transformation. Finally, Chapter VIII concludes with key findings and policy recommendations to guide future action.

Chapter II

The context of higher education in East Asia

Having established the foundation of the study and outlined the methodological approach in the previous chapter, this chapter provides an overview of the socio-economic and demographic contexts influencing higher education systems in the case study countries, outlines specific challenges they face, and discusses the potential of technology to address these challenges, enhance accessibility, and improve educational quality across the region.

2.1 Overview of case study countries

East Asia, encompassing China, Japan, South Korea, and Mongolia etc., is marked by diverse political structures, rapid economic development, and advanced technological capabilities. These factors, coupled with demographic trends, significantly shape education and technology policies in the region.

Economically, East Asia represents a mix of highly developed economies and emerging markets. Countries such as China, Japan, and South Korea leverage their economic strength to make substantial investments in digital education infrastructure. The region is home to some of the world's top-performing education systems, as evidenced by PISA results, and hosts globally respected higher education institutions, making it a leader in education innovation.

Demographic diversity further shapes educational strategies. Aging populations in Japan and South Korea drive a rethinking of education policies, with digitization seen as a means to sustain competitiveness and address labour market challenges. Mongolia, with its emerging economy, pursues digital transformation as a pathway to leapfrog traditional education limitations and improve access in rural areas.

Political stability and robust government support across the region are key enablers of digital transformation. Each country follows a unique trajectory shaped by its political priorities, economic conditions, and demographic pressures. The shared ambition for global competitiveness in economic and educational terms further accelerates digitization efforts.

In summary, East Asia's political stability, economic power, demographic trends, and technological capabilities position the region as a global leader in the digitization of higher education. This overview lays the groundwork for understanding the distinct approaches and challenges that define digital transformation efforts in these countries.

Profile of China

China, officially the People's Republic of China (PRC), is located in East Asia and is the world's third-largest country by area, covering approximately 9.6 million square kilometres. With a population of approximately 1.44 billion people,[15] China has a fertility rate of 1.16 children per woman, below the replacement level of 2.1. The country's age structure is as follows: 0-14 years (16.48%), 15-64 years (69.4%), and 65 and over (14.11%). The life expectancy is 78.6 years.

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15   UNESCO. (2023). China: UNESCO country strategy 2022-2025. https://unesdoc.unesco.org/ark:/48223/pf0000388348

China's HDI increased to 0.788 in 2022, placing it in the category high HDI countries.[16] The country is ethnically diverse, with the Han Chinese forming the majority alongside 55 recognized ethnic minorities. Economically, China ranks as the second-largest economy by nominal GDP,[17] with a GDP estimated at $27.31 trillion in 2023. Key industries include manufacturing, technology, and agriculture, and major trading partners include the United States, the European Union, and Japan.

Despite significant progress in human development and lifting hundreds of millions out of poverty,[18] China still faces challenges such as income inequality and environmental degradation. Economic disparities between urban and rural areas, and between coastal and western regions, create even more challenges for equal access to digital education and other forms of learning. The rapid expansion of China's middle-class has increased the demand for higher education, with digital platforms playing a key role in addressing this demand.

Profile of Mongolia

Mongolia, a landlocked country in Northern Asia, lies between its two vast neighbours, China to the south and Russia to the north. Covering an area of 1,564,116 square kilometres, it is one of the least densely populated nations globally, with just 1.76 people per square kilometre. The capital, Ulaanbaatar, serves as the country's political, cultural, and economic centre.

Mongolia transitioned to a democratic system in the 1990s. Since then, the government has prioritized modernization, including integrating technology into the education sector. As of the 2020 census, the population is approximately 3.3 million, with a relatively young demographic: 27.1% are aged 0-14 years, 68.9% aged 15-64 years, and 4% aged 65 and over. Life expectancy is 68.63 years, with an average of 66.16 years for males and 71.23 years for females.

The ethnic composition is predominantly Mongol, with a notable minority of Kazakhs. While Mongolian is the official language, Kazakh is also spoken in certain regions. Rapid urbanization has marked Mongolia's demographic trends, with the urban population increasing from 52% in 1990 to 69% in 2020.

Mongolia's economy is heavily reliant on its rich natural resources, including coal, copper, and gold. In 2020, the GDP (PPP) was estimated at $37.6 billion, with mining, agriculture, and services forming the backbone of its economic structure. China is Mongolia's largest economic partner, followed by Russia, Japan, South Korea, and the United States.

Over the last three decades, Mongolia has made notable progress in human development, reflected in improvements in education, healthcare and social protection.[19] Education is especially valued, contributing to a high literacy rate. Though poverty has fallen and living conditions have improved due to investments in health, education and social protection, structural inequalities persist, and poverty remains a significant challenge with a rate of 28.4 per cent, the highest in the region.

Culturally, Mongolia is deeply tied to its nomadic heritage, with approximately 40% of the workforce engaged

16   United Nations Development Programme. (2023). *China in numbers 2023*. https://www.undp.org/china/publications/china-numbers-2023

17   World Bank. (2021). *Poverty headcount ratio at national poverty lines (% of population)*. https://data.worldbank.org/indicator/SI.POV.NAHC

18   United Nations Development Programme. (2020). *Human development report 2020: The next frontier: Human development and the Anthropocene*. https://hdr.undp.org/en/indicators

19   United Nations Development Programme. (2020). *Human development report 2020: The next frontier: Human development and the Anthropocene*. https://hdr.undp.org/en/countries/profiles/MNG

in herding livestock across vast pasturelands. This nomadic tradition shapes much of the Mongolian identity, influencing its cuisine, music, and festivals. Mongolia also has a rich historical legacy as the heartland of the Mongol Empire under Genghis Khan, which continues to be a source of national pride.

Profile of Japan

Japan, an island nation in East Asia, spans 377,975 square kilometres and consists of four main islands - Honshu, Hokkaido, Kyushu, and Shikoku – alongside numerous smaller islands. Its capital, Tokyo, is among the world's most populous and influential cities. With a population of approximately 129.9 million people, Japan faces significant demographic challenges due to its rapidly aging populations, with 28.7% aged 65 and over. The age structure includes 11.98% under 14 years, 59.32% aged 15-64, and life expectancy is one of the highest globally at 84.83 years.

Japan has the third-largest economy in the world by nominal GDP. The GDP (PPP) is estimated at $5.75 trillion for 2023.[20] Key industries include automobiles, electronics, robotics, and precision machinery. Major trading partners among others include large economies such as China, United States, and South Korea.

With a high HDI, Japan excels in health care, education, and living standards. However, the country faces challenges such as a declining population and a shrinking workforce, posing long-term economic and social issues. The country is ethnically homogeneous, with Japanese being the official language.

Profile of South Korea

South Korea, officially known as the Republic of Korea, is located in East Asia and occupies the southern portion of the Korean Peninsula. Covering an area of 99,720 square kilometres, its capital, Seoul, serves as the nation's economic, political, and cultural hub. With a population of approximately 52.1 million, South Korea has a high population density, particularly in urban areas. The population age structure comprises 11.53% aged 0-14 years, 70.09% aged 15-64 years, and 18.38% aged 65 and over, with a life expectancy of 82.97 years - 79.88 for males and 86.24 for females.

South Korea is ethnically homogenous and primarily speaks Korean as the official language. Its export-driven economy, valued at $2.615 trillion in GDP (PPP) for 2023[21], is heavily dependent on technology and manufacturing, with key industries including semiconductors, automotive, shipbuilding, and electronics.

South Korea has made remarkable strides in human development, reflected in its high HDI. The country has a well-developed education system, and a high literacy rate. However, it faces significant challenges, including an aging population and declining birth rates, which pose long-term economic and social concerns.

2.2 The context of higher education

Higher education in East Asia is characterized by rapid development and significant transformation, driven by economic growth, globalization, and technological advancements. According to UNESCO, the gross enrolment ratio (GER) in tertiary education in East Asia and the Pacific increased from 19% in 2000 to 51% in 2020. These regional

20   International Monetary Fund. (2023). *World Economic Outlook Database.* https://www.imf.org/en/Publications/WEO/weo-database/2023/October

21   International Monetary Fund. (2023). *World Economic Outlook Database.* https://www.imf.org/en/Publications/WEO/weo-database/2023/October

averages mask country-specific progress.[22] South Korea has one of the highest tertiary enrolment rates globally, with a GER of 96.4% in 2022. Mongolia recorded a GER of 71.5% as of 2022. Japan and China also achieved significant progress in terms of expanding access to higher education with their GERs being 59.6% (2021) and 64.6% (2022) respectively. This expansion reflects a strong commitment to broadening access to higher education, but brings challenges such as ensuring quality and equity across diverse socio-economic groups.

As of 2023, China hosts approximately 3,013 universities with an enrolment exceeding 47 million students. Japan has 810 universities accommodating over 3 million students, while 202 universities in South Korea serve around 2.4 million students. Mongolia has 95 universities with a student population of about 157,000. Table 2 presents selected education indicators, offering a comparative view of these countries' higher education landscapes.

Table 2. Selected higher education indicators

Country	No. of universities/ HEIs	Adult literacy rate (age 15+) %	GER 2020	Total enrolment 2020	Female enrolment (ratio) 2020	Enrolment at private HEIs (2020)	Gross expenditure on R&D as % of GDP 2020
China	3072	97.0 (2020)	58.42	27,737,623	0.51	14.91	2.40
Mongolia	69	98.7	68.75	157,625	0.60	44.18	0.29 (2023)
Japan	788	99.0	82.80	3,873,760	0.48	78.86	3.26
Korea	202	99.0	98.45	3,035,867	0.43	80.40	4.81

Source: Draft country reports on digital transformation of higher education (2024), UIS (2021) World Bank (2021)

East Asia region boasts impressive literacy rates, with nearly universal literacy among adults. The region's elementary and secondary education systems are robust, marked by high enrolment rates and strong international assessment performance. China has achieved near-universal access to compulsory education, while Japan and South Korea are renowned for their exemplary secondary education systems. Mongolia has made significant progress in improving educational outcomes. These achievements underscore the region's dedication to quality education, providing a strong foundation for advancing higher education and embracing digital transformation.

Investment in education is a critical factor in the region's development. According to UNESCO, government expenditure on education as a percentage of GDP varies across East Asia. For instance, China invests about 4 per cent of GDP, Japan around 3.5 per cent, South Korea approximately 5 per cent, and Mongolia about 5.8 per cent.[23] These investments target enhancements in educational infrastructure, teacher quality, and learning outcomes, reinforcing the region's competitiveness in the global knowledge economy.

Gender equality in higher education has seen evident progress, with female enrolment rising significantly. However, women remain underrepresented in leadership roles within higher education institutions (HEIs) due to cultural and social barriers. Labour market outcomes for women and men in East Asia reflect both progress and persistent

22   United Nations Educational, Scientific and Cultural Organization. (2021a). *Global education monitoring report 2021:* https://www.unesco.org/en/global-education-monitoring-report

23   United Nations Educational, Scientific and Cultural Organization. (2021b). *Global education monitoring report 2021:* https://www.unesco.org/en/global-education-monitoring-report

gender disparities across various sectors and countries. While East Asia has seen significant economic growth and an increase in employment opportunities, there are still notable differences in participation rates, wage equality, and types of employment between genders. Typically, men occupy higher-paying and full-time roles, while women face wage gaps and are often concentrated in lower-paying, less secure jobs (World Bank, 2012). Efforts to promote gender-sensitive policies and practices are essential to achieving meaningful change in this area.

Enrolment in STEM (Science, Technology, Engineering, and Mathematics) subjects is a key focus for many East Asian countries. For instance, China and South Korea have high percentages of students pursuing STEM degrees, contributing to their strong presence in global technology and innovation sectors. This emphasis on STEM education is crucial for driving economic growth and addressing future workforce needs.

The presence of world-class universities in East Asia is notable. In China, institutions like Tsinghua University and Peking University consistently rank among the top globally. Japan is home to prestigious universities such as the University of Tokyo, Kyoto University, Osaka University, and Tokyo Institute of Technology, all recognized for their research excellence and innovative teaching methods. Similarly, South Korea boasts leading institutions like Seoul National University (SNU), Korea Advanced Institute of Science and Technology (KAIST), Yonsei University, and Korea University, known for their rigorous academic standards and research capabilities. In Mongolia, top universities include the National University of Mongolia, Mongolian University of Science and Technology, and Mongolian National University of Medical Sciences. These universities reflect the region's commitment to enhancing the quality and global competitiveness of its higher education systems.

East Asia, particularly China, has emerged as a global leader in research output, surpassing the United States as the largest producer of research publications (Nguyun & Choung, 2020).[24] This shift is driven by substantial investments in higher education and a strong emphasis on scientific advancement. China's universities rank among the world's most research-intensive, fostering innovation across diverse fields such as technology and health sciences. Japan and South Korea also contribute significantly as scientific powerhouses, with well-developed research infrastructures, supported by government initiatives and academia-industry collaboration. Emphasis on STEM (science, technology, engineering, and mathematics) education has cultivated a highly skilled workforce, propelling cutting-edge research and development.

Collectively, these nations contribute to a dynamic research ecosystem that emphasizes not only quantity but also the quality of scientific output, positioning East Asia as a key player in global knowledge production and innovation. This shift has profound implications for international collaboration in research and the competitive landscape of technological advancement.

Internationalization is a prominent trend in East Asian higher education, with institutions actively engaging in cross-border collaborations, student and faculty exchanges, and adopting global best practices to boost the global competitiveness of education systems and cultivate a more interconnected academic community (British Council, 2024). In 2023, China hosted approximately 500,000 international students, Japan 279,274, South Korea approximately 180,000, and Mongolia around 12,000. Conversely, China sent around 703,500 students abroad in 2019, Japan sent approximately 62,000, South Korea sent about 105,000. China is both a major destination for international students, particularly from Africa and Asia, and exporter of students to global universities. Many Mongolian students opt for international study, leading to concerns over a brain drain and a loss of talent to other countries.

The COVID-19 pandemic and rising nationalism have had a profound impact on cross-border education. Travel restrictions, visa issues, and health concerns led to a decline in international student mobility. Many students

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24   *Nguyen & Choung. (2020).* Scientific knowledge production in China: A comparative analysis. *Scientometrics, 124 (2), 1279–1303.*

struggled to obtain visas, while some countries imposed stricter immigration policies. Although the shift to online learning provided some benefits, it could not fully replace the loss of in-person international experiences. These challenges have underscored the need for more resilient and adaptable education systems capable of withstanding global disruptions. Moving forward, it will be essential for higher education institutions to innovate and support international students, ensuring the global academic collaborations.

Technological integration is a key feature of higher education in East Asian countries, driving innovation and enhancing learning experiences. Countries like South Korea, Japan, and China have made significant investments in ICT infrastructure, enabling the widespread use of digital tools and online learning platforms in universities. This integration fosters more interactive and personalized learning environments, where students can access resources anytime and anywhere. Furthermore, initiatives to improve digital literacy among both students and faculty ensure that the educational community can effectively use these technologies. Collaborative efforts between institutions in the region also promote the sharing of best practices and research, positioning East Asia as a leader in using technology to improve educational outcomes and prepare students for a rapidly evolving job market.

2.3 Challenges in higher education

While East Asian countries have made remarkable strides in expanding access and improving global competitiveness, they continue to face several key challenges. These challenges are shaped by factors such as demographic shifts, technological advancement, economic pressures, and global competition. A brief breakdown of these challenges is presented below:

Demographic decline

One of the most pressing challenges facing higher education in East Asia is the demographic decline, particularly in Japan and South Korea. Both countries are experiencing significant population aging, resulting in fewer young people entering universities. In Japan, the decline has led to shrinking enrolments, particularly in regional institutions, many of which struggle to maintain financial viability. The number of 18-year-olds in Japan has halved since 1992, and this trend is likely to continue in the coming years. As a result, universities faced with difficult decisions, including consolidation or even closure. This situation threatens access to higher education in rural areas, exacerbating educational inequalities and leaving certain regions with limited access to academic opportunities.

South Korea faces a similar issue with its exceptionally low birth rate, one of the lowest globally, which has been a major factor in the decline of university enrolments. This demographic trend is putting immense pressure on the sustainability of many institutions, particularly those in rural areas that are less economically developed.

In contrast, China is not yet facing the same level of demographic challenges as Japan and Korea. However, the country is expected to follow a similar trajectory in the coming decades as the population begins to age rapidly. The effects of this demographic shift will likely impact university enrolments in the near future, requiring proactive measures to address these potential declines. Mongolia, while not dealing with an aging population, faces a different challenge: rural-urban migration. As more people, particularly young individuals, move to urban centres in search of better opportunities, regional universities are seeing a decline in student enrolment.

Mismatch between graduates' skills and the demands of the labour market

Despite the high enrolment rates in higher education across East Asia, there is a growing concern about the mismatch between graduates' skills and the demands of the labour market. In South Korea, for instance, youth unemployment remains stubbornly high despite the country having one of the world's highest tertiary

enrolment rates. Often times university graduates struggle to find jobs that match their qualifications, leading to underemployment or taking positions that do not require a degree. The education system in Korea, which has historically emphasized academic performance and standardized testing, has been slow to adapt to the evolving needs of the job market, especially in the tech and creative industries.[25]

Similarly, in China, while the number of graduates has skyrocketed due to the massification of higher education, many find it difficult to secure stable employment. The labour market cannot absorb the rapidly growing pool of university graduates, particularly in fields like the humanities and social sciences. At the same time, there is a shortage of skilled professionals in technical and vocational fields, highlighting the imbalance between what universities offer and what the market demands.

Japan also faces challenges in aligning higher education with labour market needs, though its issues are more related to the rigidity of the employment system. The practice of lifelong employment, while diminishing, still influences hiring patterns, making it difficult for young graduates to enter industries outside of traditional recruitment channels. In Mongolia, the "brain drain" problem exacerbates the mismatch, as many students who study abroad do not return, leaving the country with a shortage of highly skilled professionals in key sectors.

Access and equity challenges

Access and equity remain a significant challenge in higher education across four East Asian countries, despite the high enrolments rates in universities. Admission to top-tier public universities is often highly competitive, creating an environment where students from wealthier backgrounds are better positioned to succeed. These students typically have access to better preparatory education, private tutoring, and urban schooling, which gives them an advantage in the competitive entrance exams for prestigious institutions. This creates and perpetuates socioeconomic disparities, with students from disadvantaged backgrounds finding it more difficult to gain admission to top universities.

Moreover, the financial divide between public and private universities adds another layer of inequality. Public universities, while typically less reliant on tuition fees, often have limited resources compared to their private counterparts, which rely heavily on tuition income. However, private universities may provide fewer academic opportunities and have weaker industry links, resulting in fewer career prospects for their graduates. Addressing these challenges requires comprehensive policies that aim to provide equitable access to high-quality education across both public and private universities, regardless of a student's socio-economic background or geographic location.

Quality challenges

As East Asian countries expand access to higher education, maintaining quality has emerged as a critical challenge. The rapid expansion of universities has resulted in disparities in quality across institutions. While top-tier universities consistently perform well on the global stage, many regional and smaller universities face significant challenges such as underfunding and a shortage of qualified faculty. This strain on resources means that some institutions struggle to provide the infrastructure and support needed to offer high-quality education.

Despite the introduction of accreditation systems to ensure quality standards, these frameworks are still developing and are not always effective in guaranteeing consistency across all universities. The pressure on students to

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25   Organisation for Economic Co-operation and Development. (2021). *Education at a glance 2021: OECD indicators.* OECD Publishing. https://doi.org/10.1787/eag-2021-en

excel in university entrance exams has fostered a narrow academic focus, often at the expense of practical skills, creativity, and critical thinking. As a result, many students graduate with strong theoretical knowledge but lack the competencies needed for today's rapidly evolving job market.

Traditional teaching methods, such as lecture-based instruction, remain prevalent in many institutions. These methods, while long established, have not kept pace with global trends that emphasize skills like creativity, critical thinking, and digital literacy. Calls for modernization are growing, but entrenched systems and institutional inertia present significant barriers to reform.

Funding

The financial sustainability of higher education in East Asia presents significant challenges. In Mongolia, universities rely heavily on limited government funding, which affects their ability to invest in facilities, research, and attract top faculty. Alternative revenue sources, such as private funding or international collaborations, are underdeveloped, hindering educational improvements.

Japan faces similar financial strain, particularly among private institutions reliant on tuition fees. Declining student numbers due to demographic shifts further reduce revenue, while stagnant government funding limits public universities' ability to sustain research output and innovation.

South Korea also encounters funding challenges despite substantial government investment in education. With a shrinking student population, universities will need to diversify funding beyond government support and tuition fees.

China has made substantial investments in higher education, especially in research and development, as part of its goal to become a global innovation leader. However, disparities in funding between elite and less prestigious institutions contribute to uneven educational quality.

Internationalization

East Asian countries have adopted policies to attract international students, including financial support programs like China's Scholarship Council, Japan's MEXT scholarship, and South Korea's KGSP, all covering tuition and living expenses. Simplified admissions and visa processes in South Korea further ease transitions for international students. The growing availability of English-taught programmes in China and Japan can potentially cater to a global student population, with partnerships enhancing academic exchanges. Mongolia, with its smaller higher education sector, faces challenges in attracting international students but is slowly increasing global engagement through partnerships with neighbouring countries.

While internationalization is a priority, it faces challenges such as maintaining quality, inconsistent English Medium Instruction, and pressures from global competition. International students are often concentrated in top institutions, leaving regional universities struggling to attract global talent. Barriers like academic freedom, equity issues, and gender disparities also hinder progress. A balanced approach that integrates global ambitions with local needs is key to effective and inclusive internationalization.

Public-private divide

The public-private divide in higher education in East Asia presents notable challenges. Private universities in these countries often receive less government funding and rely heavily on tuition fees, which can affect the quality of education. In contrast, public universities tend to be better funded, more prestigious, and have stronger research

capacities, creating a significant gap in resources and outcomes. This divide is exacerbated by demographic decline, with private institutions being more vulnerable to shrinking enrolments. Additionally, wealthier students tend to gain more access to top public universities, while less affluent students often enrol in private universities with fewer resources and lower reputations.

Addressing this divide will require reforms that ensure better funding, quality assurance, and equitable access across both sectors. These reforms should focus on governance, funding models, pedagogy, and collaboration between governments and universities. The digital transformation of higher education offers potential solutions to these challenges, which will be explored in the following paragraphs.

2.4 The role of digital transformation in higher education

Digital transformation can play a key role in addressing challenges in East Asian higher education, including access, equity, quality, funding, and internationalization. By expanding access to online education, universities can overcome geographic barriers, providing high-quality education to students in rural or underserved areas, and reducing socio-economic inequalities, especially in countries like China and Mongolia. Digital tools, such as AI-driven adaptive learning systems and virtual labs, can enhance the quality of education across both public and private institutions, narrowing the gap between elite and less-funded universities.

Digital platforms also offer financial sustainability options, allowing private institutions to diversify income streams through online programmes and micro-credentials, alleviating financial pressures from demographic declines in Japan and South Korea. These platforms can also bridge the gap between education and employment by enabling universities to update curricula to meet industry demands, improving graduates' employability.

In response to shrinking student populations, digital learning platforms can attract non-traditional students, including adult learners and international students, through lifelong learning opportunities. Furthermore, digital transformation enhances internationalization by facilitating virtual exchanges, collaborative research, and global connectivity, boosting global competitiveness and fostering cultural exchange.

In sum, digital transformation can improve access, equity, quality, financial viability, and alignment with employment needs, making East Asian higher education systems more inclusive, adaptive, and sustainable. It is crucial for the region's economic transformation and competitiveness, as higher education provides the skills and research necessary to apply and advance technologies.

Building on the contextual landscape of higher education in Asia discussed in Chapter II, the focus now shifts to the policy context of digital transformation in the region. Understanding these policies is critical for comprehending the dynamics and driving factors of digital initiatives. Thus, the next chapter provides a comprehensive analysis of these policies.

Chapter III

The policy context of digital transformation of higher education in East Asia

This chapter examines the policy context of digital transformation in higher education, emphasizing government initiatives designed to promote the integration of digital technologies across various functions of educational institutions. It begins by outlining digital trends in the region, highlighting measures of connectivity, Internet usage, digital development, and the cybersecurity index. The chapter then explores how digital transformation is framed in national policy documents, followed by a discussion of key policy milestones established by different countries.

3.1 Digital trends in the region

The region is one of the most diverse globally, with economies that are leaders in digital innovation and societal development. These countries are pioneers in high-speed Internet access and usage, fuelling advancements in technology and connectivity. However, the diversity goes beyond technological progress, as there are significant contrasts in income distribution, population size, and geography. From rugged Himalayan Mountain ranges to isolated islands, each country faces unique challenges and opportunities in its pursuit of growth and development.

Mobile subscription

The mobile markets in the region are highly advanced, with mobile cellular subscriptions exceeding 100 per 100 inhabitants in all four countries (ITU, 2023). According to the ITU estimates, active mobile broadband subscriptions per 100 inhabitants are as follows: China (114), Japan (246), South Korea (122), and Mongolia (120).[26] These figures surpass the global average of 87.4 per 100 inhabitants, highlighting the region's advanced mobile broadband infrastructure. This exceptional level of connectivity not only facilitates widespread communication but also supports the growth of digital services and applications, driving economic development and enhancing the overall quality of life for its residents.

Fixed broadband subscription

Compared to other regions, East Asia has significant potential for expanding the fixed broadband market. The ITU (2021) estimated an average fixed broadband penetration rate of 15 subscriptions per 100 inhabitants for the Asia-Pacific region in 2020, closely aligning with the global average of 15.2 subscriptions per 100 inhabitants.[27] Notably, three East Asian countries—South Korea (42.76), Japan (33.50), and China (31.34)—have surpassed this threshold, achieving fixed broadband subscription rates exceeding 15 per 100 inhabitants. In contrast, Mongolia lags significantly behind, with only 9.84 subscriptions per 100 inhabitants, falling well below both the global and regional averages.

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26   United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development. (2021). *Digital trends in Asia-Pacific 2021*. https://www.unapcict.org/sites/default/files/2021-03/Digital%20Trends%20in%20Asia%20Pacific%202021.pdf

27   United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development. (2021). *Digital trends in Asia-Pacific 2021*. https://www.unapcict.org/sites/default/files/2021-03/Digital%20Trends%20in%20Asia%20Pacific%202021.pdf

Internet usage

In recent years, Internet usage has seen notable growth across East Asia, with countries exhibiting varying levels of access and connectivity (Table 3). According to the latest data for 2022-2023, China reports that 77.5% of individuals are using the Internet, with 80.9% of households having Internet access as of 2021. This reflects a significant increase in digital engagement and highlights efforts to enhance connectivity across the nation.

Japan shows a high Internet usage rate of 84.9% among individuals, alongside a commendable 89.5% of households with Internet access in 2022. These figures demonstrate Japan's commitment to maintaining a robust digital infrastructure that supports widespread Internet connectivity.

Mongolia has also made impressive strides, with 83.9% of its population utilizing the Internet in 2023, while 80% of households had Internet access in 2021. This growth indicates ongoing efforts to improve connectivity and digital inclusion throughout the country.

South Korea leads the region with an impressive Internet usage rate of 97.4% in 2023, coupled with the remarkable achievement of 100% household Internet access. This signifies that every household in South Korea has access to the Internet, underscoring the country's advanced digital infrastructure and comprehensive policies aimed at fostering connectivity.

Globally, nearly two-third of the total population uses Internet (67.4%), corresponding figures for four East Asian countries are above the global average. Overall, the data illustrates a positive trend in both individual Internet usage and household access across East Asia, with countries making significant investments in technology and infrastructure to support their populations in an increasingly digital world.

Table 3. Percentage of individuals using the Internet and households with Internet access

Country	Percentage of individuals using the Internet for the recent year	Percentage of households with Internet access for the recent year
China	77.5% (2022)	80.9% (2021)
Japan	84.9% (2022)	89.5% (2022)
Mongolia	83.9% (2023)	80% (2021)
South Korea	97.4% (2023)	100% (2023)

Source: ITU (2024)

Digital divide

Recent data on Internet usage in East Asia reveals different disparities based on sex and geographic location. In China, 76% of males and 75.2% of females are using the Internet. However, the digital divide between different areas is quite striking, as Internet usage is significantly higher in urban areas (81.8%) compared to rural areas (57%), indicating the country's need for better connectivity in rural regions.

In Japan, the gender gap on Internet usage is quite moderate, with 87.9% of males and 82.1% of females with access to the Internet. Moreso, the Internet usage of urban residents is 89% compared to 82.5% of those in rural areas, showcasing the country's well-developed digital infrastructure.

In Mongolia, 82.9% of males and 80.4% of females are reported using the Internet. However, the disparity between rural and urban populations is stark, with only 6.06% of rural residents having Internet access compared to 31.5% in

urban areas. This highlights the need for targeted efforts to improve connectivity in remote regions.

South Korea leads the region in Internet accessibility, with 98.1% of males and 96.7% of females using the Internet. The divide between rural and urban areas is minimal, with 95.9% of rural residents connected compared to 97.6% in urban areas. This demonstrates the country's comprehensive digital policies and infrastructure that ensure high levels of connectivity across all demographics.

Overall, while East Asia demonstrates impressive Internet usage rates, the data reveals evident disparities based on two important indicators, sex and geographic location. Addressing these gaps will be crucial for ensuring equitable access to digital resources and opportunities in the East Asia region.

Table 4. Internet usage across East Asia by sex and geographic location

Country	Individuals using the Internet by sex (%)		Individuals using the Internet by location (%)	
	Male	Female	Rural	Urban
China	76	75.2	57	81.8
Japan	87.9	82.1	82.5	89.0
Mongolia	82.9	80.4	6.06	31.5
South Korea	98.1	96.7	95.9	97.6

Source: ITU (2021)

ICT skills

The ITU defines ICT skills at three levels: basic, standard, and advanced. Basic skills include tasks such as copying and moving files, sending emails with attachments, and transferring files between devices. Standard skills involve using arithmetic formulas in spreadsheets, connecting devices, and creating presentations. Advanced skills are characterized by the ability to write programmes using specialized programming languages.

Table 5. Basic, standard, and advanced ICT skills

Country	Basic	Standard	Advanced
Hong Kong, China	51.3	33.1	1.3
Japan	59.9	48.8	N/A
Korea	73.1	50.5	6.1
Mongolia	14.3	11.3	4.3

Source: ITU (2021)

As reported by the ITU (2021), ICT skills levels vary significantly across East Asian countries/territories.[28] Notably, the Republic of Korea leads its neighbours in all three categories. Hong Kong and Japan report basic skill levels nearly 50 per cent and 60 per cent, respectively, while Mongolia trails behind all others in both basic and standard skills (Table 5). There is no data for mainland China.

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28   International Telecommunication Union. (2021). *Measuring digital development: Facts and figures 2021*. https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mdd.aspx

ICT Development Index (IDI)

A recent ITU publication (2024) reports on the ICT Development Index (IDI), which serves as a measure of the state of digital development.[29] The index consists of two dimensions: universal and meaningful connectivity (UMC). UMC measures the possibility of enjoying a safe, satisfying, enriching, and productive online experience at an affordable cost. This framework emphasizes the necessity for holistic strategies that go beyond mere infrastructure development. The ITU argues that such a comprehensive approach is essential for fully harnessing connectivity for social and economic advancement. The objective of the IDI is to assess the extent to which a country's connectivity is both universal and meaningful.

Table 6. ICT Development Index

Country	Income group	IDI score 2023	IDI score 2024	Change	Universal score	Meaningful score
China	Upper Middle Income	84.4	85.8	+2%	79.0	92.6
Japan	High Income	92.0	93.2	+1%	94.6	91.9
Korea	High Income	93.8	94.4	+1	93.4	95.5
Mongolia	Lower Middle Income	85.9	87.0	+1	82.9	91.1

Source: ITU (2024)

UMC consists of two main pillars: universal connectivity, which measures access for individuals and households at home, schools, community centres, and workplaces; and meaningful connectivity, which assesses five enablers—infrastructure, affordability, devices, skills, and safety and security—though the current IDI exercise excludes indicators for skills and safety.

The scores for the overall ICT Development Index (IDI) and its two pillars range from 0 to 100. A score of 100 indicates that an economy has achieved the target value for every component indicator, while a score of zero represents a hypothetical scenario with no Internet access, no mobile broadband coverage, no subscriptions, and no data traffic. Table 6 illustrates the distribution of country scores for the main components of the IDI. In 2024, the average IDI score for 170 economies is 74.8, with the lowest score at 21.3 and the highest at 100.0. Overall, the region has performed very well on the ICT Development Index, with Japan and South Korea leading ahead of Mongolia and China. There has also been a slight improvement in the IDI score for 2024 compared to the previous year.

Global Cybersecurity Index (GCI)

The Global Cybersecurity Index (GCI), developed by the International Telecommunication Union (ITU), measures countries' commitment to cybersecurity across several dimensions: legal measures, technical measures, organizational measures, capacity building, and cooperation. By evaluating the presence of relevant laws, technical standards, national strategies, and collaborative efforts, the GCI provides scores and rankings that highlight each country's strengths and areas for improvement. This index serves as a vital tool for policymakers to enhance national

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29   International Telecommunication Union. (2024). *ICT Development Index (IDI): Measuring digital development.* https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mdd.aspx

cybersecurity strategies and promote international collaboration in addressing cyber threats.[30]

The ITU Global Cybersecurity Agenda (GCA) provides the framework for assessing cybersecurity efforts. Its five pillars are scored from 0 to 20, and countries are grouped into five categories based on their overall scores: 1. Role Modelling, 2. Advancing, 3. Establishing, 4. Evolving, and 5. Building. Mongolia currently falls into the "Establishing" category, while Japan and South Korea are classified as "Role Modelling," and China is in the "Advancing" stage (Table 7). Overall, the region performs well on the index; however, with the emergence of new forms of security threats, countries must remain vigilant and implement appropriate policies and security measures to enhance cybersecurity.

Table 7. Ranking of East Asian countries on the various measures of cybersecurity

Country	Legal measures	Technical measures	Organizational measures	Capacity development	Cooperation measures	Tier performance
China	20	17.14	18.34	18.46	17.7	2 (Advancing)
Japan	20	19.6	20	19.07	18.91	1 (Role modelling)
Korea	20	20	20	20	20	1 (Role modelling)
Mongolia	19.18	6.64	13.62	10.43	6.49	3 (Establishing)

Source: ITU (2024)

3.2 Conceptualizations of digital transformation in national policies

The conceptualization of digital transformation in policy documents and institutional plans is crucial for its effective implementation, directly influencing the digital landscape of higher education institutions (HEIs). This section presents national perspectives on digital transformation.

Conceptualizations

The Mongolian report aligns closely with the definitions commonly found in global literature, stating digital transformation implies processes related to profound changes that occur in all sectors of the economy and society due to the adoption and use of digital technologies. The transformation process encompasses phases such as digitization, digitalization, and ultimately, digital transformation (Kane et al., 2015).

The report highlights digital transformation for higher education institutions (HEIs) as a transformative process involving the dismantling of outdated management practices and their reinvention through creative disruption enabled by digital technologies. This process seeks to enhance management efficiency and forge innovative relationships within and beyond institutions. As a result, both academic staff and their institutions experience rapid evolution, actively reshaping their roles and practices in response to digital transformation. Specifically, the Mongolian country report emphasizes that digital technologies drive substantial improvements in processes, business models, and institutional interactions, showcasing the potential of digital transformation to redefine the higher education landscape.

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30   International Telecommunication Union. (2020). *Global Cybersecurity Index 2024*. https://www.itu.int/en/ITU-D/Cybersecurity/pages/global-cybersecurity-index.aspx

The digital transition in education spans diverse areas, including advanced pedagogies, adaptive and smart technologies, and innovative tools like augmented reality and virtual laboratories. It goes beyond integrating technology, demanding holistic reform through cultural adaptation, workforce readiness, and structural innovation. By aligning these elements, HEIs can drive innovation, strategic growth, and improved value delivery in education and administration.

The South Korean case study report does not provide a formal definition of digital transformation; instead, it employs several key terms and phrases that relate to the process of digitization in higher education. These include the alignment of educational practices with digital imperatives and the shift from mere survival to genuine transformation. This transformation not only aims to create a technology-friendly teaching and learning environment but also necessitates institutional and educational reforms within the sector.

The report emphasizes that true digital transformation in higher education hinges on the ability to implement institutional changes, ensuring educational systems keep pace with the evolving digital landscape, enhance student engagement, and produce graduates who are well-prepared for modern careers. It highlights that sustainable digital transformation requires institutional frameworks to be tailored to the unique contexts of different countries and universities, optimizing resource use and fostering cross-disciplinary collaboration. By embracing these principles, institutions can establish a strong foundation for ongoing innovation and maintain their relevance in a technology-driven world. Ultimately, digital transformation should aim to enhance accessibility, interactivity, and administrative efficiency.

China's concept of "educational informatization" highlights its approach to leveraging digital technologies in education, encompassing initiatives like computer-assisted instruction, multimedia classrooms, and widespread Internet access. The term reflects a systematic effort to build a comprehensive digital environment within schools and universities.

In practice, China's digital transformation of education is viewed as an incremental but transformative process. It emphasizes integrating high-quality online resources into traditional and innovative learning environments, fostering scenario-based learning, and utilizing intelligent management systems. Robust data protection is a critical component, ensuring security in the digital ecosystem. The ultimate aim is to elevate the quality of education while expanding accessibility, aligning with broader goals of modernization and equity in learning. This approach underscores China's strategy to use technology as a catalyst for educational improvement.

The Japanese case study underscores that digital transformation should be comprehended through three key perspectives: wholeness, life improvement, and critical perspective. Wholeness pertains to the digitalization of an organization or society as a cohesive entity, rather than in isolated segments. Life improvement focuses on enhancing the quality of life for citizens and members through digital technologies. The critical perspective involves developing digital competencies, with an emphasis on the importance of learning support provided by university libraries and academic courses. Together, these three perspectives provide a comprehensive framework for understanding the broader impacts and necessary supports for effective digital transformation.

The Higher Education Bureau of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) distinguishes between "digitization" and "digitalization." Digitalization is defined as the creation of opportunities to generate new benefits and value through digital technology (MEXT, 2020a, p. 6). This initiative aims not just to employ digital technology in teaching but to "maximize the value of classes" by achieving high levels of academic achievement, fostering spontaneous learning, and ensuring experiential opportunities similar to on-site training and experiments (MEXT, 2020b, p. 7).

Furthermore, the 2018 Digital Guidelines issued by Japan's Ministry of Economy, Trade and Industry define digital

transformation (DX) as the evolution of products, services, and business models to meet societal needs, alongside changes in operations, organizations, processes, corporate culture, and climate. This transformation is designed to help companies adapt to rapid environmental changes and leverage data and digital technologies for competitive advantage (Ministry of Economy, Trade and Industry, 2018, p. 2).

Historically, much research on digitization has focused on business and organizational contexts. However, recent scholarship has begun to explore the concept from an educational perspective. The digitalization of education extends beyond merely applying technology in teaching and learning; it involves a comprehensive restructuring of the educational process, encompassing pedagogy, curriculum, teacher evaluation, and governance. The ultimate goal is to maximize value for individuals and society through enhanced knowledge and skills.

Many scholars view this process as a continuum, starting with digital awareness—where users develop skills and confidence—progressing to digital usage, where familiarity with digital tools increases. Finally, transformative actions emerge as users experiment and innovate with available technologies, leading to creative applications that enrich the educational environment and maximize societal value.

Common threads and differences

The conceptualizations of digital transformation across Mongolia, South Korea, China, and Japan reveal both common threads and divergences. A key commonality is the emphasis on integration; all countries highlight embedding digital technologies within educational frameworks to enhance teaching and learning. There is also a shared focus on improvement, recognizing that digital transformation should enhance educational quality and accessibility, fostering innovative learning environments. All discussions underscore the need for institutional change, suggesting that successful digital transformation requires significant shifts in organizational practices, including pedagogy and culture. Each country reflects a holistic understanding that digital transformation encompasses curriculum redesign, teacher training, and enhanced student engagement.

Despite these similarities, notable divergences exist. Terminology and definitions vary: China uses "educational informatization," while Japan distinguishes between "digitalization" and "digitization." Perspectives on competency development also differ; Japan emphasizes critical digital citizenship more explicitly than other countries. The stage of digital transformation varies as well, with China, South Korea and Japan being more advanced, while Mongolia, on the other hand, remains in the establishing phase. Contextual factors shape each country's approach, influencing priorities and strategies. For instance, China focuses on comprehensive digital infrastructure, whereas South Korea aims to create tailored institutional frameworks.

Overall, while there is consensus on the significance of digital transformation in higher education, the specific interpretations and strategies reflect the diverse educational landscapes and developmental stages of each country. This interplay of common themes and distinct approaches highlights the complexity of implementing digital transformation in the region.

3.3 Policy trends and priorities for digital transformation of higher education

National policies are essential for the digital transformation of higher education, providing strategic direction, resources, and safeguards to ensure sustainability and alignment with broader societal objectives. These policies offer a long-term vision, aligning educational goals with national economic, social, and technological development plans. Governments play a pivotal role in funding and resourcing digital infrastructure, research, and training.

Effective national policies establish the necessary norms, standards, and legal frameworks to govern digital

tools in education, including data protection laws, cybersecurity protocols, intellectual property regulations, and quality assurance for online education. Importantly, these policies address the digital divide, ensuring that all students—regardless of their background or location—have access to digital learning opportunities. They also foster partnerships between higher education institutions, the private sector, technology companies, and international organizations.

This section outlines the policy context that supports the digital transformation of higher education in the four case study countries, highlighting the various policy initiatives and strategies they have implemented toward this goal. It focuses on presenting and analysing these policies and strategies to understand their effectiveness and impact on the higher education landscape.

Policy trends in China

In recent years, the Chinese government has launched significant strategic initiatives to drive digital transformation in education, especially higher education. Beginning as early as 1978, leader Deng Xiaoping emphasized the importance of using technology to expand educational opportunities, advocating for modern tools like television and radio. China's journey in educational informatization has evolved through three critical stages: the initial adoption of computer-assisted teaching, the development of digital environments, and the current phase known as Educational Informatization 2.0.

The Chinese government has played a pivotal role in advancing digital education through well-structured strategic plans, norms, and effective management mechanisms. Notably, the "Strategy for National Medium and Long-Term Education Reform and Development (2010-2020)" emphasized the importance of technology in modernizing education. Similarly, the "Ten Year Development Plan for Education Informatization (2011-2020)" sought to create digital campuses equipped with essential resources for all educational institutions.

In 2015, China issued guidelines to enhance the application of online courses in higher education, emphasizing the creation of high-quality massive open online courses (MOOCs). Subsequently, the "New Generation Artificial Intelligence Development Plan" introduced in 2017, aimed to advance "Smart Education" by leveraging intelligent technologies to improve talent cultivation and blended learning.

In 2018, three major policy documents marked a pivotal moment for higher education: the "Higher Education Artificial Intelligence Innovation Action Plan," the "Guidelines for the Construction and Application of Online Learning Spaces," and the "Education Informatization 2.0 Action Plan." These initiatives focused on advancing AI in higher education, modernizing educational practices, and ensuring that both teachers and students have access to digital resources.

Building on this momentum, China launched the "Double First-Class Plan 2.0" in 2019, aiming to develop high-quality courses in various formats. The "14th Five-Year Economic and Social Development Plan (2021-2025)" focuses on the digitization of the economy, emphasizing advancements in cloud computing, big data, and AI, while promoting human capital development through higher education and lifelong learning.

Recent policies, such as the "Data Security Law" and the "Action Plan for 5G Applications," aim to strengthen digital infrastructure in education. In 2023, the Ministry of Education emphasized the importance of theoretical research on higher education digitization and the creation of strategic research bases. The "101 Plan," launched in 2024, focuses on developing top-tier courses and teaching teams in AI. Overall, China's higher education digitization policy framework is robust, recognizing technology investment as a transformative catalyst rather than a mere expense.

Policy trends in Japan

In 2016, the Government of Japan introduced its Fifth Science and Technology Basic Plan, presenting the concept of Society 5.0, or the "super-smart society." This vision seeks to create a sustainable, inclusive socio-economic system powered by digital technologies like big data, artificial intelligence (AI), the Internet of Things, and robotics. Society 5.0 has made science, technology, and innovation (STI) to a political priority, leading to increased investment in digital technologies and basic research. Key themes include next-generation mobility, smart cities, advanced public services, FinTech, and next-generation healthcare, emphasizing universities' crucial role in these initiatives.

Following the 2018 Guidelines for Digitization Promotion, digitization was formally integrated into government policy, backed by a Study Group from the Ministry of Economy, Trade and Industry (METI). In 2017, the Artificial Intelligence Technology Strategy was crafted, focusing on AI as a service and outlining a three-phase implementation approach with active involvement from university leaders.

In 2020, the "Declaration on the Creation of the World's Most Advanced Digital Nation" underscored Japan's ambition to boost digital literacy and skills in mathematics, data science, and AI across all education levels, aligning with the "Basic Policies for Economic and Fiscal Management and Reform 2020," which identified digitalization as a key strategy to manage the COVID-19 crisis and adapt to new societal norms.

Several initiatives have incentivized the digitization of Japan's education system. The Global and Innovation Gateway for All (GIGA) programme, launched in 2020, aimed to equip all students in compulsory education with digital devices, enhancing learning opportunities. Additionally, the MEXT introduced MEXCBT, a computer-based testing system for self-assessment across various subjects, promoting digital learning methods.

In higher education, the Student-Centred Higher Education Ecosystem through Digitization (SCHEEM-D) was launched to ensure continuity during and after the pandemic. This initiative distinguishes between "digitization" (the use of digital tools for teaching) and "digitalization" (maximizing educational value through these tools). SCHEEM-D encourages private sector collaboration with universities to bolster educational resources.

In December 2020, MEXT announced four specific policy measures aimed at enhancing digital technology: advancing digital learning, developing hybrid education environments, promoting mathematics and data science, and researching digital technologies for university entrance selection. The COVID-19 pandemic accelerated the shift to online education, leading to numerous plans for its widespread adoption. The "Plan for the Promotion of Digitization in MEXT" was a critical response to the pandemic, underscoring the government's commitment to leveraging digital technology to enhance society and the economy, with education playing a pivotal role.

In conclusion, while Japan's ambitious policies and strategic initiatives signal a strong commitment to digital transformation in education, the effectiveness of these efforts will ultimately depend on addressing underlying challenges and ensuring equitable access to technology and resources across all segments of society.

Policy trends in South Korea

South Korea has strategically positioned its higher education system to respond to rapid technological advancements, globalization, economic growth, and evolving societal needs. Known for its educational excellence, South Korea effectively integrated technology across all educational areas well before the COVID-19 pandemic necessitated a swift transition to online learning. This proactive engagement began in the 1990s, when the country recognized the potential of technology to enhance teaching and learning while driving institutional reforms.

South Korea has systematically developed national policies, starting with its first ICT Master Plan (1996-2000), which focused on fostering skills for the emerging information-driven society. Subsequent plans expanded the vision of

a knowledge-based nation, emphasizing e-learning and ubiquitous learning systems. This effort culminated in the fourth Master Plan (2011-2014), which introduced smart education—self-directed, adaptive, and technology-rich. The fifth Master Plan (2014-2018) aimed to cultivate creative learners through the convergence of education and ICT, leading to initiatives like the Korean Massive Open Online Course (K-MOOC) in 2015.

In response to the pandemic, the "Digital-based Education Innovation Plan" (2020) was launched to enhance online education and digital technologies in universities. This initiative provided emergency funding, smart devices for students, and support centres for distance learning. This shift has opened doors for more flexible course offerings and a focus on nurturing digital skills, particularly in software and AI education.

In 2022, the government introduced the "Comprehensive Plan to Nurture Digital Talent," aiming to foster one million digital talents by 2026. This plan includes initiatives like the Convergence and Open Sharing System (COSS). This system aims to break down barriers that often exist between universities and promotes collaborative learning in fields such as AI and big data.

Figure 1: A conceptual framework of the Coss project
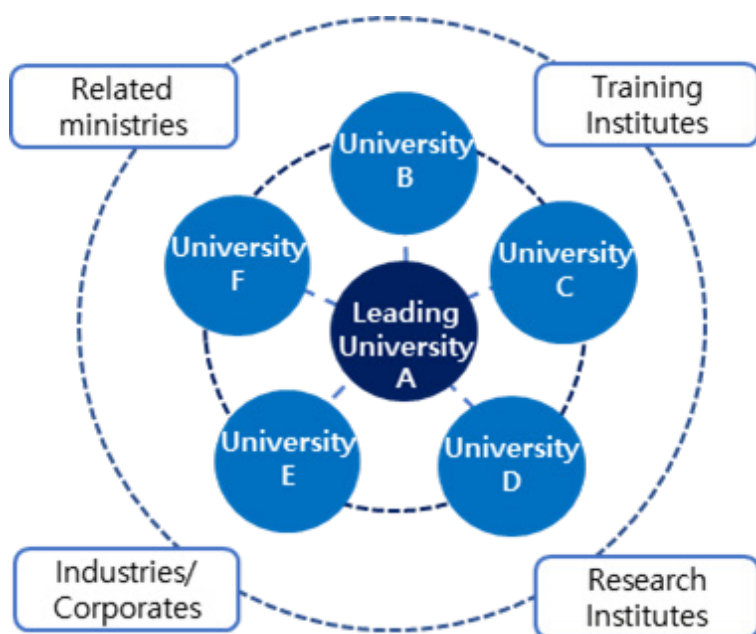
Source: Draft South Korea country report (2024)

Most recently, the Ministry of Education announced the "Personalized Education for All" plan, aligning with the national agenda for a "Learning Revolution." This initiative seeks to create an educational environment tailored to each student's abilities and preferences, emphasizing individualized learning experiences to nurture essential future skills.

In summary, South Korea has been a pioneer in higher education by strategically integrating technology, fostering digital skills, and personalizing education to prepare students for success in a rapidly evolving global landscape. This commitment reflects the nation's proactive approach to meeting the demands of technological advancement, economic growth, and societal change.

Policy trends in Mongolia

Online and digital learning is a promising and cost-effective educational model for Mongolia, especially given its vast territory and sparse population. The main challenge for Mongolian higher education is providing services in remote and rural areas. Therefore, digital transformation is crucial in the post-COVID era to ensure inclusive, equitable, and quality education.

From 2000 to 2010, the Mongolian government made significant strides in establishing ICT infrastructure for digital learning through initiatives like the "Distance Education National Program" and the "E-Mongolia National Program." Recent initiatives, such as "Vision 2050" and "Digital Nation," emphasize developing digital educational content, open educational resources (OERs), and MOOCs to transition all levels of education into e-learning.

Digitization has become a national priority, with various plans and policies aimed at fostering a digital economy, enhancing infrastructure, and promoting educational digitization. The Vision 2050 document outlines a roadmap for Mongolia to become a leading Asian country in social development and economic growth, structured in three stages:

- Stage 1 (2021-2030) focuses on inclusive and equitable education.
- Stage 2 (2031-2040) aims to strengthen lifelong learning systems and improve education quality.
- Stage 3 (2041-2050) envisions a culture of learning supported by an open education system.

Mongolia plans to establish a unified e-learning system and produce graduates with skills that meet national and international labour market standards. In 2020, the e-Mongolia platform was launched to digitize government services, which included an Action Program (2020-2024) to support the establishment of an e-learning platform and the development of e-content. This initiative aimed to create a legal framework for e-learning, encompassing e-curricula, e-content, and e-courses for lifelong learning.

The 2021 New Revival Policy aimed to transform Mongolia into an E-Nation by digitizing government services and enhancing infrastructure, with a focus on integrating advanced technologies like blockchain and artificial intelligence. This policy also seeks to improve digital skills and literacy across the population by 2027.

The Education Sector Mid-term Development Plan (2021-2030) aims to foster a knowledge-driven society by developing high-quality, inclusive educational services to meet the demands of the digital era. In 2023, the Education Package Law was enacted to enhance management and training in higher education, mandating the incorporation of electronic technologies into educational activities.

Mongolia's achievements in digital learning have been recognized internationally, as evidenced by its designation as a "champion country" at the 2022 Transforming Education Summit by the United Nations.

In summary, Mongolia's policies illustrate a strong commitment to leveraging digital technologies for educational advancement. Realizing the full potential of these technologies will require an education system to prepare students for a future where they can thrive alongside technology.

Common policy threads and differences

Across the four countries, common policy approaches aim to transform education through digital means. All nations emphasize the development of robust digital infrastructure to facilitate online learning and improve access to educational resources, especially in rural and underserved areas. Integrating technology into education is a central focus, with policies promoting e-learning platforms and creating digital educational content. Additionally, equity and inclusiveness are key themes, ensuring that marginalized populations benefit from these initiatives. Educational

digitization strategies are aligned with broader national development goals, fostering lifelong learning systems to equip citizens with the skills necessary for the evolving job market.

Despite these similarities, differences in policy approaches exist. The pace of implementation varies, with some countries advancing more rapidly in establishing digital infrastructures and rolling out e-learning programmes. Government support and funding for digital education initiatives differ, impacting resources available for training educators and developing high-quality e-learning materials. While all countries embrace technology, some prioritize specific technologies—such as artificial intelligence or mobile learning solutions—over others. Cultural contexts also shape how digital education policies are implemented, reflecting unique challenges based on educational histories and societal norms. The extent of international collaboration varies, influencing each country's ability to adopt best practices and innovative solutions in their educational systems.

3.4 Institutional framework for governance of digital transformation in case study countries

National governance mechanisms and institutional frameworks are crucial for higher education's digital transformation, providing strategic direction, funding, and support. These mechanisms ensure consistency and quality across institutions, address disparities, and promote inclusivity. Such frameworks facilitate capacity building, foster collaboration, and include monitoring systems to ensure continuous improvement. Additionally, bridging the digital divide, enhancing cybersecurity, and supporting innovation and research create a foundation for sustainable digital education.

In East Asia, governance systems exhibit both centralized and decentralized models influencing higher education's digital transformation. China and South Korea's centralized systems, with Ministries of Education setting policies and standards, allow for cohesive implementation. Japan and Mongolia adopt more decentralized approaches, granting local governments and institutions significant autonomy. These differing structures impact the pace and effectiveness of educational reforms across the region.

Institutional framework in China

The institutional landscape in China is diverse, with universities categorized into three types: those directly under the Ministry of Education, local governments, and other departments. The Ministry plays a crucial role in resource allocation and funding, essential for modernizing these institutions. While the Ministry sets national policies and standards, individual universities enjoy a degree of autonomy in designing and implementing their digital strategies. This flexibility allows them to create customized digital learning environments and adopt innovative technologies that align with their specific needs and goals.

China's higher education system is centrally governed, ensuring uniformity across the country while allowing provincial and local governments to implement policies with some autonomy. Universities operate under a presidential system, where the university president oversees administration alongside the party committee. The Chinese Service Center for Scholarly Exchange (CSCSE), under the Ministry of Education, is responsible for ensuring the quality of online and distance education. Digital infrastructure procurement involves coordinated efforts between central and local governments, with funding sourced from both national and provincial budgets to address the diverse needs of educational institutions.

Institutional framework in Japan

In Japan, the responsibility for managing the education system is shared among central, prefectural, and municipal

governments. The national Ministry of Education, Culture, Sports, Science and Technology (MEXT) sets the national curriculum, promotes digital technologies in education, and provides funding to local governments. Prefectures and municipalities oversee school management, including infrastructure procurement and learning resources. While some infrastructure, like a computer-based testing system, is provided centrally, the majority is procured locally by schools. Prefectures supervise upper secondary schools, while municipalities manage primary and lower secondary schools, maintaining their own student information systems and acquiring digital tools from various stakeholders, including universities and EdTech companies.

The central government plays a significant role in regulating and promoting digital education infrastructure. MEXT is the primary authority regulating data access and digital technology use in higher education, issuing guidelines for informed procurement decisions and overseeing data access and use. In 2020, MEXT established the Office for the Promotion of Digitization to enhance remote education. The Ministry of Economy, Trade and Industry (METI) also influences higher education digitization through policy announcements. The Cabinet, led by the Prime Minister, formulates overall education policies, with the Council for the Implementation of Education Rebuilding and its Digitalization Task Force guiding educational digital transformation. The 2021 creation of the Digital Agency coordinates digitalization efforts across sectors, ensuring coherent use of digital technologies. The Information Processing Society of Japan and Japan Association for Promotion of Educational Technology (JAPET) contribute through their work related to research, standards, and advocacy for tech adoption.

Institutional framework in South Korea

The governance of digital education in South Korean universities combines a centralized and collaborative approach. The Ministry of Education (MOE) plays a crucial role in establishing national policies and strategic directions for digital education, including the development of digital platforms, textbooks, and the enhancement of digital competencies among educators and students.

The Korea Education and Research Information Service (KERIS) supports the MOE by providing technical assistance and developing educational resources. Both the MOE and KERIS regulate and promote the use of digital tools for system and school management, while local Offices of Education also contribute to building the necessary digital infrastructure.

Although national policies are government-driven, each university develops its own institutional policies within this framework. The MOE primarily regulates access to and the use of digital technologies in education. While the use of publicly provided management tools is mandatory, the adoption of teaching resources is optional. Schools can procure additional resources from commercial providers, with some tools like Google Classroom and Microsoft Office made available through local Offices of Education.

In 2023, the MOE established a Bureau dedicated to the digital transformation of education and launched the Digital Transformation of Education Initiative. This initiative focuses on integrating advanced technologies, such as artificial intelligence (AI), to create personalized learning experiences. It includes the development of AI-embedded digital textbooks and professional development for teachers to enhance classroom learning through digital technology.

Institutional framework in Mongolia

The Ministry of Education and Science in Mongolia plays a vital role in shaping the country's educational framework. It develops nationwide policies for education, sets standards, schedules the school year, approves secondary education textbooks, administers the national entrance exam, and supports regional education agencies. Additionally, it issues licenses for higher education institutions and enhances the quality of education and scientific

research. The Ministry is also responsible for ICT development and digitization in education, coordinating various sub-sectors from pre-school to higher education.

In 2022, Mongolia established the Ministry of Digital Development and Communications (MDDC) to oversee ICT projects and coordinate initiatives across government ministries, addressing gaps in digital transformation efforts. The country also adopted the "Measure Plan for Enhancing Universal E-Skills and Competencies (2022-2026)" within the "Human Development Policy" framework. This plan, jointly approved by several ministers, aims to enhance digital literacy, bridge the digital divide, and promote innovation across society and the economy.

Two additional entities contribute to ICT in education: the National Centre for Non-formal and Distance Education (NCNFDE), which manages distance learning programmes, and the Mongolian Education Informational Technology Centre, responsible for the education sector's information systems. In 2021, the government enacted the Law on Cybersecurity, establishing a Cyber Security Council led by the Prime Minister to oversee cybersecurity activities, including the cybersecurity laboratory (Figure 2).

Figure 2: Cybersecurity laboratory of Mongolia

Source: Draft Mongolia country report (2024)

To support Mongolia's digitization agenda, the ICT in Education Policy Review Report by UNESCO Beijing (2021) recommended creating an independent agency to coordinate ICT in education programmes. Suggested options included establishing a KERIS-like entity for planning and implementation, creating a Division for Education Technology within the Ministry of Education, or implementing a two-tiered committee structure like that of the Philippines, comprising a Governance Committee for policy formulation and a Technical Committee for technical aspects of digitization.[31]

3.5 Financing of digital transformation

Digital education requires significant investments in both the physical and human infrastructure. Efficient and equitable funding and procurement mechanisms are essential for successful digital education. In East Asia, the funding landscape involves multiple stakeholders working together to integrate digital technologies in higher education.

Funding typically involves a combination of government support, public-private partnerships, and international

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31   UNESCO. (2021). *ICT in education policy review: Mongolia*. UNESCO Beijing. https://unesdoc.unesco.org/ark:/48223/pf0000379606

collaborations. Governments allocate substantial portions of their education budgets to digital transformation initiatives. According to World Bank data on government expenditure on education (2024), expenditure on higher education as a proportion of GDP varies among East Asian countries, reflecting different national priorities and economic contexts. For example, China allocates 0.5% of its GDP to higher education, Japan spends 0.4%, South Korea 0.9%, and Mongolia 0.6%.[32] These figures indicate each country's level of investment in developing and enhancing higher education systems, including digital transformation initiatives.

In China, universities are categorized into three groups: those directly under the Ministry of Education, local governments, and line departments. Financial support for digital transformation primarily comes from the Ministry of Education and local education administrative departments, with substantial funding for digital campuses and smart classrooms.

Similarly, South Korea's Ministry of Education funds digital infrastructure projects and professional development programmes to enhance digital competencies among educators. In Mongolia, financing is primarily supported by the government, with additional assistance from international organizations and development partners. The Ministry of Education and Science allocates funds for ICT infrastructure, digital learning resources, and professional development for educators, while development partners provide financial and technical support to improve access to quality education, especially in remote and underserved areas.

In Japan, funding involves a mix of public funding, institutional budgets, and private sector partnerships. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) plays a significant role by allocating funds for digital infrastructure, online learning platforms, digital literacy programmes, and special digital initiatives. Universities also invest their resources and seek grants from private companies and philanthropic organizations to support digital initiatives. Notably, Japan has implemented projects to promote the digitalization of university education in response to the COVID-19 pandemic.

3.6 Public-private partnership: towards collaboration and co-creation

Public-private partnerships (PPPs) are essential for the digital transformation of higher education, mobilizing resources, bringing technological expertise, and fostering innovation. These collaborations enable universities to access advanced digital tools and platforms, ensuring efficient implementation of digital initiatives. PPPs also enhance capacity building by providing training for educators and administrators, addressing the digital divide, and ensuring equitable access to digital resources for all students. Overall, PPPs create a sustainable educational environment, driving successful integration of digital technologies in higher education.

In East Asia, where rapid economic growth and technological advancements coexist with educational disparities, PPPs are particularly vital. They help mobilize necessary resources and expertise for large-scale digital transformation projects, fostering innovation and improving access to higher education. The robust presence of the private sector in countries like China, South Korea, and Japan further supports this initiative. In fact, private companies financed over three-quarters of national research and development activities in China, Japan, and South Korea in 2017.

Government policies in East Asia generally promote PPPs. For example, China has established frameworks to encourage PPPs in infrastructure and education, while Japan provides subsidies and creates a supportive legal environment. Technology companies such as Fujitsu, NTT data, and SoftBank support infrastructure, provide digital learning tools, and develop software. The digital initiative at Kagawa is a collaboration between university

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32   World Bank. (2024). Government expenditure on education. Retrieved from https://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS

and company staff, who are seconded to the university. South Korea's government actively supports PPPs through favourable regulations and incentives, although the Ministry of Education maintains ownership of most educational resources.

In Mongolia, PPPs are crucial for financing higher education. The government has established a conducive environment for PPPs through policies like the State Policy on PPP (2009) and the Concession Law (2010), which provide guidelines and incentives for private sector participation. This collaboration addresses gaps in educational quality and access, leveraging private sector expertise for successful digital transformation.

Notably, seven companies in Mongolia hold rights to build and operate information networks, primarily owned by private entities. For example, Information Communications Network LLC (ICNC) manages a significant portion of the national fibre-optic network, while Mongolia Telecom Company (MTC), a joint venture with Korea Telecom, illustrates private sector involvement in developing the digital infrastructure critical for higher education and other sectors.

3.7 Prospects for regional and international cooperation

Regional and international cooperation is essential for the digital transformation of higher education, enabling the sharing of best practices, resources, and technological innovations. This collaboration allows universities to leverage global expertise, improve digital infrastructure, and develop effective digital education strategies. By addressing common challenges such as the digital divide and cybersecurity, these partnerships create more inclusive educational systems and foster cross-border research and innovation. Countries like China, Mongolia, Japan, and South Korea are actively engaged in various initiatives to promote digitization and enhance digital education across the region. Here's an overview of some of their key efforts:

Bilateral and Multilateral Cooperation Mechanisms: The ASEAN Plus Three mechanism facilitates regional cooperation in education and digital transformation among China, Japan, South Korea, and ASEAN nations by promoting the sharing of educational technologies and capacity-building programmes.

Belt and Road Initiative (BRI): China's Belt and Road Initiative includes the "Digital Silk Road," promoting cooperation in e-commerce and cloud computing while building digital infrastructure with Mongolia and other neighbours, connecting with over 70 countries and enhancing cross-border digital education.

East Asia Summit (EAS): Japan, South Korea, China, and Mongolia also cooperate within the EAS framework to address digital gaps and enhance regional collaboration in educational technology through shared resources and policy alignment.

China-Africa Universities 100 Cooperation Plan: In September 2024, China announced a plan to train 40,000 African instructors over three years, fostering partnerships between Chinese and African universities to enhance teaching capabilities and promote regional digital education.

Establishment of UNESCO International Institute for STEM Education (UNESCO IISTEM): China has financially and technically supported the establishment of UNESCO IISTEM, which aims at broadening international cooperation channels and serving the development of STEM education in developing countries.

China-Mongolia Education Cooperation: China and Mongolia are collaborating to enhance digital education infrastructure in Mongolia through joint projects that build online platforms, train teachers, and share resources to improve educational quality and reduce the digital divide.

South Korea's K-EDU initiative: South Korea's K-EDU initiative promotes digital education technologies and platforms

internationally, providing e-learning content and tools to neighbouring countries like Mongolia and Japan to enhance online learning efficiency.

AI and EdTech Alliances: China and Japan are collaborating to enhance AI in education, with Japan providing expertise in advanced systems and China contributing large-scale digital platforms to develop adaptive learning tools.

Smart Campus Initiatives: South Korea and Japan are spearheading "smart campus" initiatives in collaboration with universities from China and Mongolia, aiming to integrate advanced technology into higher education for more connected, digital-first environments.

The Asia-Pacific Economic Cooperation (APEC) Digital Economy Agenda: Within the APEC framework, China, Japan, South Korea, and other member economies cooperate on advancing the digital economy, including digital education. This cooperation focuses on developing skills for the future, aligning digital education policies, and encouraging the use of online platforms for knowledge sharing.

Regional and international partnerships: South Korea is enhancing digital cooperation regionally and internationally by joining the Digital Economy Partnership Agreement, collaborating with the EU on emerging technologies, and increasing support for key digital projects in ASEAN countries. Nearly one third of the KOICA's education budget is spent on digital education. KOICA has funded the training and education of digital professionals, supported to strengthen digital capabilities of teachers and students, and provided support to establish foundations for MOOCs and LMS. (White Paper on ICT in Education in Korea, 2022)

Global and regional events: Countries in the region have been hosting events to promote ICTs in education and digital transformation. The Global Smart Education Network (GSENET), established in 2022 by the Smart Learning Institute of Beijing Normal University and partners like UNESCO IITE, Commonwealth of Learning, and others, has been organizing Global Summits on Smart Education. In August 2024, GSENET held a Global Smart Education Conference focused on educational transformation and international understanding, attended by thousands of experts and scholars worldwide.

In January 2024, China hosted the World Digital Education Conference in Shanghai, organized by the Ministry of Education and UNESCO. The event aimed to collaborate on digital education innovations and promote inclusive, quality education aligned with UN Sustainable Development Goals.

In 2023, South Korea launched the Global Education and Innovation Summit (GEIS), bringing together education leaders and policymakers from the Asia-Pacific and Europe to share best practices in teaching. The 2023 theme was "Creating an Education Innovation Eco-system in the Digital Transformation." The second GEIS in August 2024 focused on "Classroom Revolution Led by Teachers and AI," culminating in the launch of the Global Education and Innovation Alliance (GEIA) for sharing insights on integrating advanced digital technologies in education. Additionally, South Korea hosts the "Korea Education Technology and Contents Fair," Asia's premier EdTech exhibition, where the Ministry of Education collaborates with various stakeholders to showcase innovations and best practices in the field.

The Global MOOC and Online Education Alliance consists of leading universities and online platforms worldwide, focusing on addressing digital education challenges and promoting Sustainable Development Goal 4 (SDG 4) through joint teaching, capacity building, and advocacy. Founding members include some Chinese and Mongolian universities.

South Korean universities, like Seoul National University and KAIST, are leaders in digital education, supported by government policies that foster public-private partnerships and international cooperation. They collaborate

with global tech companies and engage in research networks to drive digital innovation. Similarly, Mongolian universities, such as the National University of Mongolia, are forming international partnerships to enhance their digital infrastructure, often with assistance from organizations like UNESCO and the Asian Development Bank.

Japanese universities are also active in digital transformation through regional and international cooperation. Japan's Society 5.0 initiative encourages the integration of digital technologies in education, promoting hybrid learning and collaboration with global partners to improve digital competencies. Many Japanese universities are members of Asian Association of Open University and University Mobility in Asia and the Pacific. Japanese universities engage in regional and international cooperation through collaborative research, student and faculty exchanges, joint degrees, and participation in global events and online courses. Japan organizes Japan IT Week, Edvation X Summit, and provides Japan e-Learning awards to recognize effective digital initiatives. Different ministries of Japan, including MEXT, provide financial support to UNESCO to support SDG 4, ESD, as well as digital education.

These efforts reflect a strong commitment to regional collaboration in digital education, focusing on infrastructure development, technological innovation, knowledge sharing, and capacity building to prepare for a digital future. However, the United Nations Secretary General's 2021 report emphasizes the need for a common agenda for effective digital cooperation. Key principles of this agenda are preventing Internet fragmentation, ensuring universal Internet access (including schools), promoting accountability and data protection, upholding human rights online, regulating AI, and recognizing digital commons as a public good. These principles should indeed govern digital cooperation initiatives for a more inclusive and effective digital education landscape.

3.8 Policy gaps/ challenges

East Asian countries have made significant strides in digitizing higher education, but key policy gaps remain. Many policies suffer from overcrowding and ineffective implementation due to a lack of resources and coordination, leading to a disconnect between formulation and practical outcomes. A notable issue is the digital divide, particularly between urban and rural areas, which exacerbates inequalities and highlights the New Digital Divide (NDD) that includes access, literacy, usage, capacity, participation, and outcomes gaps (Gonzales, 2023). Additionally, there is an urgent need for improved teacher training in digital pedagogy and consistent quality standards for online education. Many policies also neglect the environmental impact of digital education and fail to align higher education skills with labour market demands, emphasizing the need for comprehensive reforms to create a more inclusive and effective digital education system.

With the contextual landscape of higher education in Asia detailed in Chapter II and the critical policy context of digital transformation explored in Chapter III, the groundwork is set for a deeper dive into the digital realm. Chapter IV will transition into examining the current state of digital transformation within higher education in East Asia, highlighting the evolving digital ecosystem that characterizes the sector.

Chapter IV

The state of digital transformation in higher education

This chapter explores the intricate digital ecosystem of East Asian universities, encompassing various essential elements such as connectivity, tools, devices, programmes, and systems that interconnect to support teaching, learning, research, and administrative functions. Taking an ecosystem approach provides a holistic perspective on how these digital components collaborate to fulfil the core objectives of higher education institutions (OECD, 2023). Analysing this interconnected landscape offers insights into how universities leverage technology to enhance operational efficiency, foster collaboration, and improve the overall educational experience. This chapter delves into the state of digital transformation in East Asia, examining how institutions are evolving to meet the demands of a rapidly changing digital age.

4.1 Digital transformation and digital ecosystems

Digital transformation and digital ecosystems interact closely, supporting and amplifying each other. Digital transformation involves adopting and using digital technologies to improve processes, services, and experiences, spanning administrative tasks, teaching and learning methods, engagement with students and faculty, and research. Digital ecosystems consist of the interconnected tools, devices, platforms, and systems that collectively support these institutional functions.

The dynamic relationship sees institutions refining their digital ecosystems as they undergo digital transformation, integrating new technologies and streamlining interactions. A well-developed digital ecosystem facilitates transformation by enabling seamless communication and collaboration across departments and enhancing adaptability to emerging technologies. Conversely, digital transformation drives the evolution of the ecosystem, requiring further integration of each new tool or platform to optimize functionality and achieve institutional goals. Thus, digital transformation leads to a more robust digital ecosystem, and a strong ecosystem enhances transformation effectiveness and sustainability.

This chapter examines the interrelated components of the digital ecosystem that drive digital transformation in higher education. By analysing these interconnected elements—ranging from technological tools and platforms to integrated systems and data frameworks—it explores how they work together to facilitate seamless operations, enhance educational delivery, and support institutions in meeting their strategic objectives in a rapidly evolving digital landscape.

4.2 Components of digital ecosystems

Connectivity and networks

Connectivity and robust network infrastructure are foundational elements for the digital transformation of higher education. East Asia's commitment to enhancing digital connectivity is evident through various initiatives aimed at improving Internet access and expanding broadband networks. Significant strides have been made across East Asia in this regard, with countries investing heavily in upgrading their digital infrastructure to ensure high-speed Internet access in both urban and rural areas. This expansion is crucial for enabling online learning platforms, digital libraries, and virtual classrooms—essential components of modern higher education.

A review of the case studies indicates that connectivity and network infrastructure are not significant challenges

for the universities analysed. These institutions have established robust digital infrastructures, ensuring reliable high-speed Internet access and a wide array of digital resources, which support their efforts in advancing digital transformation in higher education.

In China, the rapid expansion of the 5G network, coupled with plans for further developing 6G technology, exemplifies this commitment to connectivity. Many universities have integrated 5G networks, enhancing campus connectivity and supporting a wide range of digital applications. For instance, Peking University has launched several projects to strengthen its network infrastructure, such as the 5G Private Network Construction and Smart Teaching Innovation Application Project. This initiative, in collaboration with various operators and equipment vendors, includes the establishment of 75 mobile stations and 30 indoor distribution systems, providing comprehensive coverage in key areas.

Japan also stands out with one of the world's most advanced broadband infrastructures, ensuring high-speed Internet access nationwide. This infrastructure enables universities to support a diverse array of digital activities. Under the GIGA School Initiative launched in 2019, the Japanese government made significant strides to guarantee that every student has access to a computer and high-speed Internet. Despite initial scepticism, this goal was largely achieved, particularly in light of the COVID-19 pandemic, with the Ministry of Education, Culture, Sports, Science and Technology (MEXT) reporting nearly 100% Wi-Fi availability in schools and classrooms by 2023.

South Korea is renowned for its world-class broadband infrastructure, providing high-speed Internet access across the nation. The Korean government has made substantial investments in expanding and maintaining this infrastructure, ensuring reliable Internet access even in remote areas. Universities are equipped with extensive Wi-Fi networks that cover classrooms, libraries, dormitories, and common areas, enabling seamless access to digital resources for both students and faculty.

In Mongolia, efforts to enhance Internet connectivity in universities and schools have played a crucial role in driving digital transformation. Recent investments by the Mongolian government, in collaboration with international organizations, have focused on expanding broadband infrastructure, particularly in urban areas. However, rural regions still face challenges in accessing reliable Internet. Many universities are upgrading their facilities with modern technology and high-speed Internet, establishing Wi-Fi networks across campuses, and integrating digital learning platforms into their curricula.

Collectively, these initiatives across East Asia illustrate how connectivity and robust network infrastructure are integral to the ongoing digital transformation in higher education. By enhancing access to digital resources, these countries are laying the groundwork for a more interconnected and innovative educational landscape.

Learning Management Systems

Learning Management Systems (LMS) are crucial for the digital transformation of higher education, providing a centralized platform that enhances accessibility to course materials and resources, enabling students to learn anytime and anywhere. These systems support personalized learning experiences through adaptive technologies, tailoring content to meet individual student needs. Additionally, LMSs facilitate data-driven insights by analysing student performance and engagement, which informs teaching strategies and improves educational outcomes. They also streamline administrative processes, such as enrolment and grading, allowing educators to focus more on teaching while fostering collaboration among students through discussion forums and group projects. With seamless integration of other educational tools, scalability for larger student populations, and support for hybrid and online learning environments, LMSs empower institutions to continuously enhance their offerings and adapt to the evolving educational landscape. Ultimately, LMSs play a critical role in making higher education more flexible,

efficient, and effective, supporting interactive learning, curriculum analysis, and customized education.

Case studies reveal that LMSs have become integral to higher education in China, Mongolia, Japan, and South Korea, particularly in the wake of the COVID-19 pandemic. In South Korea, advanced IT infrastructure has facilitated a smooth transition to online education. Universities extensively use learning platforms, supported by robust Internet connectivity and technological resources. The implementation of advanced LMS platforms exemplifies how these systems streamline content delivery, facilitate real-time interactions, and support personalized learning experiences.

Two notable examples from South Korea are LearnUs and HY-ON, developed by Yonsei University and Hanyang University, respectively. Both platforms successfully demonstrate that access to learning resources can be provided anytime and anywhere. LearnUs utilizes a cloud-based infrastructure to ensure a diverse range of courses for both students and the public, while HY-ON employs universal design principles to accommodate users regardless of physical or language barriers. LearnUs integrates interactive learning methods and real-time communication tools, creating an engaging and responsive learning environment. Meanwhile, HY-ON's features allow instructors to tailor educational content and interventions to meet individual needs, fostering effective, student-centred learning experiences and improving educational outcomes. Both platforms also automate and synchronize attendance, grade management, and course scheduling, thereby reducing administrative burdens on faculty. The Korean case study posits that these examples can serve as a roadmap for higher education institutions worldwide on how to leverage LMS effectively for digital transformation.

In China, universities increasingly utilize self-developed LMS platforms to enhance their educational offerings. The Chinese country report highlights various LMS in use among case study universities. Institutions leverage their LMS platforms to improve the educational experience, support research, and facilitate innovative teaching methods. For instance, Beijing Normal University (BNU) has an integrated digital teaching platform that streamlines online teaching. This platform creates a network of digital learning resources through multi-platform collaboration, providing comprehensive support for teachers and students. BNU's LMS, based on TronClass, offers features such as mobile teaching scenarios, blended open teaching modes, and unified teaching resources. These functionalities enable students to learn anytime, anywhere, while enhancing teaching quality and efficiency.

The Education University of Hong Kong (EdUHK) has utilized LMS for blended and distance learning since 2000, currently employing Moodle version 4.0. This LMS integrates with the Student Information System (SIS), allowing automatic course creation. The Centre for Learning, Teaching and Technology (LTTC) provides frontline support for this integration.

Peking University has developed multiple system platforms to offer various online teaching services, including a classroom recording and broadcasting system that digitizes offline courses, the ClassIn system for live teaching, and the "Yan Yun Live Broadcast" system for significant events. These initiatives ensure that all classrooms support recorded and live broadcasts, enhancing the learning experience for both teachers and students.

In Mongolia, higher education institutions utilize a variety of LMS platforms, including Moodle, Microsoft Teams, Google Classroom, Google Meet, and Zoom. A majority of surveyed students from institutions such as the Mongolian University of Science and Technology (MUST), University of Finance and Economics (UFE), and Mandakh University (MU) reported using Moodle, an open-source platform known for its flexibility and extensive features. MUST employs the UNIMIS management information system, which serves as a comprehensive web-based platform encompassing facets such as student registration, curriculum management, course standards, course evaluation, academic performance tracking, and results management. This system facilitates essential academic functions for instructors, including entering grades, generating transcripts, and conducting in-depth grade analysis.

While Japan is recognized as a technologically advanced country, its adoption of LMS still lags behind that of other

nations.[33] A report indicates that around 40% of Japanese universities have adopted Moodle, the most widely used LMS in the country.[34] However, challenges such as student unfamiliarity and resistance to using these tools have impeded their diffusion. Recent efforts, particularly in response to the COVID-19 pandemic, have led to wider LMS adoption among Japanese universities. Hosei University, for example, has initiated its digitization efforts under the Hosei University Digitization Promotion Plan, developed in 2020. This includes the HOSEI HI-DX project, designed to provide personalized learning through a digital information system that analyses learning behaviour patterns and optimizes individual talents.

Despite their growing popularity, implementing LMS in universities presents challenges, including technical issues, resistance to change, and financial constraints. Ensuring a robust IT infrastructure and providing comprehensive training for educators and students are crucial for successful adoption. Additionally, developing high-quality online content and adapting teaching methods to the digital environment requires significant resources and effort. Addressing data security and privacy concerns is also essential to protect sensitive information. Nevertheless, proactive planning and stakeholder involvement can help universities maximize the benefits of LMS and enhance the overall educational experience.

Data centres and data management

Universities across China, South Korea, Mongolia, and Japan have increasingly established data centres to support cloud computing, big data analytics, and AI applications, which are essential for managing and processing vast amounts of educational and research data. These data centres facilitate a range of activities, from optimizing administrative processes to supporting complex research initiatives, which enables universities to make data-driven decisions and adapt to modern educational demands.

In China, *Peking University* operates an advanced data centre supporting high-performance computing and big data analytics for projects in artificial intelligence and machine learning. *Chengdu University's* "Digital Intelligence Chengdu University" initiative exemplifies how Chinese universities are driving digital strategies using scenario-driven, synergistic, and security-focused principles. These data centres facilitate data sharing, resource management, and digital research integration, providing a foundation for the university's high-quality growth and security in digital intelligence.

In South Korea, data centres play a crucial role in enabling universities to benefit from the country's advanced IT infrastructure. *Seoul National University (SNU)*, for example, uses its data centre to support cloud computing, research, data management, and administrative processes. Such centres help universities manage extensive data related to student information and faculty resources, as well as facilitate AI and machine learning applications, which enhance research capabilities and educational flexibility.

Mongolia is in the early stages of developing data centre infrastructure. Universities like the *National University of Mongolia* and the *Mongolian University of Science and Technology (MUST)* are establishing foundational data systems with support from government initiatives and international collaborations. MUST, for example, uses its data centre to manage student records and academic resources and to support online education, thereby building the foundation for data-driven decision-making in administration and teaching.

Universities in Japan leverage data centres for cloud-based research, AI applications, and high-performance

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33   Murakami, C. (2016). *Challenges and potential of learning management systems in higher education: The case of Japan*. Learning, 23(2), 34–40. Retrieved from https://ld-sig.org/wp-content/uploads/2016/10/Article-4-Murakami.pdf

34   E-learning. *Moodle is the most widely used LMS in Japanese and European Universities.* https://www.e-learning.asia/bl2021101101/

computing. These centres support a broad spectrum of fields including genetics, climate science, and engineering. Data centres are also used to manage student information systems and to enhance digital learning. For instance, *Hosei University's* HI-DX system integrates data resources to provide personalized learning and academic data analysis, aligning with the nation's educational digitization goals.

In summary, the data centres in the case study universities are integral to their digital transformation, supporting research and education by providing secure and accessible data management, enabling large-scale analytics, and integrating digital resources across the academic ecosystem. This foundational infrastructure reflects each country's commitment to evolving educational practices through technology.

Smart campuses/smart classrooms

Smart campuses are transforming higher education institutions across East Asia by integrating next-generation technologies within well-architected infrastructures to enhance learning experiences and administrative efficiency. These smart campuses utilize AI-driven tools, IoT, big data, and advanced digital resources to optimize campus operations, personalize learning, and facilitate seamless access to educational services. The concept of smart campuses reflects the growing importance of technology in reshaping educational spaces, promoting innovations like machine learning, natural language processing, intelligent tutoring systems, gamification, and predictive analytics, all aimed at enhancing both teaching and learning.

In China, institutions such as Peking University pioneered smart campuses by incorporating IoT devices, smart classrooms, and automated systems that significantly improve resource management and the learning environment. Beijing Normal University (BNU), for example, features various types of smart classrooms, including discussion-based and holographic interactive classrooms, as well as VR-integrated spaces that enhance engagement in ideological and political courses (Figure 3).

Figure 3: Beijing Normal University's holographic interactive smart classroom (left) and immersive online and offline hybrid teaching smart classroom (right)

Source: BNU draft report (2024)

Chengdu University is implementing a vision for a "Digital Intelligence Chengdu University," aiming to transform its campus with big data, IoT, and AI applications to create a more interconnected and intelligent campus environment. The University's Information Network Centre spearheads these efforts, enhancing teaching, research, and administrative processes with integrated digital solutions. A planned high-speed campus network will provide full wireless coverage, enabling innovative services like smart libraries with self-service borrowing and payment systems, as well as an electronic office system to streamline administrative tasks.

South Korea's Yonsei University implements platforms like "LearnUs," blending digital and physical spaces to support hybrid learning with cloud storage, AI-driven analytics, and interactive virtual tools. KAIST (Korea Advanced Institute of Science and Technology) employs IoT technology to track student engagement in real time, supporting personalized learning and efficient class interactions. The widespread deployment of digital whiteboards, VR/AR tools, and automated attendance systems also aligns with South Korea's national strategy to support dynamic, fully integrated learning environments.

In Korean universities, VR classrooms have been adopted as cutting-edge tools to enhance learning across various fields, ranging from simulating extreme environments to providing advanced medical training (Figure 4). These VR classrooms, often referred to as VR studios, VR lounges, or VR zones, are specially designed environments that utilize virtual reality technology to offer students immersive educational experiences beyond the capabilities of traditional classrooms. Typically, they are equipped with VR headsets, motion controllers, and educational software tailored to specific disciplines, providing an innovative approach to education that engages students in interactive, experiential learning.

Figure 4: Centre for global education engineering VR studio at SNU

Source: Draft South Korea country report (2024)

In Japan, institutions are similarly innovating the smart campus notion by utilizing AI-assisted classrooms featuring digital devices, real-time assessments, and data-driven discussions, facilitating a collaborative and personalized learning experience. Under the GIGA School Programme, Japan has equipped schools with high-speed Internet and digital devices for each student to support a tech-enriched educational setting. Hosei University's HI-DX project illustrates a unique approach to digital transformation by incorporating adaptive digital tools to personalize student learning, analyse classroom interactions, and tailor teaching methods to individual needs.

In Mongolia, smart campus technologies are emerging through government programmes and international partnerships. For instance, Mongolian National University has started integrating digital projectors, interactive whiteboards, and digital platforms like Moodle and Google Classroom to support blended learning, particularly in rural regions. These technologies facilitate access to educational resources and enhance interactive learning, demonstrating Mongolia's commitment to inclusivity in education.

Across East Asia, universities are leveraging smart campus initiatives to adapt to the evolving educational landscape, using technology to foster learning environments that are more interactive, flexible, and efficient. Through these efforts, institutions demonstrate how a well-orchestrated digital infrastructure supports a range of academic and operational functions, ultimately driving the digital transformation of higher education in the region.

MOOCs

The concept of Massive Open Online Courses (MOOCs) has gained momentum globally as a tool for accessible, flexible education, enabling institutions to reach learners regardless of time, location, or traditional barriers. In East Asia, each country has developed unique approaches to MOOCs, reflecting both national strategies and regional priorities.

China has taken a proactive approach in supporting the development, regulation, and standardization of MOOCs through national frameworks. Local platforms such as XuetangX and iCourse163 offer diverse courses from top universities, enhancing educational access. The government hosted the World MOOCs Conference and issued policies such as the 2015 *Opinions on Strengthening the Application of Management of Online Open Courses in Higher Education Institutions*, aimed at creating high-quality online courses integrated with teaching services. In 2020, the World MOOC and Online Education Conference was held, resulting in the *Beijing Declaration on MOOC Development* and establishing the World MOOC and Education Alliance. Notable universities are also involved:

Peking University collaborates with Alibaba on Chinese MOOCs, offering nearly 270 courses, while *Chengdu University* uses MOOCs to deepen online-offline teaching integration and reform classroom methods. China's Ministry of Education reported that as of 2020, the country hosts the world's largest pool of MOOCs, with over 34,000 courses and 540 million users.

Korea's national platform, K-MOOC, launched in 2015 with government support and has grown to over 2,380 courses. Managed by the National Institute for Lifelong Education (NILE) and powered by an Open edX platform, K-MOOC provides diverse, accessible courses and collaborates with over 100 institutions. Recent expansions in 2023 aim to develop 500 new courses, with ongoing investment from the Korean government to promote lifelong learning and a globally recognized K-MOOC brand. The platform, which supports personalized learning with credential options, is available in both Korean and English.

Japan's primary MOOC platform, JMOOC, was launched in 2014 to certify and promote university courses in Japanese. Although enrolment is high—with over 1.47 million registrations as of early 2022—challenges persist, such as limited recognition by universities and limited course development due to resource constraints. *Waseda University* is notable for using ICT to make its courses widely available, with initiatives like offering MOOCs through edX for international students and JMOOC for domestic learners.

MOOCs are in early stages in Mongolia, with the *Mongolian University of Science and Technology (MUST)* as a member of the Global MOOCs and Online Education Alliance. Although no national platform exists, Mongolia's Education Sector Mid-term Development Plan (2021-2030) includes goals to establish university-affiliated Open Education Centres, deliver MOOCs for skill development, and facilitate credit transfers. MUST has also collaborated with Tsinghua University in China and UNESCO to promote online education and equip faculty with skills in smart classroom technology.

UNESCO Bangkok has played a significant role in fostering MOOC collaborations across platforms in East Asia and beyond, promoting mutual exchange and cooperation to standardize and enhance MOOC offerings. While MOOCs provide accessible education, quality assurance remains a critical concern, particularly where rapid expansion may outpace rigorous planning and evaluation (GEMR 2023). These initiatives illustrate East Asia's diverse approaches to MOOC development, each aligning with national educational goals while contributing to a regionally interconnected digital education ecosystem.

Digital libraries

Digital libraries play a crucial role in the digital transformation of higher education by providing students and faculty with access to a vast array of academic resources and research materials. They support both teaching and research activities, fostering an enriched learning experience and enhancing research capabilities.

In China, Peking University boasts a significant digital library collection, featuring nearly 120,000 electronic books and journals. This extensive resource supports the academic pursuits of its students and faculty. The Central China Normal University (CCNU) has a digital library that provides extensive resources for its students and faculty. Beijing Normal University and The Education University of Hong Kong both have digital libraries that provide extensive resources, including e-books and academic journals, to support teaching and research activities.

In Mongolia, the Mongolian University of Science and Technology (MUST) offers an e-library containing approximately 5,000 e-books in Mongolian, alongside 2,755 e-books and 2,704 professional e-textbooks in foreign languages. Another case study university, the National University of Mongolia (NUM), provides access to nearly 10,000 e-books, including 150 in foreign languages and around 700 e-textbooks in Mongolian. Additionally, the University of Finance and Economics (UFE) supports its faculty and students with a comprehensive library that offers access to two million electronic resources, including 61,500 digital textbooks in various languages and 466 digital textbooks in Mongolian. Students also benefit from digital access to hundreds of recorded video lectures and self-study materials.

In South Korea, several universities have established robust digital libraries to support their academic communities. Hanyang University offers a digital library that provides access to e-books, academic journals, and various digital resources. Seoul National University (SNU) features a comprehensive digital library with a vast collection of electronic resources, including scholarly articles and databases, facilitating research and learning for its students and faculty. Similarly, Yonsei University has a digital library that grants access to a wide range of digital resources, enhancing the academic experience with scholarly articles, e-books, and multimedia materials.

In addition, the Korea Education and Research Information Service (KERIS) facilitates the development of digital libraries across educational institutions. It provides digital resources and services to universities, helping them build and maintain extensive digital collections. KERIS also promotes the use of digital libraries for research and learning, significantly contributing to the overall digital transformation of higher education. The National Library of Korea (NLK) is at the forefront of these efforts, offering extensive digital resources to the public.

Japan also has a strong focus on digital libraries, with many universities providing access to a wide range of digital resources, including e-books, academic journals, and multimedia content. The National Diet Library (NDL), Japan's largest library, plays a key role in the digitization of library resources. Its digital collections grant access to a vast array of materials, including books, periodicals, rare manuscripts, and historical documents. In Japan, Hosei University, Miyagi University of Education, and Kagawa University each offer digital libraries that provide access to a variety of academic resources, including e-books, journals, and multimedia materials, enhancing the research and learning experience for students and faculty.

In summary, digital libraries across these countries are instrumental in enhancing academic research and learning, making substantial contributions to the digital transformation of higher education.

AI and big data

Artificial Intelligence (AI) is transforming higher education by personalizing learning experiences and improving outcomes. Through predictive analytics, AI identifies at-risk students and offers timely interventions, while intelligent tutoring systems provide real-time support. Automated grading and administrative efficiencies allow educators to concentrate on teaching, while AI fosters innovation in research by enabling complex data analyses. This integration makes higher education more dynamic, efficient, and effective. Although there are risks associated with AI, its applications in education are expanding, with early evidence suggesting that AI-driven tools can effectively analyse student performance, tailor educational content, and enhance learning outcomes.

In China, universities are increasingly integrating AI into their operations. For example, The Education University of Hong Kong (EdUHK) has implemented a chatbot-based large language model (LLM) using the Microsoft Azure OpenAI service, designed to facilitate engagement with AI technology (Figure 5). This service operates similarly to OpenAI's ChatGPT and aims to support students in developing critical thinking skills. The integration of AI at EdUHK serves as a model for other institutions. According to a report by GEMR (2023), learning analytics have also been utilized in primary and secondary schools to identify student difficulties and manage resources more effectively.

Figure 5: Artificial intelligence education laboratory of EdUHK

Source: Digital transformation of the Education University of Hong Kong case study draft 2024

Mongolia's government has set a goal in its Vision 2050 plan to develop open curricula complemented by AI technologies across all educational sectors. In its Action Programme for 2020-2024, the government aims to prepare human resources in fields like AI and data science. Mongolian universities, such as the Mongolian University of Science and Technology (MUST), are employing AI in research, particularly within its Data Analysis Theory and Applications Research Laboratory. Meanwhile, the National University of Mongolia (NUM) has developed an AI-driven chatbot named "Andaa," which has achieved a 96% accuracy rate in understanding and responding to user queries (Figure 6).

Figure 6: Screenshot of "Andaa" virtual assistant developed by a Mongolian university
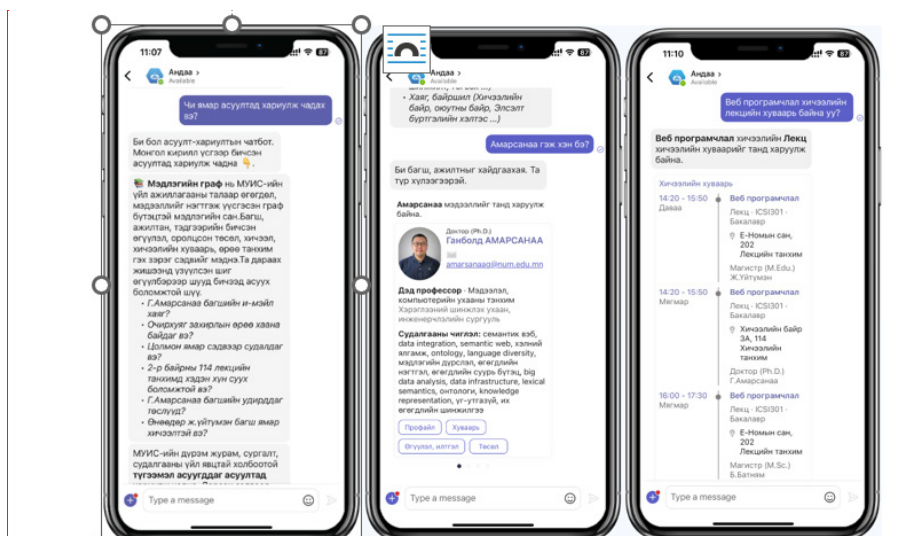
Source: Draft Mongolia country report (2024)

South Korea is positioning itself as a leader in educational innovation through AI and digital technologies. The Ministry of Education has established the AI Education Alliance and Policy Lab (AIEDAP) to enhance digital competencies for teachers through collaboration between the private sector, government, and educational institutions. The Graduate School of Data Science at Seoul National University (SNU), launched in 2020, provides courses on essential technologies like big data and AI, accessible to all bachelor's degree holders regardless of their background. Additionally, SNU's Faculty of Liberal Education has developed a programme to advance faculty proficiency in AI and digital tools through workshops and clinics.

In Japan, the rise of AI technologies, particularly since the introduction of ChatGPT, has led higher education institutions to focus on enhancing the digital competencies of their faculty. The Ministry of Economy, Trade and Industry (METI) has emphasized the need for knowledge in mathematics, data science, and AI among all citizens in its 2020 policy document, "Declaration on the Creation of the World's Most Advanced Digital Nation." Initiatives, such as those at Miyagi University, are training teachers to educate students in an AI-driven society, while Japan's AI Strategy 2022 aims to integrate AI and data science into university curricula to cultivate a workforce adept in these technologies.

AI in education offers transformative benefits, including personalized learning, automation of administrative tasks, and real-time feedback, which enhance efficiency and tailor education to individual needs. However, it also poses risks such as perpetuating biases from flawed data, data privacy issues, and exacerbating the digital divide, potentially widening educational inequalities. To fully realize AI's potential in education, it is essential to establish strong ethical guidelines and regulatory frameworks that ensure fairness, protect data privacy, and provide equitable access to technology (UNESCO, 2021).

E-Administration systems

Digital systems are transforming administrative tasks such as enrolment, grading, and communication between students and faculty, leading to enhanced operational efficiency. E-administration in higher education leverages digital technologies to automate processes, making them more effective and efficient. This includes enrolment,

scheduling, and financial management, which reduces paperwork and errors while improving accessibility and transparency. Digital record management ensures secure storage and easy retrieval of student records, while better communication tools enhance collaboration among faculty, staff, and students. Overall, e-administration simplifies operational workflows, allowing institutions to focus more on strategic initiatives and improving service delivery to stakeholders.

Chinese universities are actively utilizing e-administration systems to streamline processes like student enrolment, scheduling, and financial management, significantly enhancing operational efficiency. Peking University, for example, has developed a Cross-Campus Data Management and Data Sharing system that enables data sharing and management reform across its various campuses. Beijing Normal University (BNU) offers a unified identity authentication platform for its community, allowing single sign-on access to the university's application systems. Furthermore, over 91% of Chinese national universities have implemented digital security management systems covering various campus areas.

Japan's universities are embracing digital tools to improve administrative processes. For instance, Miyagi University of Education uses ICT equipment to enhance school support systems, optimizing educational activities and reducing the administrative burden on teachers. Kagawa University is pursuing its "Digital One Strategy," which aims to create an integrated management system for its multiple campuses by merging online and offline operations. This initiative seeks to enhance the quality of administrative and academic processes.

Korean universities are leveraging e-administration to improve operational efficiency. By automating administrative tasks, these institutions reduce errors while enhancing transparency and accessibility. The COSS project aims to establish a shared university system for new technology fields, enabling collaboration among institutions to optimize resources like educators and educational content, with digitization playing a crucial role.

The Mongolian government's New Revival Policy, announced in 2021, focuses on digitizing government services and streamlining administrative processes. This includes improving public information infrastructure by reducing paper-based operations. The government aims to enhance the accessibility of services offered electronically. At the Mongolian University of Science and Technology (MUST), a Human Resource Management System maintains various electronic databases related to personnel management, contributing to an integrated management approach for state institutions.

Blockchain technology

Blockchain technology offers promising applications in education, enhancing transparency, security, and efficiency. In China, its adoption in universities is significantly driven by the government's strategic push to establish the country as a global leader in this field. The Chinese government has strongly advocated for blockchain, emphasizing its potential to revolutionize various sectors, including education. This support has led to the creation of numerous blockchain programmes and research initiatives at universities.

Notably, Chengdu University of Information Technology was the first to establish a College of Blockchain Technology, while leading institutions such as Tsinghua University, Beijing University of Posts and Telecommunications, and Shanghai Jiao Tong University are at the forefront of blockchain research. In 2018, several universities, including Tsinghua University, formed a blockchain alliance called the "Youth Education Chain."

Blockchain technology offers secure storage and verification of academic credentials like diplomas, transcripts, and certificates. Students can use a digital wallet to manage and share their verified credentials globally. Key features include immutable records and enhanced data privacy, ensuring that grades and attendance cannot be altered. This technology also automates administrative processes such as enrolment, fee payments, and course registrations.

Additionally, it supports decentralized learning platforms, providing global access to educational resources and personalized learning experiences by securely tracking and analysing student progress. Overall, blockchain can significantly improve the efficiency, security, and transparency of educational processes.

The Chinese Country Report highlights China's commitment to integrating blockchain technology by investing in talent development and creating standardized resources. Both universities and vocational schools show strong interest in incorporating blockchain into their digital campuses, enhancing data security and credibility. According to China's Ministry of Education, the proportion of universities using blockchain technology rose from 5.90% in 2020 to 6.28% in 2021. Despite its many benefits, blockchain still faces challenges that need ongoing efforts to resolve.

In Mongolia, the General Education Law mandates that all educational documents be issued in both paper and electronic formats. The General Department of Education has initiated a transition to blockchain-based diploma verification in 2022, with universities successfully implementing electronic verification through the TEO blockchain. The Mongolian University of Science and Technology (MUST), for example, has begun digital verification of its graduates' diplomas using blockchain technology, establishing a startup to validate these diplomas. This process ensures the authenticity and security of diplomas, with verification completed within two days. It can also verify credentialed training institutions using blockchain, enhancing transparency for employers and reducing uncertainty.

In South Korea, several universities are exploring blockchain for academic credential verification, student record management, and improving transparency in administrative processes. For example, Yonsei University is developing blockchain-based solutions for secure diploma issuance. The Korea Blockchain Association promotes blockchain research and development across various fields, including education, and collaborates with universities and private companies to foster innovation.

Japanese universities are conducting research on blockchain applications and developing courses focused on blockchain technology and cryptocurrencies. Japan is also exploring the use of blockchain for verifying educational credentials and certifications, with several institutions researching how to enhance the security and authenticity of academic records.

As East Asian countries continue to explore and implement blockchain technology in education, their collective efforts reflect a strong commitment to enhancing transparency, security, and efficiency in academic processes. This regional enthusiasm for blockchain not only positions East Asia as a leader in educational innovation but also sets the stage for a more interconnected and technologically advanced educational landscape.

E-assessment

E-assessments, or electronic assessments, represent an innovative approach in higher education by leveraging digital tools and platforms to administer, evaluate, and manage student assessments. These assessments offer several advantages over traditional paper-based methods, including enhanced efficiency, ease of administration, flexibility, and accessibility. Technologies such as automated grading systems allow for immediate feedback, fostering continuous learning. The data from e-assessments can be analysed to gain insights into student performance and learning trends, enabling educators to tailor their instructional strategies and improve educational outcomes. The integration of e-assessments is essential for modernizing educational practices and meeting the evolving needs of students in the digital age.

During the COVID-19 pandemic, many universities in East Asia adopted online learning and e-assessments to facilitate remote education. In recent years, East Asian universities have increasingly incorporated e-assessments as part of their digital transformation efforts. For instance, Chinese universities utilize learning platforms to administer and grade assessments, providing features such as real-time feedback and performance analytics. South

Korean universities employ sophisticated e-assessment systems that support various assessment types and offer detailed performance analytics. In Japan, institutions are exploring advanced technologies to create adaptive assessments tailored to students' levels of understanding, thereby offering a personalized evaluation experience. Despite infrastructural challenges, Mongolian universities are also embracing digital assessment tools, often collaborating with international organizations to ensure quality and accessibility. These practices demonstrate the region's commitment to enhancing the efficiency, inclusivity, and effectiveness of the assessment process through digital innovation.

A background paper from the Global Education Monitoring Report (Chen, 2023) reviewed technology-based assessment practices and highlighted significant gaps in adoption across countries. While some countries have transitioned to technology-based assessments with mixed results, others struggle due to limited resources. Key challenges include variability in digital tools, institutional support, teacher competency, and societal expectations. Despite mixed outcomes in areas like cheating reduction and learning enhancement, positive results include higher measurement precision, increased learner engagement, cost-effectiveness, and time efficiency. Barriers such as a lack of supportive policies and infrastructure, misaligned digital applications, and teachers' low competencies in assessments remain. The review underscores the need for in-depth field-based studies.

Quality assurance

Quality assurance (QA) in online education, MOOCs, Open and Distance Learning (ODL), and digitization in higher education is crucial for maintaining educational standards and ensuring effective learning outcomes. East Asian countries have developed comprehensive QA systems that mandate universities to undergo rigorous QA procedures. This involves a combination of national standards, international frameworks, continuous improvement practices, and technological integration.

In China, the Ministry of Education (MoE) plays a pivotal role in overseeing the quality of online education, MOOCs, and digitization efforts. The MoE has established comprehensive national standards and guidelines to ensure the quality and effectiveness of digital learning initiatives. The China Academic Degrees and Graduate Education Development Center (CDGDC) is instrumental in accrediting higher education programmes, including those delivered online. Regular evaluations and audits are conducted to uphold high standards, with significant investments made in digital infrastructure to support these initiatives. China has developed the "Higher Education Institutions Information Technology Development Monitoring System," an index system designed to monitor the development of information technology in higher education institutions. This system comprises seven primary indicators: institutional mechanisms, infrastructure, information systems and data governance, IT support for teaching, IT support for research, cybersecurity, and the application of new technologies. Notably, the QA framework draws from several international QA systems, including South Korea's 2010 education IT evaluation indicators. However, the quality assurance of online education is not yet integrated into the general QA framework.

Mongolia's approach to QA in online education and digitization is led by the Ministry of Education and Science, which sets standards and ensures compliance through regular assessments. The National Council for Education Accreditation (NCEA) plays a crucial role in accrediting higher education institutions and programs. Mongolia collaborates with international organizations, such as UNESCO, to learn from the experiences and best practices of other countries, promoting the development of high-quality digital education. However, despite these efforts, the Mongolian country report has confirmed that there are currently no established quality assurance mechanisms to ensure the quality of digital education programs, indicating a gap in the country's approach to overseeing digital learning initiatives.

In Japan, MEXT has issued QA guidelines aligned with the international frameworks and best practices. The National

Institution for Academic Degrees and Quality Enhancement of Higher Education (NIAD-QE) is responsible for accrediting higher education institutions, including their online programmes. The Japan University Accreditation Association (JUAA) also evaluates and accredits digital and distance learning. Continuous improvement practices, regular audits, and feedback mechanisms are integral to maintaining high standards in digital education. There are no separate guidelines for quality assurance and accreditation of digital education. However, there is a system for accrediting programmes in Mathematics, Data Science, and AI education.

Korea's QA framework for online education is overseen by the Korean Council for University Education (KCUE) and the Korean Educational Development Institute (KEDI). These organizations establish national standards, conduct evaluations, and provide guidelines to ensure the quality and effectiveness of digital learning initiatives. Korea's approach leverages cutting-edge technologies, expands digital infrastructure, and fosters international collaborations to enhance the quality of higher education. Regular audits, student and faculty feedback, and data-driven decision-making are key components of Korea's QA practices, ensuring that digital education remains innovative and effective.

National QA frameworks are essential for evaluating and improving educational quality, ensuring institutions meet established standards. Aligning national frameworks with international standards, such as those by UNESCO, enhances credibility and fosters continuous improvement. Regular reviews allow for timely adjustments and innovations. Integrating international QA standards into national frameworks for digital education is crucial for enhancing credibility, promoting best practices, fostering inclusivity, and encouraging innovation. East Asian countries have made significant strides in aligning their national QA frameworks with international standards. However, challenges remain, including varying resources and institutional capacities, affecting full compliance. Continued efforts are necessary for East Asian countries to fully integrate and benefit from international QA standards in their educational systems.

To sum up, the digital ecosystem in East Asian higher education presents a diverse landscape characterized by differing levels of technological integration and government support among its countries. South Korea stands out as a leader, having established a sophisticated digital education infrastructure supported by comprehensive policies and a commitment to innovative technologies. Its universities utilize advanced online learning platforms and e-assessments, ensuring high-quality education and robust student engagement. In contrast, China is aggressively advancing its digital ecosystem, fuelled by significant government investments and the rapid adoption of technologies such as blockchain for credential verification. This ambitious push is accompanied by the development of quality assurance frameworks to maintain educational standards.

Japan is also making strides in enhancing its digital education landscape, focusing on integrating advanced technologies and fostering personalized learning experiences, though it faces challenges in keeping pace with the rapid developments in other East Asian countries. Meanwhile, Mongolia is in the early stages of exploring digital education initiatives, experimenting with online learning and quality assurance mechanisms in collaboration with international organizations to build a strong digital infrastructure.

With the policy framework established and the digital ecosystem defined, the report now moves into the human aspect of digital transformation. The next chapter delves into the digital competencies of teachers and students, whose capacities ultimately determine the overall *effectiveness* of the educational system.

Chapter V

Digital competencies of teachers and students

In the rapidly evolving landscape of higher education, the digital ecosystem relies fundamentally on the human elements of teaching and learning—teachers and students. This chapter explores the essential competencies required by educators to effectively leverage digital tools and foster engaging learning environments, as well as the skills students need to navigate and thrive within this digital realm. As educational practices shift towards more flexible and personalized approaches, understanding and developing these competencies becomes crucial. By emphasizing the interplay between technology and the human dimension of education, this chapter aims to examine whether teachers and students are adequately prepared for the digital world, ensuring that digital infrastructures and systems translate into meaningful and impactful learning experiences.

5.1 Understanding digital competencies

Digital technologies are now fundamental to educational processes, enhancing instructional quality and facilitating the digital transformation of institutions. However, this shift is often constrained by a lack of digital skills and pedagogical expertise among faculty members, students, and administrative staff. Higher education institutions must prioritize the development of these essential competencies to effectively harness digital devices, systems, and platforms. Despite this need, there is no universal definition of digital competence, with terms in the literature such as "skills," "competence," "competencies," "aptitudes," "understandings," "dispositions," and "thinking" reflecting the varied forms and applications of digital technologies.[35]

A basic level of digital competency, or foundational skills, is required to operate digital devices and navigate platforms, such as connecting to the Internet, setting up accounts, and accessing resources. These skills are foundational for all technology use, enabling entry-level interactions with digital tools. As individuals progress, they require intermediate competencies that enable meaningful and effective uses of technology. These "generic digital skills" allow users to engage with digital systems in ways that enhance their productivity and foster critical digital literacy.

Higher-level digital competencies enable more transformative engagements with technology. These skills extend beyond foundational and generic competencies to support specialized, empowering uses of digital tools, particularly in the context of professional ICT careers. Advanced competencies are typically developed through formal education or specialized training and include skills such as programming, network management, and digital content creation. Such competencies are critical as they enable users to adapt to and innovate within an increasingly digital world (World Bank, 2016).[36]

Several frameworks have been developed to structure and assess these competencies. The Technological Pedagogical Content Knowledge (TPACK) framework, for instance, defines digital competence within three core knowledge areas: technological, pedagogical, and content knowledge. TPACK's approach has been instrumental in teacher training,

35   UNESCO & Intel. (2017). *Digital skills for life and work*. Broadband Commission for Sustainable Development. https://unesdoc.unesco.org/ark:/48223/pf0000259013

36   World Bank. (2016). *World Development Report 2016: Digital Dividends*. Washington, DC: World Bank. https://www.worldbank.org/en/publication/wdr2016

helping educators integrate technology effectively into their instructional practices (Mishra and Koehler, 2013).[37]

Starkey (2020) further categorizes digital teaching competence into three areas: general digital competence, digital teaching competence, and professional digital competence. This approach enables teachers to apply digital tools within their pedagogy and manage digital learning environments effectively.[38]

Global initiatives and frameworks such as UNESCO's Digital Literacy Global Framework (DLGF)[39] and the European Commission's Digital Competence Framework (DigComp) set standards for digital literacy and guide policy and curriculum development worldwide (European Commission, 2016).[40] These frameworks emphasize a range of competencies from basic digital operations to more complex skills, such as problem-solving, data literacy, online collaboration, and digital content creation. For educational institutions, these models provide essential benchmarks for designing curriculum that fosters both technical fluency and higher-order digital skills.

Furthermore, assessments like the OECD's Programme for International Student Assessment (PISA) and UNESCO's UIS Indicator 4.4.1 provide tools to evaluate digital literacy on a global scale. PISA, for instance, includes digital reading and computer-based problem-solving as metrics for assessing the digital skills of students worldwide, helping identify areas where further support or training may be needed.[41]

In this report, for clarity and convenience, the terms "digital competency," "competencies," or "skills" will be used interchangeably. These represent a progression of abilities, from foundational skills to higher-order competencies, that evolve with technological advancements and adapt to emerging digital demands.

5.2 Digital competencies among university professors and staff

University professors increasingly need diverse digital skills to effectively enhance their teaching and engage students effectively. These skills include proficiency with digital tools and platforms, such as Learning Management Systems (LMS) and video conferencing software, as well as the ability to create and manage digital content like multimedia presentations and interactive materials. Effective online communication skills are essential for interacting with students and colleagues, while digital pedagogy involves integrating these tools into teaching practices to improve learning outcomes. Data literacy is crucial for analysing educational data to refine teaching strategies, and cybersecurity awareness is necessary to protect sensitive information. Adaptability is key as professors must quickly learn and implement new technologies in a rapidly evolving digital landscape. Together, these competencies enable professors to leverage digital technologies to provide high-quality, engaging, and secure online education.

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37   Mishra, P., & Koehler, M. J. (2013). *Introducing technological pedagogical content knowledge*. In R. A. Reynolds, R. E. Kenny, & K. A. Thomas (Eds.), *Handbook of research on educational communications and technology* (4th ed., pp. 99-110). Springer. https://www.punyamishra.com/wp-content/uploads/2013/08/TPACK-handbookchapter-2013.pdf

38   Starkey, L. (2020). Digital teaching competence: A framework for teachers in the digital age. *European Journal of Education*, *55*(1), 21-33. https://doi.org/10.1111/ejed.12395

39   UNESCO's Digital Literacy Global Framework (2018) outlines essential skills and competencies for thriving in a digital world, going beyond traditional digital skills. It emphasizes a comprehensive understanding of digital literacy that includes practical skills, critical thinking, ethical attitudes, and lifelong learning. The framework promotes inclusivity and equity in access to digital education and advocates for integration into educational systems worldwide, aiming to empower individuals to navigate and create digital content responsibly.

40   The European Commission's Digital Competence Framework (2016) establishes standards for digital literacy, guiding policymaking and curriculum development. It defines key competencies across five areas—information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving—and outlines eight proficiency levels to assess and enhance individuals' digital skills, promoting inclusivity and lifelong learning.

41   OECD. (2019). *PISA 2018 Results (Volume I): What Students Know and Can Do*. OECD Publishing. https://doi.org/10.1787/5b1e3e50-en

Many countries have established guidelines for developing teacher digital competencies in both pre-service and in-service training at the school level. These guidelines include teacher professional standards, competence frameworks, and various laws or directives governing the teaching profession. Some education systems have even implemented distinct curricula focused on teaching student digital competencies, alongside the integration of digital skills across all subject areas.

During the COVID-19 pandemic, university professors faced significant pressure to quickly acquire digital skills and adapt to remote teaching with minimal preparation. This urgent need highlighted the importance of digital competencies in higher education. Now, as universities plan to transition to digital modalities more systematically, they recognize the necessity of equipping faculty with the skills needed for effective digital teaching. This shift reflects a broader strategy to enhance educational delivery, improve student engagement, and prepare for a future where digital literacy is essential. Consequently, institutions are developing comprehensive programmes aimed at fostering digital competencies among faculty, ensuring they are well-prepared to utilize various digital tools and pedagogical approaches in their teaching practices. By investing in these initiatives, universities are positioning themselves to thrive in an increasingly digital landscape.

The following paragraphs discuss the essential digital skills that professors are expected to possess to effectively engage students and enhance their teaching in the evolving digital landscape of higher education, as highlighted in the four country reports and relevant literature.

Digital competencies of teachers in China

The Chinese Ministry of Education issued the Teachers' Digital Literacy Standards in February 2023, covering five primary dimensions: digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development. These dimensions are further divided into 13 secondary dimensions and 33 tertiary competencies, providing a comprehensive framework for developing digital professional development and competency assessment.

The country report emphasizes the need for developing teachers' digital skills. Although the preparation of the case study did not include an assessment of teacher competencies, it acknowledges that Chinese teachers "still lack awareness and competence in integrating digital technology into teaching as well as the ability to innovate teaching through technology" (p. 23). The report identifies key competencies for teachers in digital education: supporting student development with technology, recognizing limitations of current methods, innovating teaching practices, empowering student autonomy, refining assessments, aiding formative evaluations, benchmarking learning achievements, adapting to digital changes, and developing essential digital transformation skills.

All five universities in the Chinese country report recognize the importance of teachers' digital skills for sustainable digital transformation. Peking University organized digital literacy courses to enhance teaching capabilities, while the Education University of Hong Kong provided workshops for both faculty and staff focused on 21st-century digital skills. Chengdu University offered hands-on training through interactive workshops, and Beijing Normal University established an office to design and implement training courses, improving digital capabilities. Central China Normal University conducts ongoing training to continually enhance digital skills. Additionally, these universities offer courses on cybersecurity, covering network security, data privacy policies, and information protection.

Studies on university professors' digital skills are limited, but a UNICEF study (2020) examining schoolteachers' digital skills revealed diverse proficiency levels. In particular, China emphasizes teachers' digital literacy through initiatives like Digital China. Despite this focus, many Chinese teachers face significant challenges, such as limited time available to improve and learn digital skills.

China stands out for its innovative methods, supported by national digital competence frameworks. Notable progress has been made in advancing digital literacy, particularly in bridging the digital divide among older demographics. The Ministry of Education has taken substantial steps to enhance digital skills development among teachers and integrate ICT skills into education. Key initiatives include Education Informatization 2.0 and the Teacher Education Revitalization Action Plan (2018-2022).

The 2018 Teaching and Learning International Survey (TALIS) findings for Shanghai, China, indicate a strong emphasis on integrating ICT into education.42 A notable 79% of teachers reported had received formal training in using ICT, the highest among the surveyed regions. Additionally, 63% of teachers felt well-prepared to use ICT in their teaching practices, exceeding the OECD average. The data also shows that 77% of teachers engaged in recent professional development related to ICT, reflecting a commitment to ongoing learning in this area. Only 30% of teachers expressed a high need for further ICT training. Moreover, principals in Shanghai reported a low rate of 10% concerning shortages or inadequacies in digital technology for instruction, indicating robust infrastructure support. Overall, these findings highlight Shanghai's proactive approach to equipping teachers with digital competencies and fostering an environment conducive to effective ICT integration in education.

Indeed, the data on schoolteachers' digital skills cannot be directly applied to college professors. While the insights do provide a glimpse into teachers' digital competencies, university professors may face different challenges and requirements in their digital skill sets due to the diverse and complex nature of higher education. Therefore, dedicated studies on university professors' digital skills are necessary to better understand their unique needs and challenges.

Digital competencies of teachers in Japan

Japan's recent policy documents, including the Declaration on the Creation of the World's Most Advanced Nation and the Basic Plan for Promotion of Public-Private Data Use, as well as the Basic Policies for Economic and Fiscal Management Reform 2020: Overcoming the Crisis and Moving into a New Future, introduced in 2020, emphasize the importance of developing STEAM (Science, Technology, Engineering, Arts, and Mathematics) human resources with world-class skills in data science, mathematics, AI, and statistics. To achieve this goal, Japan's national policies highlight the need for "specialized/expert teachers" who are adequately trained in these high-priority areas.

The policies propose prioritizing digital literacy in primary and secondary education, with universities and technical colleges focusing on applied basic education. At the expert level, there is a strong emphasis on developing practical problem-solving skills in AI to tackle real-world challenges. To achieve this, Japan needs teachers at all educational levels—from schools to universities—who possess high levels of digital competency.

The 2018 Teaching and Learning International Survey (TALIS) data reveals that Japan faces challenges in integrating ICT in education.[43] While 60% of Japanese teachers have received formal ICT training, only 28% feel well-prepared to use these skills in teaching. Additionally, 39% express a high need for further ICT-focused professional development, much higher than the OECD average of 18%, indicating gaps in both initial preparation and ongoing support. Principals report significant resource inadequacies, with 43% citing insufficient digital technology for instruction, limiting ICT implementation in classrooms. Overall, Japan needs enhanced ICT training and infrastructure to support teachers and advance digital education efforts.

42   Organisation for Economic Co-operation and Development (OECDa). (2019). *Teaching and Learning International Survey (TALIS) 2018: Insights and Interpretations.* OECD Publishing. https://www.oecd.org/education/talis/TALIS2018_insights_and_interpretations.pdf

43   Organization for Economic Co-operation and Development (OECDb). (2019). *Teaching and Learning International Survey (TALIS) 2018: Insights and Interpretations.* OECD Publishing. https://www.oecd.org/education/talis/TALIS2018_insights_and_interpretations.pdf

Following the concerning TALIS results, Japan implemented fundamental reforms to enhance digital education starting at the elementary school level. Information skills and programming are now part of the elementary curriculum, and high school students must take a course called Information II, where they learn programming. Computer skills are also included in university entrance exams. These changes demand significant enhancements in teachers' digital and pedagogical skills, leading to reforms in teacher preparation programs, including higher education. Additionally, the government's GIGA initiative has intensified the need to develop teachers' digital competencies.

Information education is increasingly a priority. As mentioned in the country report, the Institute for Information Literacy and Competency Development at Miyagi University of Education focuses on producing teachers proficient in information education. Specifically, it undertakes educational and research initiatives in information literacy, promotes information education in affiliated schools, and organizes training programs for university and schoolteachers. An evaluation of the teacher training model developed by the Institute has yielded positive results. A graduate survey conducted in 2022 indicated that a significant majority of undergraduate and graduate students felt either fully capable or somewhat capable of utilizing information and communication technologies in their teaching.

Digital competencies of teachers in Mongolia

The Mongolian case study surveyed 264 instructors from four universities to assess their readiness for digital transition. The survey focused on various aspects, including access to devices, use of applications and platforms for e-learning, instructors' technical readiness, and information skills.

In terms of demographics, the majority of respondents were male (66%), with only a small proportion (8%) aged 25-29, 30% in the 30-39 age group, and the remaining 62% aged 40 or older. Regarding access to devices and the Internet, most instructors (94.3%) reported using laptops for teaching and lesson preparation. Internet access was high, with 92% having access at work and 85% at home. However, nearly two-thirds relied on mobile data packages to connect to the Internet, indicating some limitations in consistent connectivity.

The survey revealed the e-learning platforms used by instructors, with MS Teams being the most popular (77%), followed by Google Workspace (45%) and Zoom (44%). However, the usage of learning management systems (LMS) like Moodle was minimal, suggesting limited exposure to comprehensive e-learning tools among instructors. Additionally, instructors reported using over 20 software applications for their teaching and research activities, with basic tools such as MS Word, PowerPoint, and Excel being the most common, while other educational applications were utilized by a smaller proportion of respondents.

In terms of technical readiness, instructors reported high proficiency in basic computer skills, although these assessments were based on self-perception and relatively simple tasks. Most instructors rated themselves highly in information skills, indicating confidence in their ability to search for and evaluate online resources effectively.

Despite these positive self-assessments, the survey identified several challenges in e-course delivery, including financial barriers affecting student engagement, insufficient user devices for students, and inadequate online resources such as e-textbooks and handbooks. Instructors expressed uncertainty regarding other potential challenges, reflecting mixed perceptions of the overall e-learning landscape.

The findings also indicated that instructors demonstrated competence in e-learning practices, including preparing lessons and learning materials digitally, administering exams using digital methods, and maintaining communication with students. However, it is important to note that these findings are based on self-reported data, which may be influenced by a tendency to provide socially desirable responses. The case study suggests that

Mongolian university instructors have adequate technical and information skills to support the digital transition in higher education. However, challenges related to workload, resource availability, and financial constraints persist, potentially impacting their effectiveness in implementing e-learning strategies.

Contrary to these findings, studies in Mongolia reveal significant gaps in teachers' ability to integrate technology into teaching, despite possessing foundational digital skills (Batsukh & Baatar, 2020). The COVID-19 pandemic highlighted these deficiencies, as many teachers struggled to adapt to virtual instruction (Javkhlan & Baatar, 2021). Current teacher education programs are lacking in preparing educators for modern digital demands, indicating a need for curriculum reform and comprehensive ICT training (MNUMS, 2022). A UNESCO report notes that while teachers recognize the value of digital tools, they often feel unprepared and desire more training (UNESCO, 2020). Limited access to resources and structured support further constrains teachers' digital capacities, necessitating enhanced training and improved technology access.

The OECD's TALIS 2018 report provides valuable insights into Mongolian teachers' digital skills and their professional development needs.[44] According to the report, many Mongolian teachers recognize the importance of integrating digital skills into their teaching. However, they often face challenges such as limited access to digital resources and infrastructure, impacting the effective use of technology in classrooms. A significant portion of teachers indicated a need for further professional development in ICT, suggesting both an awareness of the value of digital proficiency and a gap in skills. The emphasis on digital capacity development reflects an ongoing commitment to improving these skills among educators to meet modern educational needs.

Digital competencies of teachers in South Korea

South Korea recognizes that teachers, as pivotal agents of change, play a critical role in the successful implementation of digital education policies, positioning them at the heart of educational reform (Seo, 2023). For meaningful pedagogical innovation, teachers are encouraged to see themselves as facilitators rather than mere transmitters of knowledge. In alignment with the government's focus on student-centred education, teacher education and professional development programs have been continuously revised to reflect evolving pedagogical paradigms. At the policy level, ongoing professional development for teachers is a priority, emphasizing targeted training and support to promote the pedagogically sound integration of technology in education.

Since 1996, when Korea introduced the ICT Skill Standard for Teachers (ISST) focusing on computer literacy, the focus of teacher training has shifted from basic ICT skills to effective integration of ICT into the classroom. Pre-service teachers are now required to take courses on educational methodology and technology. As the country adopted its smart education strategy and digital textbooks, teacher competency requirements have continued to evolve. The Korean Education and Research Information Service (KERIS) provides training on educational technologies through ICT symposiums, online courses, and workshops, while an interactive knowledge-sharing platform, Knowledge Spring, supports teachers' training in digital education.

In recent years, Korea's push for digital transformation in higher education has included initiatives like the AI Education Alliance and Policy Lab (AIEDAP), targeting both pre-service and in-service teachers as well as faculty in Colleges of Education. The pre-service teacher curriculum now incorporates AI and digital technologies, preparing future educators for tech-driven instruction, hands-on experience, and critical thinking skills.

Among university faculty, digital readiness varies. While some professors are highly proficient in using digital tools,

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44   Organization for Economic Co-operation and Development (OECDc). (2019). *Teaching and Learning International Survey (TALIS) 2018: Insights and Interpretations.* OECD Publishing. https://www.oecd.org/education/talis/TALIS2018_insights_and_interpretations.pdf

others, particularly in non-technical fields, require additional support. Professors are expected to go beyond basic technology use, incorporating learning management systems (LMS), multimedia content, and online learning into their teaching. Faculty in STEM and tech-related fields often enhance their instruction with advanced tools such as coding, AI, and virtual simulations. To aid this transition, Korean universities offer comprehensive professional development opportunities, including workshops, seminars, and hands-on training on LMS, online teaching platforms, and digital content creation. Many institutions have established e-learning or educational technology centres that provide personalized training and instructional support for faculty and students. National initiatives also play a role, with government funding dedicated to improving digital competency among educators, including university faculty.

While there are no standardized national digital competency requirements for university professors, individual institutions typically set their own expectations. Professors are generally expected to demonstrate proficiency in managing online and hybrid courses and using digital resources for effective teaching. Some universities assess digital competency through course evaluations and link digital proficiency to performance reviews, promotions, and professional development goals. At Seoul National University (SNU), for instance, the Faculty of Liberal Education has developed a robust programme offering workshops, EdTech clinics, and faculty meetings to strengthen faculty members' digital pedagogical skills. Online video resources complement these activities, providing insights into innovative teaching methods and the effective integration of technology in teaching and learning. Studies show that building teachers' capacity to design and implement ICT practices has been instrumental in achieving South Korea's educational digital transformation goals (So and Seo, 2020).

The 2018 Teaching and Learning International Survey (TALIS) highlights a moderate integration of ICT in South Korea's education system.[45] Approximately 59% of teachers reported receiving formal training in ICT, and 48% felt well-prepared to use ICT in teaching, slightly above the OECD average of 43%. Furthermore, 61% of teachers participated in recent professional development activities focused on ICT, indicating a commitment to skill enhancement. However, 21% of teachers expressed a high need for further ICT training, suggesting gaps in existing programmes. In terms of student engagement, 30% of teachers regularly allowed students to use ICT for classwork, while 24% of principals reported an inadequacy of digital resources, reflecting ongoing infrastructure challenges. Although South Korea demonstrates a strong commitment to ICT professional development, areas remain for improving teacher preparedness and resource availability.

5.3 Digital competencies among students

This section discusses student preparedness for navigating higher education, where digital competencies are increasingly essential due to the integration of digital technologies. As universities expand their use of technology in curricula, students' digital skills become critical for both academic success and a productive learning experience. These skills enable students to effectively access and evaluate vast information sources, collaborate through digital platforms, and apply innovative problem-solving approaches. The digital skills also support career readiness of students by equipping them with the digital literacy required in most modern workplaces. Furthermore, fostering digital skills promotes lifelong learning, allowing students to adapt to new technologies and remain current in their fields. Cultivating these competencies is central to higher education's digital transformation, preparing students for dynamic, tech-enhanced environments within and beyond academia.

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45   OECDd. (2019). *Teaching and Learning International Survey (TALIS) 2018: Insights and Interpretations.* OECD Publishing. https://www.oecd.org/education/talis/TALIS2018_insights_and_interpretations.pdf

Digital competencies of students in China

In China, the emphasis on digital competencies and skills in education has become increasingly significant, starting from early education and continuing through university. The national curriculum incorporates digital literacy as a core component, introducing students in primary schools to basic computer skills, Internet research, software applications, and Internet safety. The Ministry of Education has established guidelines to promote digital literacy as a vital competency, focusing on essential skills such as software usage, online etiquette, and foundational programming. This early exposure aims to equip students with the tools they need to thrive in a technology-driven world.

At the university level, digital skill development remains a priority. Higher education institutions aim to enhance students' competencies through specialized courses in information technology, data analysis, and digital media. Many universities mandate coursework specifically designed to improve digital skills. To support this learning, institutions often provide resources such as workshops and seminars that offer hands-on training in advanced digital tools and technologies. Additionally, collaborations with tech companies allow students to gain practical experience through internships and projects, fostering a deeper understanding of the digital landscape.

Students are expected to develop a diverse set of digital skills throughout their education. Proficiency in basic computer operations and common software applications, such as Microsoft Office, is essential. They should also be adept at Internet research, digital communication, and understanding data privacy and cybersecurity fundamentals. Basic programming knowledge, particularly in languages like Python and Java, is increasingly important, along with the ability to utilize digital tools for collaboration and project management. These skills are critical for success in an increasingly competitive job market.

Despite progress, challenges persist in digital education in China. One major issue is the disparity in access to technology and quality education between urban and rural areas, with urban students often having more resources and better-trained educators. Additionally, the emphasis on standardized testing can overshadow the importance of practical digital skills, hindering students' readiness for real-world applications. Keeping curricula aligned with rapid technological advancements presents another challenge, as educators must continually adapt their methods and materials. Furthermore, there is a growing recognition of the need to foster critical thinking and creativity alongside technical skills, ensuring students are not only proficient in technology but also able to apply it innovatively.

Digital competencies of students in South Korea

The 2015 National Curriculum in South Korea prioritizes digital literacy and practical experience across key subjects, including "Technology" and "Home Economics" for middle and high school students, to deepen understanding of the country's evolving industrial landscape. From elementary school onward, Information and Communication Technology (ICT) education is embedded across subjects, guided by ICT Education Guidelines from 2000 and 2005. This includes four core domains: Computers and Networks, Presentation and Logic of Information, Algorithm and Modeling, and Information Society and Ethics. Within these domains, six essential skills are emphasized: Define, Access, Evaluate, Create, Manage, and Communicate, helping students develop comprehensive digital competencies vital for today's information society.

In 2019, software education expanded to require 17 hours per year for elementary students, with middle school students receiving 34 hours, while high school students can opt for elective courses. The STEAM framework encourages real-world engagement, including recognizing problems, creating innovative solutions, and developing emotional connections to challenges. Additionally, South Korea's "Act on Fostering and Supporting Women Scientists and Technicians" promotes greater female participation in science and technology fields through

protective measures and affirmative actions in academia and employment.

South Korean students thus enter higher education well-prepared to thrive in digital environments due to early exposure to technology and robust national curricula in digital literacy and ICT. Supported by advanced infrastructure, including widespread Internet access and device availability, they readily engage with online learning resources and platforms. In response to the rapid digital transformation of society, South Korean universities are bolstering digital readiness with resources like Learning Management Systems (LMS), digital textbooks, online research databases, and hybrid learning models. Students benefit from specialized courses in data analysis and programming, along with device loan programmes and digital literacy training to support equitable access.

With e-learning integral from the start, South Korean universities offer dynamic digital environments that support diverse educational needs. High-quality resources aid the transition to blended and flipped classrooms, enhancing traditional instruction. Recognizing students as digital natives, institutions encourage students to navigate LMS platforms confidently and leverage advanced research tools. Government policies and institutional support promote academic engagement and digital readiness, critical for success in modern e-learning settings.

Digital competencies of students in Japan

Japan's vision for ICT in education, articulated in 2011, acknowledges the country's slower progress in digital literacy compared to other industrialized nations. In response to an OECD 2015 report indicating that 25% of young Japanese adults (aged 16-29) lacked basic computer skills, the Japanese government recognized an urgent need to bolster information literacy. Defined as the capability to utilize, understand, and participate effectively in the information society, information literacy was recommended as a compulsory subject for middle and high school students. The vision document links ICT skills to personalized learning and collaboration, highlighting their role in preparing students for a dynamic, digital world.

Recent initiatives, like the GIGA School Programme, have significantly advanced digital literacy by providing every student with a personal computing device and high-speed Internet, facilitating ICT integration across subjects.[46] Since 2020, programming has been mandatory in elementary schools, aiming to equip students with foundational skills early. While Japan has made strides, especially with digital learning adaptations during COVID-19, studies reveal that university students often feel less digitally prepared than their international peers, particularly in information literacy, online collaboration, and digital content creation. To address this, many Japanese universities have incorporated digital skills into their curricula to enhance students' digital proficiency and foster their familiarity with educational platforms.

At the policy level, Japan is aligning its education system with UNESCO's concept of digital citizenship. This approach, reflected in national policies and reports by the Ministry of Internal Affairs and Communications (e.g., the 2022 Media Information Literacy Survey and 2023 ICT Policy Subcommittee Report), underscores critical thinking, ethical digital conduct, and online safety. By fostering awareness of privacy, copyright, and cyber risks, Japan is committed to preparing students as responsible digital citizens, equipped to navigate complex digital landscapes with integrity and respect. This holistic framework reflects a commitment to creating a safe, inclusive, and equitable digital environment for all learners.

At the university level, students are expected to possess strong digital literacy skills; however, studies indicate a gap in these skills compared to international peers. Many students also recognize the need to improve their digital

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46   Ministry of Education, Culture, Sports, Science and Technology (MEXT). (2020). *The image of the transformation of learning brought by "1 device for 1 student with a high-speed network."* https://www.mext.go.jp/en/content/20200716-mxt_kokusai-000005414_04.pdf

abilities, especially for study abroad opportunities. Key expected digital skills include information and data literacy, effective communication and collaboration using digital tools, digital content creation, and understanding of safety and security practices.

Overall, while Japan is making strides in integrating ICT into education, further efforts are needed to ensure that university students are fully equipped with the necessary digital skills for the future. Recent policy documents emphasize that there is a strong need for universities and other institutions in the New Normal (post COVID-19) to improve education and provide better learning opportunities for students by utilizing digital features.

Digital competencies of students in Mongolia

The Mongolian country study conducted a comprehensive survey to assess digital readiness among university students, focusing on five primary dimensions: device usage, digital and information skills, adaptability to digital transitions, and students' perspectives on e-learning. The survey included nearly 1,500 students from four universities, predominantly undergraduate, with around two-thirds of the participants being female. This study offered a valuable overview of students' digital readiness for higher education in Mongolia.

Device usage and learning platforms: The survey revealed that smartphones (92%) and laptops (84%) were the most commonly used devices for academic tasks, while desktop computers and tablets were less popular. Key platforms used by students included MS Teams, Moodle, Google Classroom, and Google Meet. However, engagement with global online learning platforms, such as MOOCs, remained relatively low. While some students accessed MOOCs, the findings suggest that only a quarter of students had engaged with MOOCs or micro-credentialing courses, indicating potential gaps in accessing globally curated digital learning content.

Readiness for digital transition: Students' readiness was assessed across four skill domains: Basic Device Operations, Software and App Management, Document and Content Management, and Internet and Online Activities. Overall, students rated themselves highly, reflecting confidence in both fundamental digital skills and more advanced competencies, such as navigating productivity software and recognizing online security risks. These ratings suggest a solid baseline for students' digital adaptability in academic environments.

Information and technology management skills: The survey highlighted strong self-assessed proficiency in information management, covering skills such as sharing files, verifying information accuracy, and distinguishing between credible sources and unreliable data. Students also rated their technology usage positively, indicating confidence in their ability to adapt quickly to new technologies, manage social media, and exercise Internet safety. While ratings were high, the study indicated that expanded support in digital literacy could further empower students.

Advanced digital skills and attitudes towards E-Learning: The survey explored students' comfort with advanced digital skills, including intellectual property awareness, content creation, and effective online communication, such as email etiquette and cloud storage management. Most students rated themselves highly in these skills, though the report suggested additional support to fully integrate these competencies. Regarding e-learning, students generally held positive attitudes, though engagement with resources like MOOCs was less familiar, signalling areas for increased exposure and integration into curricula.

The findings from the Mongolian country study suggest that students are moderately prepared for digital learning transitions, with strong baseline competencies in technology usage and information management. However, growth areas include expanding access to global e-learning resources and building advanced digital content creation skills. As Mongolia advances its digital education strategies, fostering continuous digital skill development will be essential for student success in an increasingly digital academic environment.

Capacity gaps and challenges

The digital transformation of higher education in East Asia is advancing rapidly, with each country showcasing distinct strengths. South Korea, Japan, and China lead in terms of digital infrastructure and tech-savvy student populations, facilitating the integration of technology across teaching, learning, and administration. These countries have built robust digital systems and broad accessibility, enabling extensive engagement with online platforms and digital learning tools.

In Mongolia, digital readiness is progressing, with a focus on expanding access and skills development, especially in rural regions where connectivity and device access have been improving. Professors and students in Mongolia are steadily building digital competencies through targeted initiatives aimed at increasing digital engagement.

Faculty readiness across East Asia varies, with many younger and STEM-focused professors proficient in digital tools, while non-technical and senior faculty are gaining familiarity with digital methods. Increasing the confidence and knowledge of senior faculty members about digital technologies and transformation is important. Training programmes across the region are evolving to support comprehensive technology integration into teaching.

Region-wide, universities are embracing digital transformation through policies that support digital learning and resource access. In China, Japan, and South Korea, cohesive digital strategies are fostering inclusive and technology-rich learning environments, setting a positive course for sustainable digital growth tailored to each country's unique context.

In the overall, as East Asian universities shift to a digitally dominant approach, mastering digital skills is no longer just an option—it's essential for both faculty and students to keep up. While this transition can feel overwhelming, it also presents a valuable opportunity to develop competencies that will be invaluable in the future.

Building on the foundations established in the previous chapters, the upcoming chapter, Chapter VI, delves into the prominent digital initiatives of East Asia. These initiatives, each representing four countries of the region, stand out as key examples of digital transformation in higher education.

Chapter VI

Key digital initiatives transforming higher education in East Asia

This chapter explores pivotal digital initiatives that are reshaping the landscape of higher education in four countries of East Asia. These initiatives collectively highlight the region's diverse approaches to the digital transformation of education. Each initiative demonstrates the unique strategies these countries have adopted to integrate various digital systems into their education frameworks, responding to both local needs and global trends. By examining these key projects, the chapter will provide insights into how these digital systems are reshaping learning environments, enhancing accessibility, and fostering innovation across East Asia.

6.1 China's MOOC Triumph

Massive Open Online Courses (MOOCs) have significantly reshaped the landscape of higher education worldwide, and China is no exception. As the world's most populous country, China's rapid and widespread adoption of MOOCs has been driven by government initiatives, educational reforms, and technological advancements. This section traces the origins of MOOCs in China, their evolution, key drivers, policy frameworks, beneficiaries, and the challenges.

Origin and evolution of MOOCs in China

MOOCs first gained international attention in 2012 with the launch of platforms like Coursera, Udacity, and edX in the United States. Recognizing the potential of this digital learning model, China began exploring its use to transform education. The first major Chinese MOOC platform, CNMOOC, was established in 2013, followed by XuetangX, which launched later that same year. Founded by Tsinghua University, XuetangX has become one of the largest MOOC platforms in China, serving a user base of 133 million as of early 2024, making it the second largest globally.[47] In many parts of the world, MOOCs is considered a cost-effective solution for increasing access to higher education (Wang, 2024).[48]

China's involvement with MOOCs was initially inspired by the global trend but was also driven by internal needs, such as expanding access to education in a country where traditional university spots are limited. The government views MOOCs as a means to democratize education, provide lifelong learning opportunities, and improve overall educational quality. A primary objective of the government's oversight is to enhance equity in higher education by promoting MOOCs to eliminate barriers related to time and location, enabling students from various regions to access quality educational resources. This initiative aligns with broader strategies to reform traditional teaching models and facilitate the sharing of educational resources among universities.

The development of Massive Open Online Courses (MOOCs) in China has seen exceptional growth, marked by clear phases that underscore their expanding role in the country's educational landscape. The evolution of MOOCs

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47   Global MOOC and Online Education Alliance. (n.d.). *China ranks first in the world in numbers of MOOCs and viewers.* Retrieved October 31, 2024, from https://mooc.global/xuetangx/china-ranks-first-in-world-in-numbers-of-moocs-and-viewers/

48   Wang, L. (2024). MOOCs will drive HE innovation across the Asia-Pacific. *University World News.* https://www.universityworldnews.com/post.php?story=20240614111839425

in China can be categorized into three phases.[49] Beginning in 2013 with the early adoption phase, prominent universities pioneered the introduction of MOOCs by collaborating with international platforms such as edX and Coursera. Alongside these partnerships, they launched China-specific platforms like XuetangX and iCourse to address the unique needs of local students and educators. This period was characterized by experimentation, with universities testing how MOOCs could complement traditional education.

As the movement gained traction, it entered the expansion and localization phase, where universities across China developed Mandarin-language courses, allowing for greater accessibility and cultural relevance. To support this wave, the Ministry of Education initiated policies and funding programmes encouraging the widespread creation of MOOCs, aiming to improve teaching quality, extend access to higher education, and serve the learning needs of diverse populations. By the height of this phase, thousands of MOOCs were available, offering a wide array of subjects that aligned with China's educational priorities and socio-economic goals.

In the current phase of national integration and standardization, MOOCs are not only embedded within China's education system but are also pivotal to its strategy for lifelong learning, skill development, and vocational training. Policy frameworks now recognize MOOCs as part of formal education, further validated by the COVID-19 pandemic, which accelerated the integration of online learning solutions to maintain educational continuity. MOOC platforms are increasingly connected with traditional universities, where many courses are recognized for academic credit, effectively bridging online and offline learning. This phase has also seen substantial government investment in digital infrastructure to support ubiquitous access to MOOCs, positioning them as fundamental components in China's broader educational reform.

Today, MOOCs in China serve not only as tools for remote learning but also as a means of democratizing education, extending opportunities to underserved communities, and fostering workforce readiness. Supported by significant national initiatives, this systematic approach continues to evolve, paving the way for an educational ecosystem that aligns with China's vision of a digitally connected, inclusive society.

Key drivers of the MOOCs agenda

China's MOOC agenda has been propelled by a multifaceted ecosystem of actors, most notably the government, leading universities, and EdTech companies. This collective push has been underpinned by a set of strategic drivers that address both domestic needs and global education trends.[50]

Government support: The Chinese government has played a crucial role in advancing the MOOC agenda through comprehensive policies and national programmes. Initiatives like the "University Online Open Course Development Program" and the integration of MOOCs into the "China Education Modernization 2035" strategy reflect a commitment to modernizing education. These policies aim to enhance higher education quality, support lifelong learning, and stimulate innovative teaching methods.[51] Government investments in digital infrastructure and educational equity have also positioned MOOCs as essential tools for democratizing learning and extending opportunities to underserved communities.

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49   Liang-Lu, H., Huang, H.-Y., & Ye, Q.-Y. (2018). The development of MOOC and its impact on higher education in China. In *Proceedings of the International Conference on Education Reform and Management Science (ERMS 2018)*. Nanjing University of Finance and Economics, Nanjing, China. https://www.researchgate.net/publication/326310589_The_Development_of_MOOC_and_Its_Impact_on_Higher_Education_in_China

50   Jiao & Fan (2019). Current state of practice and research on MOOCs in Mainland China. In J. Jiao & Y. Fan (Eds.), *MOOCs and open education in the Global South* (1st ed., pp. 13–30). Routledge.

51   Ministry of Education, People's Republic of China. (2019a). *China Education Modernization 2035*. Retrieved from http://en.moe.gov.cn/documents/reports/202102/t20210209_513095.html

Strong cultural foundation: China's longstanding cultural emphasis on education has facilitated the widespread acceptance and integration of MOOCs. The value placed on continuous learning and self-improvement aligns well with the MOOC model, supporting its growth as a respected component of modern Chinese education.

Universities and elite institutions: Leading institutions, such as Tsinghua University, Peking University, and Fudan University, are at the forefront of MOOC development, offering hundreds of courses on both domestic platforms like XuetangX and international platforms such as edX. These universities leverage MOOCs not only to deliver education but also to expand their reach, attract a global audience, and enhance their reputations as international education leaders.

EdTech Companies: Private companies like Tencent, NetEase, and Alibaba have been instrumental in the MOOC movement by investing in platforms and technological infrastructure. Their involvement recognizes MOOCs as a critical means to meet the growing demand for accessible, flexible education and vocational training.

Demand for accessible education: The rising demand for affordable, flexible, and accessible education has driven the need for scalable online learning solutions. MOOCs provide a model that allows individuals to access quality education, regardless of location or economic status, furthering educational equity.

Technological advancements: Breakthroughs in Internet technology, video streaming, and digital communication have made it possible to deliver high-quality educational content to vast audiences. These advancements enable MOOCs to offer an interactive, engaging experience, comparable in many ways to traditional classroom settings.

Lifelong learning and workforce development: The evolving job market and the need for continuous skill development have intensified demand for learning options that accommodate working adults. MOOCs are particularly suited to provide flexible, on-demand courses that support career advancement and personal growth.

Institutional outreach and economic efficiency: Universities use MOOCs to expand their influence and attract a diverse student population, strengthening their global reach. MOOCs also offer an economically efficient way for institutions to educate massive audiences without the limitations of physical infrastructure, thus optimizing educational delivery for a broader audience.

Together, these drivers highlight China's strategic approach to making MOOCs an essential component of its educational framework, enabling scalable, high-quality, and equitable learning solutions aligned with the nation's modernization goals.

Role of the government and MOOCs policies in China

The Chinese government plays a pivotal role in overseeing and promoting MOOCs to enhance higher education through a comprehensive approach that includes quality assurance, policy regulation, infrastructure support, and efforts to enhance equity and global collaboration.[52]

Key aspects of government oversight:

- National Recognition and Quality Assurance: The Ministry of Education has established a rigorous evaluation process for national recognition of MOOCs, assessing courses based on criteria such as design, content quality, teaching effectiveness, and social impact.

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52   Ministry of Education, People's Republic of China. (2019b). *China Education Modernization 2035*. Retrieved from http://en.moe.gov.cn/documents/reports/202102/t20210209_513095.html

- Policy and Regulatory Framework: In 2015, the Ministry of Education issued directives aimed at strengthening the development and management of MOOCs, standardizing course creation, sharing, and utilization to meet educational standards and promote equitable access.
- Infrastructure and Technological Support: The government invests in expanding digital infrastructure to support MOOCs, enhancing high-speed Internet access, and developing platforms like XuetangX.
- Global Collaboration and Standards: China actively engages in international collaborations to enhance the quality and reach of its MOOCs, participating in global MOOC conferences and promoting the sharing of best practices.

Policies supporting MOOCs

Several policies support the implementation of MOOCs in China. The "Double First Class" Initiative indeed emphasizes the development of world-class universities, and MOOCs play a central role in this effort. The University Online Open Course Development Program encourages universities to create and share top-tier online courses, while the National Lifelong Learning Initiative recognizes MOOCs as vital resources for lifelong learning, especially for working adults. Additionally, integrating MOOCs into traditional programs is a growing trend, allowing students to earn academic credits through online courses, bridging digital learning with formal education.

Beneficiaries of MOOCs

MOOCs offer diverse benefits across multiple groups of learners. College students gain access to high-quality, often free courses from prestigious institutions, providing a flexible learning supplement to traditional education. Working professionals can upskill, obtain certifications, or explore new fields, especially valuable for those unable to commit to full-time programmes. For rural and underserved communities, MOOCs address educational disparities by making high-quality courses accessible in areas lacking higher education resources. Universities benefit from MOOCs by expanding their reach, enhancing teaching methods, attracting international students, and fostering global collaboration.

Recognition of MOOC courses

China is integrating MOOCs into its formal educational system, with many universities offering credit-bearing courses. The process for gaining national recognition involves several steps. Universities in China submit MOOCs for evaluation, provided they are developed by Chinese institutions and have been offered for at least two sessions. The evaluation process assesses courses based on criteria such as team composition, design, content quality, teaching methods, social impact, and learner support. Recognized MOOCs receive labels on platforms, must remain free for learners, and undergo periodic reviews to ensure that the content and support remain current and effective.

Nationally recognized MOOCs are categorized into three main types: Basic courses, Cultural courses, and Professional courses, with subjects such as Computer Science, Electronics & Information, Mathematics, Business & Management, and Foreign Languages being frequently offered.

Challenges and issues

Despite the numerous opportunities that MOOCs present in China, several significant challenges persist, affecting

both quality and accessibility (Gütl, Rizzardini, Chang, & Morales, 2017).[53]

Quality variability and instructional design: One of the foremost challenges is the inconsistent quality of MOOCs, which can diminish the overall learner experience. Many courses suffer from varied instructional design and delivery standards, often due to limited training in curriculum development for educators. This inconsistency can frustrate learners, leading to disengagement and low completion rates. There is also a lack of emphasis on deep learning and critical thinking, with many MOOCs focused on surface-level knowledge rather than fostering in-depth understanding.

Low engagement and motivation: MOOCs are predominantly self-paced, which can make it difficult to maintain learner engagement and motivation. The limited interaction and personalization in many MOOCs create a one-size-fits-all experience, which may not cater to individual needs. The overwhelming number of available courses can also lead to choice overload, making it challenging for learners to navigate their options effectively.

Digital divide and accessibility barriers: The digital divide continues to hinder equitable access to MOOCs, particularly for students in rural areas where Internet access is limited. This disparity prevents many potential learners from fully participating, creating an uneven playing field that undermines the inclusive goals of MOOCs.

Recognition and credibility: The absence of standardized national guidelines for curriculum and platform quality contributes to inconsistent recognition and credibility of MOOC credentials. Without formalized, standardized credit systems, it is challenging for learners to receive recognition for their accomplishments, which can limit the practical value of MOOCs in academic and professional contexts.

Technical and institutional support: Many institutions face difficulties in providing sufficient technical support to both educators and students, which can disrupt the smooth delivery and functionality of MOOCs. Furthermore, university professors may lack the specific training required to effectively design and deliver online courses, adding to the pedagogical challenges.

Funding and sustainability: High-quality MOOC production requires substantial financial investment, raising concerns about the long-term sustainability of these programmes. As MOOCs expand, funding constraints may impact their quality and accessibility.

Limited personalized support and information literacy skills: Given the large scale of MOOCs, providing personalized support is challenging, which can impact learner success. Additionally, many students lack the information literacy and self-regulated learning skills necessary to succeed in these self-directed environments.

Addressing these challenges—through improvements in instructional design training, national standards, digital infrastructure, and technical support—will be essential to ensure the continued growth and effectiveness of MOOCs in China's educational ecosystem.

Policy recommendations for maximizing the potential of MOOCs

To enhance the quality and accessibility of MOOCs, it is vital to establish and enforce national quality standards for their design, content, and delivery. Investing in training programmes focused on online pedagogical methods will ensure instructors are equipped to deliver effective online courses. Expanding broadband access in rural areas is essential for reliable access to MOOCs for all learners. Monitoring compliance with national frameworks for

53   Gütl, C., Rizzardini, R. H., Chang, V., & Morales, M. (2017). Digital transformation challenges: A case study regarding the MOOC development and operations at higher education institutions in China. In C. Gütl, V. Chang, M. Morales, & R. H. Rizzardini (Eds.), *Digital Transformation in Higher Education* (pp. 193-213). Springer. https://doi.org/10.1007/978-3-319-58503-1_8

recognizing and accrediting MOOCs will facilitate transferable academic credits. Integrating MOOCs into national lifelong learning strategies can promote collaboration between universities and industries. Providing funding incentives for universities to create innovative MOOCs in critical areas, while encouraging platforms to offer student support and engagement, will improve completion rates. Exploring sustainable funding models will ensure free or low-cost courses remain available. Promoting blended learning models that combine MOOCs with traditional instruction offers a more comprehensive educational experience. Finally, establishing mechanisms to assess the long-term impact of MOOCs on educational outcomes and skills development will help gauge effectiveness and drive continuous improvement.

To sum up, as China continues to develop its MOOC landscape, the future looks promising. The integration of MOOCs into traditional education systems will likely deepen, creating hybrid learning models that combine online and offline education. Moreover, advancements in technology—such as artificial intelligence, machine learning, and adaptive learning—will further enhance the learning experience, allowing for personalized education tailored to individual needs. Additionally, international collaboration in MOOC development will foster knowledge sharing, ensuring Chinese MOOCs continue to evolve and improve in quality.

6.2 A university's journey towards digital transformation: The case of Kagawa University

Background

Kagawa University, established in 1949, is a national public university in Takamatsu, Japan, serving approximately 6,530 students across faculties such as Agriculture, Economics, Education, Engineering, Law, and Medicine. Committed to academic excellence and societal contribution, Kagawa University aims to cultivate creative and compassionate professionals. It is leading digital transformation efforts through initiatives like the Digital ONE Strategy and the Kadai DX Boot Camp, fostering innovation and collaboration within and beyond the university community.

Digital transformation initiative at Kagawa University

Kagawa University's digital transformation initiative is spearheaded by the Digital Transformation (DX) Promotion Research Centre, part of the Integrated Centre for Information Technology Promotion. Under Professor Rihito Yaegashi's leadership, the centre is pivotal in advancing the university's initiative. Kagawa University's strategy emphasizes establishing an in-house agile development system, enabling independent solution creation. This Do-It-Yourself (DIY) approach involves agile practices, proactive issue identification by staff, and the student-led 'DX Lab' initiative, promoting collaboration with local communities and fostering university-led civic activities. This approach emphasizes self-sufficiency and hands-on involvement, encouraging members of the university community to develop their own solutions—often without relying on extensive external support or highly specialized equipment. This can include creating digital content, enhancing learning environments, or managing administrative processes through adaptable, user-friendly technologies.

The School of Creative Engineering, established in 2018, is integral to these efforts, focusing on developing "next-generation engineering personnel" through a design thinking framework that emphasizes user understanding and iterative problem-solving. Professor Yaegashi advocates for a shift from traditional waterfall development to agile methodologies, emphasizing "hypothesis-testing agile development." This process identifies "minimum viable products" (MVPs) that incorporate essential user functionalities, allowing for adaptive, collaborative, and rapid delivery.

A cornerstone of the university's DX policy is the "Digital ONE Strategy," which integrates its previously dispersed campuses into a unified management system (Figure 7). Based on the OMO (Online Merges with Offline) concept, this strategy enhances the quality of operations, education, and research through improved collaboration between students and staff. Components of this strategy include the Digital ONE Campus, Digital ONE Office, and Digital ONE Lab for in-house system development.

Figure 7: Kagawa University's Digital One Strategy
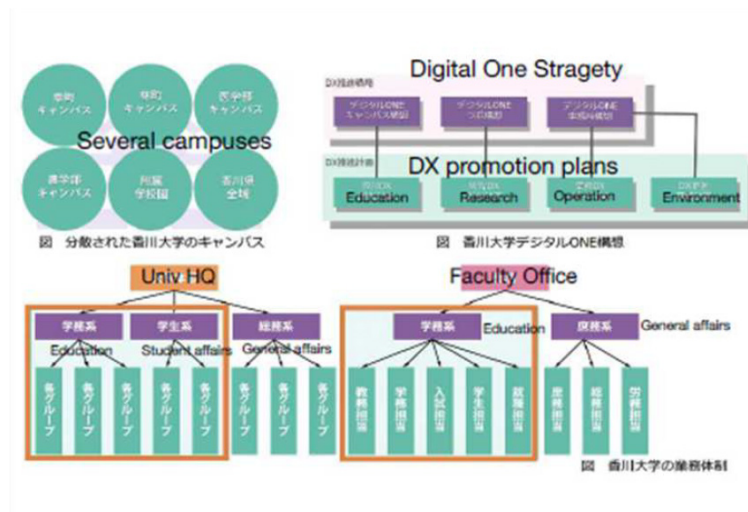
Source: Japan draft country report (2024)

Kagawa University digital transformation activities in practice

Kagawa University's DX approach prioritizes user experience (UX) innovation and productivity enhancement through a strategy termed "UX growth hack." This concept fosters cross-departmental collaboration to analyse user experiences and implement rapid improvements, merging marketing, product development, and data analytics to test impactful strategies.

An operational digitization survey revealed insights into work processes and identified challenges, such as a culture valuing long overtime hours and the interruptions caused by phone calls. In response, the university developed a knowledge database, a chatbot system, and a centralized lost and found management system using an image database for efficient item retrieval.

The university also hosts the "Kagawa ICT Town-Building Idea-Thon," which encourages collaboration among students, local companies, and government officials to address community issues. Utilizing no-code and low-code application development through Microsoft's Power Platform, students and staff lead system development in the DX Lab.

From May 2021 to January 2023, Kagawa University developed over 50 operational business systems in-house, employing a bottom-up, field-led approach. Key projects include absence report systems, commuting allowance applications, and external research fund information sharing systems. Interviews with DX Lab students indicate that these activities enhance their engineering skills and provide practical experience in "design thinking" and "co-creation."

The university visualizes and analyses data from these systems using Microsoft Power BI to identify challenges and

drive improvements, with initiatives like the "Concurrent Work Data Project" aimed at consolidating data across departments. Additional systems include applications for absence reporting, staff attendance, and job search status.

Hands-on events at Kagawa University

Kagawa University's "Hands-on" events provide participants with practical experience in developing business systems and data analysis. By July 2024, 29 events had attracted 629 external participants and 954 overall. These events, alongside idea-thons and system development initiatives, are central to Kagawa University's DX efforts. Hiroyuki Takeda from the DX Promotion Section emphasizes the interrelated nature of these initiatives, involving interviews with faculty to identify work-related issues, generating solutions, and developing systems based on insights from hands-on sessions.

Digital ONE Ambassadors play a crucial role in promoting the Digital ONE strategy, conducting UX research within departments and facilitating system development. Since their inception, 176 systems have been developed, with results shared in debriefings.

Moreover, the Information Media Centre organizes the annual Kadai DX Boot Camp, a short-term intensive training course for students, staff, and young IT engineers focusing on DX thinking and programming techniques. Participants develop apps and systems, tackling user problems and creating prototype solutions during an all-day judging session.

A bottom-up, inclusive process

Kagawa University exemplifies best practices in digital transformation, aligning closely with academic definitions and the United Nations' vision. The university employs a bottom-up, agile development process, engaging all structures and staff, including students, to foster an inclusive environment. It operates as a civic movement, extending solutions to local communities through initiatives like hands-on activities and the Kadai DX Boot Camp.

Professor Yaegashi highlights that digital transformation embodies the "democratization of technology," making it accessible to all. The current landscape allows easier learning and utilization of technology, driven by individual motivation with community support. Kagawa University's DX policies and initiatives provide valuable insights for achieving effective and inclusive digital transformation.

6.3 Korea's AI Education Alliance and Policy Lab (AIEDAP)

Background

While many countries remain uncertain about the role of AI in education and other sectors, South Korea has adopted a proactive approach, positioning itself at the forefront of educational innovation. As a global leader in digital transformation, South Korea's extensive efforts to integrate technology into education illustrate its commitment to preparing both educators and students for the digital age. In recent years, Korea has initiated a range of initiatives designed to equip the next generation with the skills needed to thrive in a rapidly evolving technological landscape. This proactive stance serves as a benchmark for other nations aspiring to embrace digital transformation in education. The case study of Korea exemplifies a commitment to leveraging AI and digital technologies throughout the education system.

AIEDAP and its features

The AI Education Alliance and Policy Lab (AIEDAP) is a cornerstone of South Korea's National Agenda 81, titled "Cultivating One Million Digital Talents." This ambitious plan aims to nurture one million professionals in fields such as AI, big data, the metaverse, and other digital technologies by 2026, addressing the increasing demand for digital expertise and promoting the interdisciplinary fusion of digital technologies across various fields of study. In line with National Agenda 81, the South Korean Ministry of Education announced a comprehensive plan in 2022 to train teachers in AI competencies with the broader goal of developing digital talents as outlined in the national strategy.

AIEDAP establishes collaborative governance and partnerships among the private sector, government authorities, and educational institutions. The initiative primarily aims to ensure that both in-service and pre-service educators are equipped to integrate AI into their teaching practices, fostering a more innovative and personalized learning environment. The plan's core vision is encapsulated in the phrase "classroom revolution led by teachers." By empowering teachers with AI competencies, the Ministry of Education aims to facilitate transformative changes in teaching methodologies.

This teacher-led revolution underscores the pivotal role of educators in driving the digital transformation of classrooms, ensuring that both students and teachers are prepared for the future. As articulated in the Beijing Consensus on Artificial Intelligence and Education, "while AI provides opportunities to support teachers in their educational and pedagogical responsibilities, human interaction and collaboration between teachers and learners must remain at the core of education. Teachers cannot be displaced by machines, and their rights and working conditions must be protected" (UNESCO, 2019, p. 5).

The planned introduction of AI digital textbooks in 2025 aims to enhance personalized learning and provide real-time data to support student progress. The 2022 Revised National Curriculum emphasizes the integration of digital literacy and AI competencies across all subjects. Furthermore, the new high school achievement evaluation, set for introduction in 2024, seeks to provide a more comprehensive assessment of students' skills and knowledge through the incorporation of digital tools and methodologies. AIEDAP is underpinned by these significant policies, collectively offering a coherent approach to leveraging AI and digital technologies to enhance student learning.

The collaborative governance approach ensures that the AIEDAP project benefits from the diverse expertise and perspectives of all stakeholders involved. This framework promotes transparency, accountability, and inclusivity, ensuring that policies and implementations are well-rounded and effective. By engaging government bodies, educational institutions, private sector partners, and communities, collaborative governance addresses potential challenges, maximizes resource utilization, and builds broad support for sustainable digital transformation.

A primary objective of AIEDAP is to equip both pre-service and in-service teachers with the necessary AI competencies and digital skills for effective integration of AI into their teaching practices. This involves providing professional development and training programmes, creating resources and tools for AI-driven instruction, and fostering a culture of continuous learning and adaptation. By empowering teachers, AIEDAP aims to enhance the learning experience for students and prepare them for a technology-driven future.

Recognizing that effective digital transformation and educational innovation must start with the pre-service preparation of teachers, AIEDAP integrates AI and digital competencies into teacher education programmes from the outset. This approach ensures that new educators enter the profession equipped with the skills and knowledge needed to utilize AI tools and methodologies effectively. By laying this foundational training, AIEDAP establishes a solid basis for sustainable and comprehensive digital transformation in education.

AIEDAP proposes that pre-service teachers develop a foundational understanding of AI and the educational

significance of digital technologies, enabling them to apply these skills in various aspects of their roles, including teaching, learning, student guidance, school administration, and personal development. To support this initiative, AIEDAP has established a national definition of teachers' AI and digital competencies through the AI and Digital Competency Framework for Teachers.

This comprehensive framework is structured into three core areas, nine sub-competencies, and 30 behavioural indicators, providing a standardized approach to AI and digital competency training. Although initially designed for in-service training, this framework is equally applicable to pre-service teacher education programmes, ensuring a solid foundation for integrating AI and digital technologies from the start of their careers. By equipping pre-service teachers with these essential skills, AIEDAP seeks to foster a more innovative, efficient, and adaptive educational environment. The AI and Digital Competency Framework for Teachers is presented in Table 8.

Table 8. Digital competency frameworks for teachers

Area	Competency
1.AI and Digital Basics	1.1 Utilization of AI and digital technologies
	1.2 Practice of AI and digital ethics
2. AI and Digital Education Practice	2.3 Educational context analysis utilizing AI and digital technologies
	2.4 Instructional design utilizing AI and digital technologies
	2.5 Resources development utilizing AI and digital technologies
	2.6 Implementation of lessons utilizing AI and digital technologies
	2.7 Educational evaluation and reflection utilizing AI and digital technologies
3.Professional Engagement	3.8 Professional development
	3.9 Social engagement

Source: Draft country reports (2024)

AIEDAP has developed a comprehensive education program designed to enhance the AI-integrated education competencies of pre-service teachers, addressing the societal demand for AI in education. This 15-week program enables pre-service teachers to effectively apply AI to their major subjects and organize their classes. Additionally, the program has sparked significant interest in AI ethics, highlighting its importance in future educational frameworks. This initiative represents a critical step toward preparing pre-service teachers in Colleges of Education for a digital future.

In addition to developing the AI-Digital Competency Framework, AIEDAP aims to enhance AI and digital competency among teachers by developing innovative teaching models and content that incorporate AI and digital tools, updating curricula in Teacher Training Institutes to include comprehensive AI and digital training for pre-service teachers, and improving professional development programs for in-service teachers to continuously develop their skills. Additionally, AIEDAP evaluates the effectiveness of these programs to ensure they meet desired goals and identify areas for further improvement.

Each of these tasks plays a crucial role in creating a robust, AI-enhanced educational system driven by competent and well-prepared teachers. As countries worldwide seek to update their education systems for the digital age, the AIEDAP programme offers valuable insights and potential models for developing AI and digital education

competencies in pre-service teachers. The outcomes and progress of this initiative are of significant interest to education policymakers and researchers globally.

6.4 Mongolia: On its path to digital transformation

Background

Mongolian universities, like many institutions worldwide, faced significant challenges during the COVID-19 pandemic. They had to quickly adapt to new ways of teaching and learning to ensure the safety of students and staff. Many universities shifted to online classes to minimize the risk of virus transmission, marking the rather forced dawn of digital transformation. This required both faculty and students to adapt to new technologies and methods of instruction.

Some universities adopted hybrid models, combining online and in-person classes, especially when the situation allowed for a partial return to campus. To support the sudden shift, e-course regulations were established, detailing requirements for lecture and seminar materials, delivery methods, and the use of relevant software. Comprehensive support resources, such as advice manuals for teachers and students, video instructions, and technical guides were created. These materials were widely disseminated using social networks, channels, and university websites, effectively enabling online learning and fostering a digital learning environment. Strict health and safety protocols were enforced. This period saw institutions adopting innovative solutions to continue academic activities despite restrictions, highlighting their adaptability and resilience in unprecedented times.

Major policy in higher education

The Mongolian government formulated its New Revival Policy in December 2021, which aims to ensure political and macroeconomic stability, accelerate public-private partnerships, and create a favourable business environment. The New Revival Policy in Mongolia includes initiatives to enhance the education sector. The policy emphasizes the importance of digital transformation in education, promoting use of technology to improve learning outcomes and accessibility in accordance with the national vision of becoming a 'digital nation.'

Approach to integrating technologies in higher education functions and processes

Within the broader national framework, Mongolia's higher education sector is actively developing its policy and legal guidelines to support digital transformation in teaching and learning and other core functions of the sector. The General Law of Education mandates the adoption of electronic training, laying the groundwork for digital learning. Key policy documents in the education sector outline a phased approach to integrating technologies and digital devices into educational activities, ensuring a systematic transition to a more digitized learning environment. This evolving framework aims to modernize education and enhance accessibility through the adoption of new technologies. A phased approach is useful because it allows institutions to gradually integrate digital tools, reducing disruptions and ensuring everyone can adapt effectively. It allows for thoughtful allocation of limited resources, ensuring that each step is optimized and manageable, rather than overwhelming the system with a full-scale, sudden transition.

Key measures adopted by universities to enhance e-learning

Consistent with this approach, universities in Mongolia are making significant strides toward becoming "digital universities" as part of their strategic goals. Most universities in Mongolia have strategic plans to guide their

development and growth. The University of Finance and Economics (UFE) aims to achieve digital university status by 2030. The Mongolian University of Science and Technology (MUST) has set objectives that include implementing e-learning, offering courses through MOOCs, boosting the digital skills of its faculty and students. These efforts demonstrate a strong commitment to embracing digital technologies in higher education, enhancing both institutional and staff capabilities. In its strategic plan, the National University of Mongolia (NUM) focuses on utilizing digital technologies in education. It aims to adopt new teaching methods that leverage technological progress, increase access to online and open education resources, and integrate these resources into the educational process. This strategy highlights NUM's commitment to modernizing its educational practices and enriching the learning experiences through digital tools and resources.

The Mongolian government has actively supported digitization of higher education. Furthermore, universities are investing in the development of their own information and communication infrastructures to align with their digital transformation goals. The holistic approach not only aims to create a more efficient and accessible educational environment but also tailors the learning experience to meet individual student needs.

To facilitate e-learning, many universities utilize open platforms such as Google and Moodle as their primary educational information systems. To conduct live online lessons, especially for international students, institutions depend on platforms like Microsoft Teams, Google Meet, Google Classroom, and Zoom. Additionally, some universities integrate social media platforms like YouTube and Facebook into their educational frameworks, offering diverse and interactive ways to engage students and enhance their digital learning environment. These efforts collectively represent a significant move towards a more connected and technologically advanced higher education system. The seamless integration of these systems enhances efficiency and accessibility, creating a more effective and interactive learning environment for both students and educators.

A learning management system generally includes various components for instructors and students, administrative purposes, e-course lectures, seminars, laboratory resources, supplementary materials, student discussions, testing facilities, and statistical data on course attendance. Universities that develop and use educational information system like UNILIM, SiSi, and School Management System face minimal issues with programming, technical glitches, platform registration, and the establishment of numerous access rights. These systems are significantly enhanced through direct integration with the school's management system. For example, the UNILIM training and management information system at MUST not only facilitates the uploading of video and text contents for lecturers, seminars, and laboratory courses but also provides a dedicated space for teachers and students to discuss and exchange assignments. It offers comprehensive student information, including grades, electronic course attendance records, and details on students' engagement with the course. This level of visibility is crucial for policy-making decisions at the institutional level.

Mongolian universities, like elsewhere, are increasingly relying on their IT teams to continuously enhance Learning Management Systems, ensuring these systems are user-friendly, effective, and adaptable to the evolving needs of students and educators. IT teams in universities play a crucial role in managing LMS. They are responsible for maintaining the technical infrastructure, ensuring system security, providing technical support to faculty and students, and integrating new tools and technologies to enhance learning experiences.

MUST has a strong foundation for a Learning Management System and possesses skilled human resources for software development. However, the reliance on Microsoft Teams for organizing e-learning activities has led to significant gaps in the UNILIM training information system. This reliance has resulted in incomplete course information and hindered the university's progress in developing a complete training information system. In contrast, the University of Finance and Economics (UFE) conducts its e-learning activities through various officially permitted information systems, including UFE APP SYSTEM, INFOSYS, MOODLE, CALL PRO, ZOOM, and EASYCLASS. This robust system maintains extensive records of students, teachers, staff, school programmes, schedules, and various modules

that effectively manage and monitor the entire e-learning process. Many universities utilize foreign open-source platforms by integrating links and relevant materials from sites such as edX, Coursera, Udacity, and MOOCs.

In Mongolia, state-owned universities are supporting e-learning by establishing dedicated units and making required organizational changes. For example, NUM has expanded its teacher development centres to include e-learning support. At MNUMS, the Centre for Teacher Development and E-Learning uses the "Digital Professor" studio light board to create e-course content and hosts regular "New Faculty Orientation" sessions. Similarly, MUST's "Open Education Centre" is transitioning classes to electronic formats using advanced technologies such as AR, VR, and MR. The centre has developed content for various subjects using light board technology and is exploring opportunities for free online learning training and COURSERA-certified courses for professors. These efforts underscore a commitment to enhancing and adapting teaching methodologies to modern technological advancements.

In sum, Mongolian universities are enhancing e-learning and content preparation by providing essential equipment and establishing e-learning studios, enabling teachers to manage extensive digital content, and organizing training programs with salary incentives. They supply students with digital resources and convert library books to electronic formats. By joining the Koha library system and transitioning admissions and diploma verification to electronic processes, they aim to improve digital engagement and content preparation comprehensively. These initiatives aim to improve access to resources, enhance teaching and learning, and streamline administrative processes, supporting digital transformation of higher education in Mongolia.

Recommendations

Despite these achievements, the Mongolian study team recommends further actions to support e-learning and digital education:

- Enhance students' awareness of data protection and privacy while developing their digital skills.
- Encourage the use of digital signatures to streamline contracts and authentication.
- Invest in ongoing digital training for teachers and key staff to improve technological and pedagogical skills.
- Ensure e-learning platforms are inclusive and encourage the creation of digital content while protecting intellectual property rights.
- Implement blended learning options and allow remote teaching during absences or emergencies.
- Offer live streams of classroom sessions to expand distance learning opportunities.

To conclude, in reviewing these four innovative practices—China's expansive MOOC initiatives, Japan's digital transformation approach at Kagawa University, South Korea's forward-looking integration of AI competencies for both pre-service and in-service teachers, and Mongolia's foundational digital transformation measures—a few common threads emerge. Each initiative demonstrates the importance of aligning digital transformation efforts with broader national or institutional priorities, investing in digital infrastructure, and fostering essential digital competencies. Innovation in higher education through digital technologies requires a vision backed by resources, adaptability, and strong collaboration across stakeholders. By adhering to these principles, institutions can leverage digital tools to enhance learning experiences, bridge access gaps, and prepare educators and students alike for a rapidly advancing digital landscape.

Having explored the prominent digital initiatives in East Asia in the previous chapter, Chapter VII will investigate the factors contributing to the successes and hindrances of digital transformation in the region. Examining these enablers and barriers is crucial to finding a way forward and ensuring the ongoing progress and sustainability of digital transformation efforts in higher education, which will set the stage for making policy recommendations in Chapter VIII.

Chapter VII

Key enablers and barriers to digital transformation

The previous chapter explored four innovative practices that have transformed the landscape of higher education in East Asia. This chapter closely examines the key enablers and barriers shaping the digital transformation of higher education, recognizing that these factors can be context specific. It explores the forces driving digital adoption and innovation, as well as the challenges that can hinder progress. By analysing both sides, this chapter offers a nuanced perspective on the complex dynamics influencing digital advancement in educational institutions.

7.1 Key enablers of digital transformation

In higher education, drivers of digital transformation act as essential guiding forces that propel institutions toward modernization and innovation. These drivers provide crucial incentives, direction, and resources, ensuring that digital transformation efforts are cohesive, well-funded, and aligned with an institution's mission and goals. By identifying and leveraging these key drivers, educational institutions can navigate the complexities of integrating new technologies, thereby enhancing the quality, accessibility, and efficiency of education. Recognizing the importance of these drivers is critical, as they form the foundation for a successful and sustainable digital transformation journey. Reviewing the four country case studies, it is evident that the drivers of digital transformation in East Asian countries include the following:

Government policies and commitment

Government support and strategic commitment are pivotal drivers of digital transformation in higher education. Through comprehensive policies, funding allocations, and long-term digital strategies, governments create a supportive environment that enables educational institutions to adopt new technologies, enhance digital infrastructure, and implement innovative teaching practices. Policies like China's "Internet Plus" and the 14th Five-Year Plan, Mongolia's Vision 2050, Japan's Society 5.0, and South Korea's ICT Master Plans demonstrate a strong governmental commitment to fostering a digitally enriched educational landscape. By prioritizing digital transformation in education, governments empower institutions to stay competitive and responsive to the evolving needs of students and society in an increasingly digital world.

Leadership

Leadership at both the central/political level and the institutional level plays a pivotal role in driving digital transformation in higher education. Leaders at the central or political level can set national priorities, create supportive policies, and allocate funding to promote digital initiatives across the education sector, ensuring alignment with broader societal goals. Institutional leaders provide vision and direction within their universities and colleges, championing digital initiatives, securing necessary resources, and fostering a culture of innovation among faculty, staff, and students. Effective leadership at both levels is essential for overcoming resistance to change, managing risks, and ensuring that digital transformation efforts are cohesive, well-funded, and integrated with the institution's mission and goals. In all four countries, ministries and senior leaders recognized the role of technology in development, and university leaders also demonstrated a commitment to change.

Technological advancements

Technological advancements play a crucial role as drivers of digital transformation in higher education. These advancements provide the tools and platforms necessary for innovative teaching and learning methods, enhancing the quality and accessibility of education. East Asian universities are harnessing AI, data analytics, and other advanced technologies to drive meaningful improvements in teaching, learning, and research. For example, Chinese universities use AI-driven platforms to personalize learning experiences through adaptive assessments and intelligent tutoring systems, making learning more tailored and effective. In South Korea, institutions adopt advanced data analytics to monitor student progress in real time, allowing educators to quickly identify and support students who may need additional assistance. Japanese universities utilize AI and machine learning in research, analysing massive datasets to advance scientific fields. In Mongolia, cloud computing and data-sharing platforms facilitate collaborative research across universities, even in remote areas, enhancing research capacity and broadening access to resources. Through these advancements, East Asian universities are not only enriching education but also expanding the frontiers of research, creating more adaptive, data-informed learning environments.

The rise of the digital economy

The growth of the digital economy in China, South Korea, and Japan is a powerful driver of educational innovation, pushing universities to integrate new technologies, update curricula, and prepare students for the rapidly evolving job market. This alignment with digital economic needs ensures that graduates possess the skills required to thrive in a tech-driven world. South Korea's global tech industry, led by Samsung and LG, creates a high demand for skilled graduates, motivating universities to innovate and produce competitive, industry-ready talent. China's booming digital economy, fuelled by AI, big data, and e-commerce, requires a workforce, pushing universities to adapt their programmes and research to align with industry needs. Japan's digital economy, marked by advancements in AI, big data, and IoT, benefits from resources like supercomputers, enhancing research and education. Smart systems and remote education platforms are also being integrated to support flexible, accessible learning environments. In Mongolia, efforts to diversify its economy beyond traditional sectors like mining have led to investments in digital education, aiming to develop a workforce skilled in IT, finance, and renewable energy. Embracing digital technologies in higher education is seen as a pathway to fostering innovation and economic resilience in emerging industries.

Global competitiveness

The need to remain competitive on a global scale motivates universities in China, South Korea, and Japan to pursue digital transformation as a key strategy. This approach aims to attract international students, enhance research capabilities, and improve the overall quality of education.

In Japan, the challenge of a rapidly aging population and a declining birth rate have resulted in a reduced domestic student base. To sustain global competitiveness, Japanese universities are increasingly prioritizing the recruitment of international students and researchers, necessitating digital transformation to provide cutting-edge educational experiences and research opportunities.

Similarly, South Korea's record-low fertility rate has led to a shrinking workforce, prompting universities to bolster their global appeal by integrating advanced digital technologies and fostering international collaborations. This approach not only attracts talent from abroad but also ensures the education system remains robust and innovative.

Meanwhile, China is transitioning from a manufacturing-based economy to one driven by technology and

innovation. With a declining population, Chinese universities face pressure to produce highly skilled graduates capable of supporting this economic shift. As a result, digital transformation in higher education is essential for meeting these demands and maintaining China's competitive edge in the global landscape.

Pandemic response

The COVID-19 pandemic has significantly accelerated the adoption of digital technologies in higher education worldwide, compelling institutions to swiftly transition to online learning and highlighting the necessity for robust digital infrastructure and resources. In East Asia, the impact has been especially notable, driving rapid digital transformation across educational systems.

In China, the "Classes Suspended but Learning Continues" emergency plan mandated a shift to online teaching, enabling education for over 200 million students and prompting further investments in digital infrastructure. In Mongolia, the Mongolian University of Science and Technology (MUST) developed blended learning models that combined online platforms with traditional classroom instruction, improving accessibility and flexibility for students. Japan's government initiated a Roadmap for the Utilization of Educational Data, fostering a flexible and personalized learning environment by 2030, with the pandemic accelerating its implementation. South Korea expanded its digital infrastructure to facilitate distance learning, allowing millions of students and teachers to access educational resources simultaneously, ensuring uninterrupted education.

These examples illustrate how the COVID-19 pandemic has acted as a catalyst for digital transformation in higher education across East Asia, driving the adoption of advanced technologies and innovative practices to maintain the continuity and quality of education. South Korea experienced minimal disruption during the pandemic due to its established digital infrastructure and proactive integration of technology in education before the crisis.

Industry collaboration

Collaboration with technology companies and industry partners is a crucial driver of digital transformation in higher education. In China, policies promoting industry-university partnerships encourage universities to collaborate with major technology firms, facilitating the integration of advanced technologies into educational programmes. These partnerships enable institutions to innovate and align their offerings with industry demands. Similarly, in South Korea, government initiatives support collaborations with leading corporations, enhancing the educational landscape by providing universities access to state-of-the-art technologies and expertise. Such efforts ensure that students are equipped with the skills needed for the rapidly evolving digital workforce.

Japan also fosters industry collaboration through policies that encourage universities to engage external stakeholders in governance and decision-making processes. These partnerships drive innovation and ensure that educational programmes remain relevant to industry needs. Additionally, entrepreneurship education and cooperative education programmes are increasingly emphasized, providing students with practical experiences and skills that align with labour market demands.

In Mongolia, the challenges posed by vast rural areas and a declining urban population necessitate innovative solutions to maintain a robust educational system. Digital transformation plays a vital role in bridging these gaps by providing remote learning opportunities and enhancing access to quality education across the country. Policies aimed at fostering industry partnerships and promoting entrepreneurship education are essential for Mongolia to compete globally and develop a skilled workforce.

Changing educational aspirations

Learner demands significantly drive digital transformation in higher education across East Asia. Today's tech-savvy students, often referred to as digital citizens, adeptly navigate technology and demand seamless, flexible, and hybrid learning experiences. They seek access to digital resources, online collaboration tools, and the ability to learn at their own pace and convenience. These demands compel universities in East Asia to adopt new technologies, redesign courses, and integrate digital skills into their curricula to effectively address the evolving needs of their student body.

Furthermore, factors such as rising costs of face-to-face education, housing crises, restrictive immigration policies, and the necessity to work while studying are leading students to view online education as a more viable and attractive option. In response, universities across East Asia are increasingly driven to enhance their digital offerings and infrastructure to remain competitive and relevant in today's educational landscape. In general, university professors in East Asia are digitally proficient and well-equipped to meet the evolving expectations of their tech-savvy students.

In addition, governments and university leaders in these countries clearly recognize that the opportunity costs of not going digital can be very expensive. Keeping up with innovation and emerging technologies in society is a key motivator of digital transformation. These drivers collectively contribute to the ongoing digital transformation in higher education across East Asia, helping institutions to innovate and adapt to the changing educational landscape.

7.2 Major barriers to the digital transformation of higher education

Notwithstanding the advancements, case studies from four East Asian countries reveal that their digital transformation efforts face significant barriers and challenges. Understanding and addressing these obstacles is essential for creating an environment where digital initiatives can thrive, ultimately leading to improved educational outcomes and institutional resilience in an increasingly digital world.

A review of four country reports identified 25 barriers that impede digital transformation in higher education. China reported the highest number of challenges (14), followed by Mongolia (12), South Korea (8), and Japan (5). These challenges are categorized into six groups: i) Policy and planning-related, ii) Resource-related/Financial barriers, iii) Strategic/Organizational factors, iv) Capacity-related, v) Disparity and/or digital divide, and vi) Data privacy and security concerns (Table 9).

Table 9. Barriers to the digital transformation of higher education as reported in country reports

Challenge	China	Japan	Korea	Mongolia
Capacity-related				
Lack of digital awareness, literacy and competence among students and educators, including users /limited technological readiness of students and teachers	X	X	X	X
Lack of teacher ability to innovate teaching using digital technology/ teachers failing to keep up with the ongoing technological advances	X			X
Variations in digital literacy levels among students and teachers/ or varying levels of digital literacy among both in-service and pre-service teachers can hinder progress.	X		X	
Concept of digital citizenship and citizenship competencies lacking		X		

Strategic/organizational factors				
Absence of a comprehensive digital strategy among universities	X			
Insufficient coordination and cooperation among different levels of educational institutions	X			
Weak institutional capacity to design and deliver online programmes				X
Lack of strategic leadership				X
Resistance to change among faculty members		X	X	
Insufficient collaboration between academia-industry and research	X			
Lack of support for resource collaboration between universities, education authorities, different owners or providers and consumers	X			
Disparity and/or digital divide				
Disparity and/or digital divide	X		X	X
Resource gaps between universities and between urban and rural regions/digital divide/uneven technological provision			X	X
Resource-related/financial barriers				
Inadequate or suboptimal development of digital educational resources/ lack of infrastructure	X		X	X
High installation and maintenance costs for advanced technologies / financial constraints			X	X
High cost of digital infrastructure for people with disabilities			X	
Outdated technology/unlicensed software				X
Connectivity issue (high cost)				X
Policy and planning related				
Piecemeal approach to digital transformation leading to resource wastage and redundancy/lack of a holistic approach to policy	X			
Business bias in government policies regarding digital transformation (decisions are influenced by corporate interests)		X		
DT not reflected in medium to long-range planning, short-term focus	X			
Monolithic educational policies with a one-size fits all approach which can stifle innovation and hinder effective implementation of policies		X		
Quality assurance and certification mechanisms	X			X
Data privacy and security concerns	X			X
	14	5	8	12

Source: Draft country reports (2024)

Policy and planning-related barriers

Countries have identified several policy and planning-related issues as hurdles to digital transformation. One major concern reported by China is the 'piecemeal approach,' which involves implementing digital transformation in

isolated segments rather than as a cohesive strategy. This lack of a unified approach can lead to inefficiencies and duplicated efforts, resulting in wasted resources and fragmented systems that do not integrate well. Another issue in China is the short-term focus of plans, stemming from the absence of long-range strategies. Digital transformation efforts that are not incorporated into long-term planning may lack sustainability, leading to quick fixes instead of enduring solutions and hindering the development of robust digital infrastructure.

In Japan, the business bias in government policies implies that policies influenced by corporate interests may prioritize business needs over educational goals. This can skew the focus toward profit-driven solutions rather than those that best serve educational institutions and students. Additionally, Japan reports that monolithic educational policies can stifle healthy transformation in higher education. Such one-size-fits-all policies do not accommodate the diverse needs of different institutions and may hinder effective implementation of digital transformation initiatives that require flexibility and customization.

Concerns regarding data privacy, quality assurance, and cybersecurity are critical. Without robust mechanisms to protect data and ensure its integrity, digital transformation efforts can be compromised, leading to potential breaches and loss of trust. These challenges underscore the need for a comprehensive, well-coordinated approach to digital transformation in higher education. Addressing these issues can help create a more efficient, secure, and innovative digital landscape for educational institutions.

Resource-related and financial barriers

Countries have reported resource-related and financial barriers that hinder digital transformation in higher education. Inadequate or suboptimal development of digital educational resources and lack of infrastructure are concerns raised by China, South Korea, and Mongolia. Many educational institutions struggle to develop high-quality digital resources due to insufficient infrastructure, including a lack of necessary hardware, software, and Internet connectivity, which hampers the creation and dissemination of effective digital learning materials.

South Korea and Mongolia recognize that high installation and maintenance costs for advanced technologies are significant problems. Implementing advanced technologies often requires considerable upfront investment and ongoing maintenance costs, which many institutions cannot afford due to financial constraints. Japan highlights the high cost of ensuring digital accessibility for people with disabilities, which involves additional expenses for specialized hardware and software, prohibitive for many institutions.

Furthermore, data suggest that some institutions in Mongolia rely on outdated technology and unlicensed software due to financial constraints, leading to compatibility issues, security vulnerabilities, and a lack of access to the latest educational tools. These legacy systems, while still performing essential functions, can be difficult to integrate with modern technologies. Lastly, Mongolia has cited poor or unreliable connectivity as a barrier. Reliable Internet connectivity is crucial for digital education, but high costs can hinder consistent, high-speed Internet access, affecting students' and educators' ability to participate fully in digital learning. Addressing these financial and infrastructural barriers requires strategic investment, policy support, and innovative solutions to ensure that all students and educators can benefit from digital advancements.

Strategic/organizational factors

Strategic and organizational factors play a pivotal role in the digital transformation of higher education. Effective strategic leadership is essential for setting a clear vision and fostering a culture of innovation and adaptability. Building institutional capacity through continuous professional development and upgrading digital infrastructure ensures that faculty, staff, and students are well-equipped to embrace new technologies. Positive attitudes

towards change, supported by robust change management strategies, help mitigate resistance and facilitate smooth transitions. A well-defined digital strategy, aligned with the institution's overall goals, provides a roadmap for integrating digital initiatives and achieving sustainable success. Together, these factors create a conducive environment for digital transformation, driving progress and enhancing the educational experience.

These challenges were frequently mentioned in all country reports. Mongolia noted the absence of strategic leadership and weak institutional capacity as major challenges. China's report pointed to the lack of a comprehensive digital strategy among universities as a concern. Insufficient coordination and collaboration among various stakeholders—higher education institutions, EdTech providers, government agencies, consumers, and tech users—is another significant issue in China. A lack of support for such collaboration can lead to isolated efforts and missed opportunities for shared resources and best practices. Country reports from South Korea and Japan reported faculty resistance to change, mostly among older faculty members. This resistance can be attributed to their comfort with traditional teaching methods, unfamiliarity with new devices and systems, and concerns over steep learning curve required. This generational gap is a phenomenon noted in all societies, highlighting the need for tailored training and support to bridge this divide and encourage the adoption of digital tools across all groups.

Capacity-related barriers

The digital transformation of higher education significantly hinges on the digital skills of both teachers and students. Teachers with strong digital competencies can seamlessly integrate technology into their pedagogical practices, fostering interactive and engaging learning environments. Continuous professional development ensures that educators remain adept with the latest digital tools and innovative teaching methods, such as flipped classrooms and blended learning. Conversely, students equipped with strong digital skills are better prepared to engage with digital learning platforms, participate actively in online discussions, and collaborate effectively with peers. These skills also promote independent learning and critical thinking, which are essential for future workforce readiness. Therefore, enhancing the digital literacy of both teachers and students is crucial for maximizing the benefits of digital transformation in higher education.

Country reports indicate that capacity constraints among teachers and students pose challenges in all four countries. Data from China and Mongolia show that teachers often lack the ability to innovate in teaching, which is a critical component of effective digital transformation in higher education. Innovative teaching involves adopting new methodologies, leveraging advanced technologies, and continuously adapting to the evolving educational landscape. Teachers who can innovate are able to create more engaging and interactive learning experiences, tailor their approaches to meet diverse student needs, and foster a culture of continuous improvement and creativity. Additionally, reports from South Korea and China indicate significant variations in teachers' digital literacy levels, which can hinder the implementation of digital transformation initiatives.

In today's interconnected world, digital citizenship skills are essential for navigating the digital landscape responsibly and ethically. These skills include digital literacy, which enables individuals to use technology effectively and safely, as well as ethical behaviour, which involves respecting intellectual property and engaging in respectful online communication. Understanding data privacy and security is crucial for protecting personal information and recognizing potential threats. The Japanese country report noted that the concept of digital citizenship was not adequately understood, and both teachers and students lacked the necessary competencies. This highlights the need for teaching digital competencies from an early stage in education.

Disparity and/or digital divide

The digital divide refers to the gap between individuals, households, businesses, and geographic areas at different

socio-economic levels regarding their access to information and communication technologies (ICTs) and use of the Internet. This disparity can lead to unequal access to educational resources, with some students and institutions having far superior digital tools and connectivity compared to others. Three countries (China, South Korea, and Mongolia) identified this as a challenge, while no reference to this issue was made in the Japanese country report. Related to this is the concern about resource gaps between universities and between urban and rural regions, as noted in the Korean and Mongolian country reports. There are often significant differences in the availability and quality of digital resources between universities, particularly between well-funded institutions and those with fewer resources. Additionally, urban areas typically have better technological infrastructure compared to rural regions. This uneven provision of technology can result in students in rural areas or less affluent universities facing limited access to digital learning tools, which can affect their educational outcomes. These challenges underscore the need for targeted policies and investments to bridge the digital divide and ensure equitable access to digital resources across all regions and institutions. Addressing these disparities is crucial for fostering inclusive and effective digital transformation in higher education.

Data security and privacy issues

Data security and privacy issues are significant barriers to digital transformation in higher education across East Asia. Universities collect vast amounts of sensitive data, including personal information, academic records, and financial details, making them prime targets for cybercriminals. The rapid adoption of digital tools has outpaced the development of robust cybersecurity measures, leading to various security threats such as data breaches, phishing attacks, ransomware, and malware. Insider threats and insecure networks further exacerbate these vulnerabilities. Additionally, the lack of comprehensive and consistent data protection regulations across the region complicates efforts to maintain privacy standards.

To address these challenges, higher education institutions must invest in comprehensive cybersecurity measures, conduct regular security audits, provide training, and implement advanced security technologies. Ensuring data privacy and security is crucial for maintaining trust and protecting the integrity of educational systems. China, South Korea, Japan, and Mongolia have all established legal frameworks to address data protection and security, aiming to safeguard personal data, ensure privacy, and provide guidelines for handling data breaches and cybersecurity threats. Continuous compliance with data protection regulations is essential to protect the sensitive data of students and staff.

7.3 Key areas for improvement

The review identifies 25 barriers to digital transformation in higher education, categorized into six key areas: policy and planning, resource-related and financial barriers, strategic and organizational challenges, capacity-related constraints, disparities from the digital divide, and concerns regarding data privacy and security. Addressing these interconnected challenges is essential for promoting equitable and effective digital transformation.

In East Asia, several key enablers facilitate this transformation. Government commitment and supportive policies are crucial, with many countries implementing comprehensive strategies to enhance digital infrastructure, allocate resources, and foster collaboration between academia and industry. The drive for global competitiveness pushes institutions to adopt innovative practices, particularly in response to the rising digital economy and the need for skilled graduates.

The COVID-19 pandemic has further accelerated digital transformation, prompting institutions to quickly adapt to online learning and digital tools. This shift has reshaped student expectations, with learners now seeking flexible, personalized, and engaging educational experiences. In response, institutions are enhancing their digital offerings

and investing in innovative teaching methods.

To advance digital transformation, policymakers should focus on amplifying these key enablers while addressing remaining challenges. Strengthening government support, enhancing digital infrastructure, and ensuring equitable access to technology are critical. Policies must also be adaptable to tackle persistent issues, such as access disparities and data privacy concerns. By fostering a supportive environment that builds on successes and proactively addresses challenges, a sustainable framework for ongoing digital transformation in higher education can be established. The final chapter will present specific policy recommendations to guide effective implementation, providing a roadmap for policymakers to navigate these complexities and drive meaningful progress in digital education.

Chapter VIII

Summary, conclusions, and recommendations

8.1 Background

As shown in preceding chapters, East Asia serves as a compelling model for understanding digital transformation in education, marked by rapid economic growth, technological innovation, and diverse educational contexts. Countries such as China, Japan, and South Korea have successfully integrated digital technologies into higher education, thanks to robust government support and significant investments in infrastructure. These efforts have resulted in widespread access to education and the development of a highly skilled workforce. The region's experiences—both its successes and challenges—offer valuable lessons for nations worldwide.

East Asia's approaches to bridging the digital divide, enhancing digital literacy, and promoting lifelong learning underscore the importance of comprehensive and inclusive policy frameworks. As countries adapt to an increasingly digital landscape, the strategies employed in East Asia can inform effective policy formulation, implementation, and evaluation, ultimately supporting efforts to achieve Sustainable Development Goal 4 (SDG 4).

To document these insights, UNESCO Beijing, in collaboration with the International Centre for Higher Education Innovation (ICHEI), a Category II Centre under the auspices of UNESCO, has prepared case studies on the digital transformation of higher education in four countries in East Asian countries. This regional synthesis report consolidates findings from these studies, highlighting achievements, challenges, and key lessons. It serves as a valuable resource for global policymakers aiming to leverage technology to enhance equity and quality in education, ultimately contributing to improved educational outcomes for all.

8.2 Objectives

The primary objective of this regional synthesis report is to consolidate and analyse key findings, trends, practices, and insights from country reports on the digital transformation of higher education in East Asia. Specifically, the report documents existing policies and initiatives that support digital transformation, examines the current state and innovative practices within institutions, assesses the digital competencies required for effective engagement with technology among teachers and students, and identifies key enablers and challenges in the process. Furthermore, the report provides comprehensive policy recommendations to guide stakeholders in enhancing and accelerating their digital transformation efforts.

8.3 Methodology

The project began with a desk study analysing policy documents and national plans to understand regulatory environments in each country. Selected universities were studied for their strategic plans, digital infrastructure, ongoing digital initiatives, and faculty and student competencies. These case studies provided insights into effective practices and innovations in integrating digital technologies into education. Country reports included limited field observations and interviews with policymakers, university administrators, professors, and students, enhancing desk study data and offering deeper insights into digital transformation strategies. Country teams collaborated extensively, while UNESCO Beijing provided input, leading to the finalization of reports.

The regional synthesis report assessed findings from case studies on digital transformation in higher education

from China, Japan, Mongolia, and South Korea. The methodology included a comprehensive desk review of these studies and relevant policy documents, insights from other countries, particularly OECD members, and key UNESCO publications. A thematic analysis identified common trends, unique practices, and challenges, organizing findings around key themes: policy frameworks, digital transformation status, innovative initiatives, digital competencies, enablers and bottlenecks, and policy recommendations.

Any attempt to generalize the findings should consider the study's limitations. Data quality and availability vary between countries, and differences in methodologies complicate comparisons. Some topics were not thoroughly explored, and reliance on subjective perceptions might overstate digital competencies. Despite these challenges, the report highlights innovative practices and obstacles in digital transformation, serving as a valuable resource for policymakers and educators.

8.4 Key findings and conclusions

This section presents the key findings from the synthesis report, focusing on the highlights and takeaways. It illuminates the current landscape of digital transformation in higher education across East Asia, revealing a dynamic and multifaceted approach to digital integration. The findings showcase varying levels of advancement, challenges, and opportunities in countries such as China, Japan, South Korea, and Mongolia.

National digital strategies

National digital policies are critical for the digital transformation of higher education, providing strategic directions, resources, and addressing the digital divide while fostering partnerships among institutions, the private sector, and international organizations. Country reports reveal that China, Japan, Mongolia, and South Korea each have unique digital strategies tailored to their political, societal, and technological landscapes, yet all aim to leverage digital technologies for social and economic development. These policies prioritize innovation, smart cities, infrastructure, tech-driven industries, and digital literacy, aligning education reforms with broader national goals.

China's *Digital China* initiative strengthens digital infrastructure, promotes AI, big data, and cloud computing, and advances the "Internet Plus" strategy to integrate digital tools into various sectors, including education. The 14th Five-Year Plan emphasizes further digitization and talent development in science, technology, and innovation.

South Korea's *Digital New Deal* drives the expansion of 5G, AI, and smart learning environments, significantly transforming higher education through virtual campuses and AI-driven tools. Big data systems enable personalized learning and predictive analytics, reflecting a focus on preparing students for tech-driven industries.

Japan's *Society 5.0* envisions a human-centred integration of physical and cyber systems, emphasizing digital innovation in education. Universities are developing smart campuses, enhancing digital literacy, and incorporating AI and IoT to align with the nation's goals of innovation and competitiveness.

Mongolia's *E-Mongolia* initiative focuses on modernizing public services and fostering a digital economy, with digital education seen as a tool to address geographic and economic challenges. Progress is gradual due to infrastructure gaps, but national and higher education strategies are increasingly aligned.

Higher education plays a pivotal role in these digital strategies, serving as both a driver and beneficiary of national policies. Through investments in infrastructure, equity, pedagogy, innovation, and research, these countries aim to create a digitally skilled workforce and foster sustainable economic growth, reflecting a shared commitment to integrating education into their broader digital agendas.

Connectivity and access to digital devices

Ensuring connectivity and access to digital devices is a central policy goal across East Asia, as reliable Internet and devices are vital for personalized and engaging learning experiences. However, access varies significantly among countries and within their education systems.

China has heavily invested in university Internet infrastructure, with high-speed connectivity in top institutions. Yet, rural areas and less prestigious universities face challenges with unreliable Internet and limited access to devices. Similarly, Japan's leading universities are well-equipped, but regional and older institutions struggle with aging infrastructure and socio-economic disparities, leading to unequal access. South Korea's universities benefit from world-class Internet speeds and advanced digital systems, but affordability remains a barrier for lower-income students. Mongolia faces the greatest hurdles, with rural universities lacking adequate infrastructure and connectivity, deepening the digital divide.

Beyond connectivity, divides in digital literacy, content, language, and accessibility persist, referred to as new forms of divides (UNESCAP, 2019; OECD, 2021). Many students and faculty, particularly in rural areas or older generations, lack the skills to use digital tools effectively. Prestigious universities provide superior digital resources, leaving smaller institutions at a disadvantage. Language barriers further limit access, as much high-quality educational content is in English. Accessibility for students with disabilities is another concern, with many digital platforms lacking inclusive design. Addressing these divides is essential to achieving equitable digital education in the region.

Learning Management Systems (LMS)

Learning Management Systems (LMS) have become integral for universities in East Asia. The COVID-19 pandemic underscored the value of LMS in facilitating online teaching and learning across colleges and universities. Countries like China, Japan, and South Korea have adopted a mix of domestic and external LMS platforms to support both blended and fully online learning models. Domestic platforms, tailored to the specific needs and cultural contexts of local educational institutions, often feature language support and region-specific content. In contrast, external platforms such as Moodle, Blackboard, and Canvas are popular, especially among institutions serving international students or collaborating with global partners.

The case studies conducted did not assess the effectiveness of these systems or evaluate the user experience. However, measuring both student and teacher experiences could generate valuable data for enhancing user satisfaction. In Mongolia, the available data on user experiences is reported to be positive, there is a need to examine the effectiveness of LMS in enhancing student learning outcomes.

Studies have indicated several challenges in the implementation of LMS, including selecting appropriate systems, significant diversity in LMS deployment across universities, user acceptance and engagement, and limited opportunities for social interaction. Addressing these challenges requires a comprehensive approach considering the diverse factors involved. It is also noted that the full potential of LMS remains underutilized regarding their direct impact on learning outcomes, indicating a need for better alignment between technology and pedagogy.

Provision of digital teaching and learning resources

Digital teaching and learning resources in higher education across East Asia are generally well-developed but vary by country and institution. Many universities in China, Japan, and South Korea offer digital learning platforms, open educational resources (OER), and Massive Open Online Courses (MOOCs) to enhance student learning. Platforms like China's XuetangX and Japan's JMOOC provide extensive digital course materials, while South Korea integrates smart learning environments into many institutions. Several universities have developed their own digital systems to meet

specific educational needs, reflecting a focus on localized digital solutions. The emergence of digital resources for self-assessment is becoming more common, allowing students to track their progress and receive instant feedback through quizzes and adaptive learning tools embedded in LMS.

Professional development resources for teachers, including online training modules and digital communities of practice, are also available, although their accessibility and quality can vary. Social media platforms like WeChat, Twitter, and Facebook are increasingly used to create learning communities, share resources and facilitate communication.

Despite these advancements, several challenges persist. One of the challenges relates to the unequal access to digital resources due to socio-economic disparities and geographic location, particularly in rural areas with limited Internet access. Usability issues arise as not all resources accommodate diverse learner needs. The quality of digital resources varies, with some lacking rigorous content and effective pedagogical design. Professional development resources may not always align with current educational technologies, leading to gaps in digital teaching skills. Domestic platforms may face interoperability challenges with international systems in collaborative settings.

AI in education

East Asian countries are making significant strides in incorporating AI into higher education. China, South Korea, Japan, and Mongolia are actively developing and implementing AI policies to enhance personalized learning, intelligent tutoring, and improved administrative efficiency.

In China, the "AI + Education" action plan promotes intelligent tools for individualized learning paths, improving student engagement and outcomes. South Korea's "AI Education Promotion Plan" focuses on fostering AI literacy among students and educators, using AI-driven resources for real-time assessment and feedback. Japan's "AI Education Promotion Strategy" aims to create smart learning ecosystems by embedding AI in curriculum development and teacher training, enhancing instructional quality. Meanwhile, Mongolia is working to integrate AI tools to improve access and quality in higher education, particularly in rural areas.

These AI initiatives encompass curriculum development, teacher training, student assessment, and resource management. They aim to transform the educational landscape, making learning more personalized, efficient, and effective, while preparing students for a technology-driven economy. Overall, the commitment to leveraging AI in education reflects a broader goal of enhancing educational outcomes, fostering innovation, and preparing students for the demands of a rapidly evolving digital economy. As these initiatives progress, they hold the potential to transform the educational landscape in East Asia, making learning more personalized, efficient, and effective.

Personalized learning

The personalized learning experience enabled by AI and digitization presents both opportunities and challenges within the context of East Asian educational culture, particularly its exam-oriented focus. Countries such as China, Japan, and South Korea place a high value on standardized exams that determine key academic and career outcomes. This traditional emphasis on uniformity and collective achievement contrasts with personalized learning, which aligns education with individual needs, pacing, and learning styles. While this shift may face resistance, AI's capacity to target specific learning gaps and provide tailored support could complement exam preparation, enhancing students' readiness for high-stakes tests. Personalized learning aims to offer each student an appropriate curriculum or task and scaffold them to solve specific problems based on an assessment of their knowledge and gaps.

However, the entrenched exam culture and societal expectations in East Asia might slow the adoption of

personalized learning. A hybrid approach may emerge, wherein AI-driven learning enhances traditional methods, providing more flexibility while maintaining the rigor of exam preparation. As governments in the region begin to recognize the need for reforms that promote creativity and critical thinking, personalized learning could gradually gain acceptance, blending with existing systems to support both individualized growth and standardized success.

Student Information Systems

East Asian countries have developed sophisticated student information systems (SIS) primarily designed to manage academic records, attendance, and administrative tasks, while increasingly integrating digital devices into classrooms to facilitate learning. In China, platforms like the "Smart Campus" and AI-driven learning applications provide access to personalized learning resources. Similarly, Japan's "Classi" and South Korea's "Neis" systems manage student data while supporting classroom instruction through digital devices such as tablets and interactive boards. These tools are transitioning from basic administrative functions to more significant roles in personalized education, offering real-time feedback and tailoring learning experiences to individual student needs.

Despite this progress, much of the data collected by these SIS platforms remains focused on administrative purposes rather than directly enhancing learning outcomes. To fully realize the potential of digital education, there is a need for better integration of learning analytics into these systems. For instance, tracking student engagement, learning progress, and performance patterns could yield actionable insights for teachers to adjust their teaching methods and for students to improve their learning strategies. While digital devices facilitate more interactive learning experiences, the effective use of data to inform these experiences remains underdeveloped.

Assessment

The digitization of assessments in higher education across East Asia offers several opportunities and challenges. Traditional methods of assessment face challenges from generative AI, posing threats to academic integrity and equity. Digital assessments bring efficiency, scalability, and flexibility, enabling quick grading, faster feedback, and innovative formats, like simulations and adaptive testing. They also generate data for deeper insights into student learning patterns, useful large-scale assessments in densely populated universities in countries like China, Japan, and South Korea.

However, challenges include ensuring equitable access to digital infrastructure, particularly for students in rural or disadvantaged areas. There are concerns about the security and integrity of digital assessments, such as potential cheating, data breaches, and system failures. Additionally, to maximize the potential of digital assessments, it is essential to explore creative, interactive methods for evaluating higher-order thinking skills beyond traditional formats like multiple-choice questions.

Interoperability

Interoperability in digital education refers to the seamless, secure, and controlled exchange of data between different applications and systems. It allows educational technologies to communicate, facilitating integrated use and enabling educators to view and tailor student progress. However, interoperability is a challenge in East Asian higher education due to the fragmented use of various Learning Management Systems (LMS) across universities and countries. While domestic and external platforms offer robust features, they often lack seamless integration, creating obstacles for student mobility, cross-institution collaboration, and academic data transfer. This limits opportunities for credit transfer, shared resources, and joint courses.

In East Asia, the challenge is amplified by the coexistence of domestic and international platforms with varying

standards and features. For example, universities using domestic LMS may face difficulties integrating with global research networks or external collaborative tools. Additionally, interoperability issues can restrict data sharing, complicate analytics, and impede the development of personalized learning experiences. Addressing this requires coordinated efforts to adopt open standards, enhance cross-platform compatibility, and foster collaboration among technology providers, universities, and policymakers.

Digital competencies of teachers and students

As higher education in East Asia becomes more digitized, the demand for strong digital competencies among students and educators has grown significantly. The adoption of Learning Management Systems (LMS) and advanced digital tools in teaching underscores the need for robust digital skills, but challenges remain uneven across countries and institutions.

In China, leading universities are advancing digital teaching methods, but faculty in smaller or rural institutions still face barriers. Japan's educators, despite significant investments in digital infrastructure, are often in the early stages of digital adoption. South Korea's advanced technological landscape is offset by gaps in comprehensive teacher training, while Mongolia faces the steepest challenges, with many rural professors lacking the technical skills and resources for digital education.

Efforts to improve teacher digital competencies are underway but vary by country. China and South Korea have introduced frameworks and professional development initiatives to encourage digital teaching, while Japan's programmes are less widespread. However, these initiatives often fall short, focusing on basic technical skills rather than integrating digital pedagogy into teaching. Professional development remains inconsistent, with limited structured, ongoing training or follow-ups. Frameworks are sometimes too broad or technical, leaving educators to interpret and implement them independently.

In contrast, students in East Asia generally enter higher education with solid foundational digital skills and a willingness to learn. Universities offer opportunities for skill enhancement, but disparities in resources and capacity lead to gaps between institutions. As digital skill demands grow more complex, particularly in technical fields, many students' abilities fall short, especially when adapting to new tools and systems.

To bridge these gaps, universities across the region are introducing support initiatives, including workshops, formal courses, and online resources. However, the availability and quality of these programmes vary, highlighting the need for more consistent and comprehensive strategies to ensure equitable digital skill development.

Post-Covid momentum of digitization

Although the country reports have not specifically examined post-Covid momentum of digitization, they suggest that all four countries have maintained and even accelerated their digitization efforts, ensuring that the momentum created by COVID-19 remains strong.

However, elsewhere, digital transformation in higher education, initially accelerated during the COVID-19 pandemic, has lost momentum in some regions as institutions revert to pre-pandemic norms. Many universities that rapidly shifted to digital teaching and learning now face challenges in maintaining these innovations, particularly as pressures to restore traditional practices increase. The waning focus on digital transformation risks undermining progress in making education more flexible and accessible.

The reduction in digital focus in these areas poses challenges to maintaining the advancements made in educational flexibility and accessibility, raising concerns about potential setbacks in adapting to the needs of a digital

economy. Sustaining these efforts is critical for preparing students for a digital economy and supporting global educational standards.

8.5 Major recommendations: policy options for reform

Building on the findings presented above, this section introduces a set of recommendations based on the insights from each country report, as shown in Table 10. While the recommendations are tailored to specific countries, some common themes emerge across the reports. These suggestions address critical areas identified, supporting the ongoing digital transformation and improving educational outcomes in the region.

Table 10. Policy recommendations made by the Country Teams

Recommendation	China	Japan	Mongolia	South Korea
Improve digital governance design	X			
Integrate blockchain for campus management	X			
Focus on talent development	X			
Upgrade standards for digital resources	X		X	
Promote a broader understanding of digital transformation in society and educational institutions		X	X	
Align digital strategies with UN and UNESCO digital and AI frameworks		X		
Adopt agile methods for digitization led by teaching staff, rather than a top-down approach		X		
Ensure children's rights are protected in digital environment according to UN conventions on children's rights		X	X	
Integrate UNESCO's 2023 recommendation on digital global citizenship and media information literacy into school curricula		X	X	
Create a flexible, resilient HE system that can adapt to rapid technological advancements and diverse student needs.				X
Invest in advanced technological resources to enable universities to provide students and faculty with the tools necessary to engage in dynamic, interactive learning experiences, thus reinforcing the foundation for digital transformation.				X
Organize professional development programmes to equip faculty members with the skills needed to navigate and utilize digital technologies effectively and ensure that they can integrate digital tools into their teaching methods, leading to more engaging and effective learning experiences.			X	X

Enhance AI and digital skills among students to enable them to excel in a technology-driven workforce, thereby closing the gap between academic preparation and industry expectations.			X	X
Strengthen digital capacity of universities to leverage LMS and other digital systems to optimize educational processes, enhance student engagement, and support the overall digital transformation of higher education.				X
Create a more adaptive, innovative, and inclusive educational system that is well-equipped to meet the challenges and opportunities of the digital era.				X

Source: Draft country reports (2024)

Based on the findings of this regional synthesis report and a review of relevant literature on digital transformation initiatives, the following policy actions are recommended to enhance and accelerate the digital transformation of higher education across countries. These measures aim to foster innovation, improve access, and ensure the highest quality of education for future generations. The recommendations are grouped according to major themes: policy reform, digital infrastructure, digital capacity building, pedagogy, learning and assessment, governance and system building, and digital cooperation.

Policy reform

Recognize digital transformation as a catalyst for systemic change

Policymakers in East Asia have recognized the importance of digital transformation in higher education, viewing it as a catalyst for systemic change across society, the economy, and governance. Digital education promotes civic engagement, strengthens community ties, and prepares individuals to tackle societal challenges, fostering social cohesion. It also enhances innovation and competitiveness in the workforce, aligning education with labour market needs. Furthermore, digital transformation boosts transparency, accountability, and political engagement in governance.

To sustain these benefits, policymakers must continue their commitment to digital transformation, ensuring ongoing investment and support. This will help maintain the progress made, further advancing societal, economic, and political development. Embracing digital transformation in higher education is essential for preparing students for the future, promoting innovation, and maintaining competitiveness in a digital economy.

Pursue a systemwide approach to the digital transformation of higher education

A systemwide approach to digital transformation in higher education necessitates coordinated change across institutions, creating a unified digital ecosystem that transcends isolated initiatives. This strategy involves not only advanced technology adoption but also a fundamental rethinking of institutional structures, processes, and cultures to align efforts with mission-driven goals. By fostering a shared vision and collaboration among stakeholders, this approach promotes sustainable development and builds commitment at all levels.

A systemwide strategy enhances agility and responsiveness, ensuring educational environments meet the evolving needs of students and society in a digital world. It requires action across all fronts, including regular policy reviews, stakeholder involvement in strategy development, data analytics for real-time feedback, continuous professional

development for educators, experimentation with new tools, and fostering cross-sector collaboration. By prioritizing digitization and adopting these practices, countries can create a comprehensive, equitable, and innovative digital ecosystem that enhances learning outcomes and prepares students for the digital age. The development of multi-sectoral and whole-of-society approaches can be guided by the UN Digital Compact (United Nations, 2024).

Continue making digital transformation a national priority

In the wake of the COVID-19 pandemic, digital education became a national priority across all four countries, focusing on enhancing digital skills and strengthening educational infrastructure. During the pandemic, strategies centreed on transitioning to remote learning, with governments and institutions rapidly adopting online platforms to maintain educational continuity. Key efforts included providing devices and Internet access to bridge the digital divide and supporting educators with training and resources to adapt to online teaching. Engaging students in virtual environments presented challenges, necessitating innovative approaches to sustain motivation.

As the world moves into the post-pandemic era, the emphasis has shifted towards sustaining and enhancing digital education. Continued investment in high-speed Internet and modern technological infrastructure remains critical. Countries should prioritize resilient, scalable digital systems that support teaching, learning, and administration, ensuring reliable access to essential resources. Institutions committed to digital transformation will benefit from increased adaptability and preparedness for future disruptions. This commitment requires ongoing training, development of digital infrastructure, continued financing, and partnerships.

Develop virtual spaces of learning as a public good and human right

Virtual learning spaces are crucial for delivering engaging content to diverse learners, including teachers, students, and marginalized groups. Public platforms like websites and apps enhance educational opportunities for individuals facing challenges due to disability, geography, conflict, poverty, language, or gender. They also provide learning pathways for those outside formal education systems, like migrants and refugees.

The 2022 Transforming Education Summit (TES), organized by the United Nations highlighted the importance of optimizing these virtual spaces to support education as a public good and a fundamental right. The Summit identified key actions aligned with UNESCO's Recommendation on Open Educational Resources, which include creating high-quality, curriculum-relevant digital teaching and learning content, strengthening the capacity to utilize digital technology for enhanced learning, and ensuring digital connectivity for all educational institutions and individuals to access available resources. Public curation of digital materials is vital to guarantee the availability of high-quality, accessible resources for learners.

Digital infrastructure

Ensure high-quality, meaningful connectivity and equitable access to digital devices

Improving connectivity and access to digital devices necessitates sustained policy efforts. Governments should expand high-speed broadband infrastructure in rural and remote areas to ensure all universities and students have reliable Internet access. Universities can enhance access by providing free Wi-Fi zones on campuses and partnering with local authorities to establish community Internet points for students lacking home connectivity.

Public-private partnerships with device manufacturers and telecom providers can help deliver broadband services to underserved areas and offer affordable digital devices to low-income students. Additionally, universities should implement device loan programmes and increase subsidies for purchasing digital devices. Governments can also expand targeted financial support for low-income students who struggle to access personal devices and

Internet connections.

To create a digitally equitable higher education landscape, connectivity must extend beyond classrooms to reach students and teachers in their homes or wherever they are. Governments should ensure that educational institutions receive systematic and ongoing assistance for the provision, renewal, and maintenance of digital infrastructure. East Asian countries have implemented various pandemic-led policies to provide digital devices, supporting education and learning anytime and anywhere, regardless of socio-economic conditions.

Close the digital divide with targeted initiatives for equitable access to technology

Digital transformation efforts often focus on physical infrastructure—connectivity, Internet access, and devices—but ensuring equitable access and usage for disadvantaged populations must remain a priority. The digital divide manifests in various ways, and simply providing access is insufficient. Addressing this requires tackling different forms of the digital divide.

To bridge the digital literacy or skills divide, universities should offer training programs for both students and faculty, equipping them with the skills needed to navigate digital tools, online resources, and learning platforms. This includes training on managing online learning environments to enhance engagement.

To address the content divide, universities can collaborate to create localized Open Educational Resources (OER) in local languages, making learning materials more accessible and culturally relevant. Increased investment in virtual libraries and digital content sharing among institutions can help smaller universities access quality resources. Additionally, digital platforms should adopt universal design principles to ensure all students, including those with disabilities, can fully engage with online education. Standard features should include screen readers, closed captions, and adaptable user interfaces.

Addressing the digital divide is crucial for global development and equality. The UN, multilateral banks, international organizations, and donor countries such as Japan, China, and Korea must collaborate to invest in digital infrastructure in underserved areas, ensuring affordable and reliable Internet access. This collective effort will help bridge the global digital divide, creating opportunities for all and fostering inclusive development. Educational programs promoting digital literacy and skills are essential for participation in digital learning environments. Financial and technical assistance for low-income countries can help build and sustain their technological capabilities, while advocacy for inclusive digital policies will prioritize marginalized populations. Recognizing the multifaceted nature of digital inequality is key to finding comprehensive solutions to bridge these gaps.

Undertake comprehensive self-assessments of digital ecosystems

Higher Education Institutions (HEIs) should conduct comprehensive self-assessments of their digital ecosystems to effectively support teaching, learning, and administration in the digital age. This involves regularly evaluating infrastructure, digital literacy, pedagogy, support services, and security. By using standardized frameworks and involving a wide range of stakeholders, HEIs can identify strengths and areas for improvement. Regular reviews, benchmarking against peers, and developing clear action plans based on assessment findings will help address gaps and enhance digital capabilities. Such proactive measures ensure that digital strategies are aligned with national and local needs, fostering an inclusive, innovative, and secure digital environment for all educational community members.

Digital capacity building

Invest in leadership training to foster digital innovation

Investing in leadership training is critical for driving digital innovation and facilitating the adoption of new technologies in higher education. Strategic planning should be a core component, enabling leaders to design clear roadmaps for digital transformation that align with institutional goals. By fostering visionary thinking, leaders can articulate a compelling vision that inspires collaboration and commitment. Training should also enhance strategic planning and change management skills to ensure effective planning, implementation, and evaluation of transformation processes. Familiarity with digital technologies and collaborative leadership approaches will help leaders build partnerships and leverage diverse expertise. Effective resource allocation strategies and ongoing professional development ensure leaders remain adaptable to emerging trends.

Equip educators with digital skills to enhance and transform learning experiences

UNESCO (2021) highlights essential digital competencies for educators to effectively drive digital transformation in education. These include digital pedagogy, engaging content creation, and the use of digital tools for assessment. Educators must also demonstrate technical proficiency, promote digital citizenship, and ensure inclusivity and accessibility in digital resources.

To enhance these competencies across East Asia, policymakers should align national frameworks with international standards, providing clear guidelines for effective digital teaching. Formal training and ongoing professional development of educators should focus on online pedagogy and technology use, covering basic skills and advanced techniques through hands-on training, online platforms, peer mentoring, and opportunities for experimentation.

Governments and universities should implement incentive structures like financial rewards, professional recognition, or career advancement opportunities. Investment in technical support systems is essential for providing on-demand assistance. Universities should collaborate to share best practices and create shared competency frameworks, establishing collaborative learning communities of educators and feedback mechanisms to enable continuous adaptation and improvement.

Encouraging student feedback and peer involvement will refine digital teaching practices, leading to improved learning outcomes. Fostering a culture of continuous learning and innovation is crucial for long-term success in digital education transformation. Regular training sessions, online platforms for ongoing development, and feedback mechanisms will support educators and students in navigating the evolving digital landscape. Supporting the transition from traditional to digitally-enabled pedagogy should be a clear priority for all higher education institutions (HEIs).

Support students in enhancing their digital competencies

To best support university students in enhancing their digital competence, it is essential to integrate digital literacy courses into curricula, ensuring students develop crucial skills in areas such as data analysis, and digital communication. Universities should provide access to the latest digital tools and resources and offer ongoing opportunities to stay abreast of digital skills. Creating collaborative learning environments of students and

promoting extracurricular activities such as coding clubs[54] and hackathons[55] can foster hands-on digital learning. Additionally, engaging with industry partners to offer internships and mentorship programmes bridges the gap between academic learning and industry demands.

Ensuring inclusivity and accessibility through financial aid and support services is vital to making digital education equitable for all students. Students need to be educated about responsible and ethical technology use, including data citizenship, data privacy, cybersecurity, online safety, and the societal impacts of digital innovation.

Establish a collaborative framework for enhancement of digital intelligence across the system

To prepare students and future educators for a digitally integrated learning environment, robust collaboration among schools, universities, teacher training institutions, and education technology companies is essential. This partnership should focus on developing aligned curricula and integrated digital training programmes, ensuring that incoming students have foundational digital competencies and that future teachers are equipped with practical classroom skills.

Technology companies can play a vital role by providing access to the latest digital tools and resources, enabling institutions to incorporate current innovations and practices. Such collaboration creates a seamless pathway from secondary education to higher education and professional teaching careers, aligning standards for digital literacy and competency at each stage. By fostering this ecosystem, educational institutions can ensure that digital skills are consistently reinforced, making digital proficiency a foundational aspect of education and teacher preparation. This approach will better equip both students and teachers to meet the demands of an evolving digital landscape.

Strengthen teacher involvement in designing AI and digital tools for education

To create AI-driven tools that effectively support educational goals, it is crucial to adopt a co-creation model that actively involves teachers at every stage of development. Currently, EdTech developers, education researchers, and policymakers often operate in silos, resulting in products that may not fully address the practical needs of classrooms. Teachers, as primary end users, can offer invaluable insights into student needs, classroom dynamics, and pedagogical objectives.

Involving educators in the design process fosters tools that are more effective, user-friendly, and aligned with best practices in education. This collaborative model enhances product relevance and usability, encourages innovation, and ensures that technological solutions adhere to educational standards. A multistakeholder approach is essential for amplifying teachers' voices, ultimately leading to technologies that support meaningful, student-centred learning experiences. Encouraging collaboration between educational institutions, government agencies, and private sector organizations can facilitate the sharing of best practices and resources.

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54   Coding clubs are groups within schools, universities, or communities where members of various skill levels can learn, practice, and develop coding skills in a supportive environment. These clubs offer activities such as workshops, collaborative coding sessions, guest lectures, and mini-hackathons, which encourage creative problem-solving and real-world application of programming skills. In addition to skill-building, coding clubs provide valuable networking opportunities, foster a sense of community and teamwork, and help members enhance their coding portfolios.

55   A hackathon is a multi-day event where programmers, designers, and project managers collaborate to develop innovative tech solutions. Emphasizing teamwork and creative problem-solving, participants brainstorm, code, and create prototypes, often addressing real-world challenges and themes.

Pedagogy, Learning, and Assessment

Elevate the quality and utilization of digital teaching and learning resources

To enhance the accessibility, quality, and effectiveness of digital teaching and learning resources in East Asia, several key policy measures should be prioritized. Apart from expanding digital infrastructure and ensuring reliable Internet access, it is important to develop high-quality, peer-reviewed Open Educational Resources (OER) and expand digital libraries that are regularly updated for relevance.

Encouraging the development and scaling of MOOCs is essential, with universities collaborating to create engaging, culturally relevant courses accessible across the region. Institutions can increase the utilization of these resources by offering credit-bearing MOOCs, incentivizing faculty to incorporate them into curricula, and promoting lifelong learning programs. Inclusivity can be further supported by adopting universal design principles, ensuring digital resources are accessible to students with disabilities or limited technical skills.

Tailored professional development programmes are needed for faculty to effectively integrate digital tools into their teaching, encouraging innovative pedagogies. Policymakers should also promote regional and global collaboration and funding initiatives for the creation and sharing of digital resources, including MOOCs, to foster a cohesive digital learning environment. Establishing a monitoring framework will help understand the effective use of digital materials by diverse learner groups. Additionally, enhancing the use of social media in education through teacher training, developing usage guidelines, and ensuring equitable access to resources will further support inclusive education.

Advocate for the integration of global digital guidelines and standards in national frameworks

Advocating for the adoption and integration of global digital teacher competency frameworks within national education systems should be a priority for UNESCO and other international organizations. These frameworks provide a standardized approach to equipping teachers with essential digital skills, enabling effective technology integration into teaching practices. This integration is crucial for preparing students for the digital economy and fostering 21st-century skills such as critical thinking and collaboration. By promoting these frameworks, UNESCO can help countries enhance educational quality, support professional development, and ensure equitable access to digital resources. Ultimately, this initiative would improve learning outcomes and better prepare both educators and students for the challenges of a rapidly evolving world.

Leverage AI to transform educational experiences and outcomes

Artificial Intelligence (AI) can revolutionize education by shifting teachers' focus from administrative tasks to fostering students' growth, making teaching more impactful and fulfilling. To leverage AI effectively, it must be implemented with an emphasis on equity, quality, and the avoidance of biases. Co-creation with diverse stakeholders, easy access to AI tools for teachers, investment in digital intelligence, and support for innovation are crucial. A shared commitment to equitable and inclusive education ensures that AI benefits all students, including the most marginalized.

For effective AI integration, educational systems should adopt strategies aligned with their goals, ensuring ethical use, data privacy, and transparency. Engaging stakeholders in decision-making, providing ongoing professional development, and running pilot programmes before wider adoption will support positive and adaptable AI use. Regular impact assessments will further align AI use with educational outcomes and objectives. The use of AI should be guided by robust national regulatory frameworks and aligned with international guidelines.

Foster learner success by implementing personalized learning approaches

Implementing personalized learning in traditional education requires collaboration between policymakers and educators. Policymakers can play a crucial role in establishing standards, best practices, and ethical guidelines while also investing in infrastructure like high-speed Internet and digital devices. Funding for the development and deployment of personalized learning tools is essential, along with opportunities for ongoing professional development for educators. Teachers can enhance their approaches by using flexible lesson plans and diverse teaching methods to accommodate different learning styles, with AI tools helping to tailor instruction to individual strengths and needs. Integrating digital resources and fostering collaboration on digital platforms can further boost student engagement and outcomes, enabling educators to merge traditional teaching with individualized learning strategies to support student success.

Provide comprehensive counselling and mentorship to support student well-being

As countries embrace AI and digital tools to personalize education and enhance outcomes, the pressures of academic achievement can strain students, while teachers face challenges in adapting to new technologies. Comprehensive counselling and mentorship are essential for supporting the well-being of both students and teachers, ensuring balanced emotional and psychological health alongside academic goals. Regular mental health check-ins conducted by trained counsellors, along with peer support groups and mentoring programmes, create a safe space for sharing experiences and accessing help.

For teachers, ongoing professional development and strong support systems are also key to sustaining high standards in a tech-driven educational landscape. Developing cyber hygiene guidelines is essential to ensure that students, faculty, and staff follow best practices for protecting personal and institutional data in today's digital world.

Leverage data to boost learning outcomes and drive educational efficiency

To boost learning outcomes and improve educational efficiency, governments should prioritize using student data not just for administrative purposes but as a tool for personalized learning. Integrating advanced learning analytics into Student Information Systems (SIS) would allow educators to track real-time progress and identify areas where students need targeted support. Policies must also enforce strong data privacy regulations to ensure ethical and secure use of student information. Providing teachers with data-driven insights and promoting adaptive AI tools can help East Asian education systems enhance both individual learning and overall efficiency.

Leverage technology to modernize assessment practices in higher education

To enhance the use of technology-enabled assessments in higher education, especially in East Asian countries with a deeply rooted exam culture, several key actions and strategies should be implemented. Investing in digital infrastructure is essential to ensure equitable access to reliable Internet and necessary devices for all students and educators. Ongoing professional development will equip educators with the skills to effectively use digital assessment tools and strategies, modernizing traditional exams to emphasize critical thinking, problem-solving, and real-world application rather than rote memorization.

Authentic assessments, such as real-world tasks and projects, reflect students' critical thinking and skills application. AI-powered tools provide personalized feedback and data analytics to monitor student progress and identify areas for improvement. Technology-enhanced assessments, including online quizzes, adaptive assessments, and digital portfolios, enable personalized learning experiences and encourage collaboration through peer reviews and enhanced communication between students and teachers. Ensuring accessibility and inclusivity in assessment design is crucial to accommodate all students, including those with disabilities, while implementing ethical

guidelines upholds fairness and integrity.

Addressing challenges such as security, access disparities, and potential biases is necessary to prevent exacerbating inequalities, particularly for marginalized groups. Balancing digital methods with traditional ones supports a comprehensive and equitable approach to assessment. By leveraging technology to transform exam-based learning, East Asian countries can blend long-standing educational values with innovative, future-ready approaches.

Maximize the potential of LMS to enhance student learning and engagement

To harness the potential of Learning Management Systems (LMS) for enhanced student engagement and learning, leveraging interactive tools like discussion forums and real-time collaboration features can significantly improve outcomes for both students and faculty. Integrating advanced analytics into LMS platforms allows for personalized learning insights and targeted support. Assisting the growth and international reach of domestic LMS platforms fosters global collaboration. Additionally, investing in regular faculty training on LMS functionalities and ensuring robust digital infrastructure facilitates seamless, inclusive learning. Addressing the digital divide and ensuring equitable access for students from diverse backgrounds is crucial, particularly in East Asia, to maximize the impact of LMS platforms.

Governance and system building

Prioritize seamless integration for interoperability across digital education systems

Interoperability in digital education ensures seamless and secure data exchange between systems, promoting integrated use of educational technologies. In East Asian higher education, achieving this faces challenges due to fragmented efforts and diverse systems. Collaborative government efforts can establish guidelines for standardizing LMS platforms and adopting open standards. Universities should invest in integration tools to enhance connectivity and foster cross-institutional collaboration on shared platforms. Ongoing training for staff, students, and faculty will facilitate effective use of interoperable systems, advancing digital transformation in higher education.

Implement change management strategies for seamless digital education transition

To facilitate a seamless transition to digital education, institutions should implement effective change management strategies. Clear and consistent communication is vital, ensuring stakeholders are well-informed about the goals, benefits, and processes through regular updates and transparent policies. Actively engaging educators, students, and staff in the planning and implementation phases fosters buy-in and shared ownership. This includes offering comprehensive training, ongoing support, and feedback channels to address concerns and refine practices.

Leadership commitment is crucial, with designated digital champions to advocate for and guide the initiative. Cultivating a culture that values adaptability, continuous learning, and innovation helps normalize change and motivate participation. Pilot programmes can serve as effective starting points, enabling gradual rollouts and iterative improvements. Adequate funding and robust technical support are critical to address challenges and maintain momentum.

Leverage latest technologies and strategies to build a future-ready digital education workforce

Leveraging the latest technologies for digital transformation is a crucial step for any institution aiming to stay competitive and relevant in today's digital landscape. By adopting comprehensive implementation strategies, institutions can enhance the overall educational experience. As the technologies change, it is essential to develop and implement training programmes that prioritize flexibility and adaptability. These programmes should be

designed with frameworks that allow for continuous updates, ensuring they remain relevant as new technologies, such as AI, VR, and data analytics emerge. Creating flexible, modular learning pathways allows learners to upskill at their own pace, tailoring their learning to their specific needs. This forward-thinking approach will foster a digital education workforce capable of leveraging cutting-edge technologies, supporting innovative teaching practices, and quickly adapting to evolving demands in the digital learning landscape.

Strengthen data governance in higher education

To strengthen data governance in higher education, proactive strategies from both governments and universities are essential. Governments can establish centralized frameworks to standardize policies on privacy, security, and data management, aligning these frameworks with national privacy laws and the unique needs of the education sector. Regular audits and compliance checks, including at smaller institutions, can reinforce adherence to these standards.

Universities can enhance data governance by providing training for faculty, staff, and administrators in data privacy. Implementing mandatory training on data protection laws and appointing dedicated data officers can help oversee compliance and manage risks. Adopting technical safeguards, such as encryption, access control, and multi-factor authentication, will further protect sensitive information. Additionally, promoting data minimization practices can reduce exposure to risk. Guidelines for secure cross-border data sharing are vital to protect international student information, requiring robust cybersecurity investments.

The UN Global Compact (2024) serves as a framework for global governance of digital technology and artificial intelligence, emphasizing the importance of fostering international cooperation for digital transformation while advocating for principles that prioritize human rights, sustainable development, and collaboration across sectors.

Foster digital agility to adapt to technological advancements

Promote digital agility in higher education by encouraging institutions to cultivate flexibility, creative thinking, and the capacity to quickly adapt to emerging technologies. Being digitally agile means having the ability to anticipate digital trends, embrace innovation, and respond effectively to technological shifts by leveraging tools, processes, and skills in a strategic manner. Equip students and faculty with the mindset and competencies to implement adaptive strategies, ensuring they can navigate the challenges and opportunities of a rapidly evolving digital landscape. By prioritizing digital agility, higher education can maintain leadership and drive innovation in teaching, learning, and research.

Prioritize continuous monitoring and evaluation to ensure the effectiveness of digital solutions

Digital solutions go unevaluated, leaving their true impact and effectiveness unknown. All country reports are notably silent about the role of evaluation and monitoring in assessing the impact of their digital initiatives, creating a gap in understanding their true value and areas for improvement. Continuously monitoring and evaluating digital interventions is crucial to ensure they remain effective, relevant, and beneficial over time. As technology and the needs of students, educators, and institutions evolve rapidly, ongoing monitoring provides essential insights into whether digital tools meet their intended objectives. This allows institutions to address issues or unintended consequences early, supporting efficient resource use and enhancing the learning experience.

Furthermore, consistent assessment enables informed decision-making, demonstrates accountability to stakeholders, and contributes to a cycle of continuous improvement, where insights from current interventions shape future initiatives, fostering sustainable and adaptive educational ecosystems. Growing evidence on the benefits of digitally enhanced teaching and learning can encourage policymakers to invest in digital technologies

and build supportive environments that advance digital education.

Digital cooperation

Strengthen regional and international cooperation for digital transformation

Enhancing regional and international cooperation for the digital transformation of higher education necessitates several key actions. First, establishing multistakeholder partnerships among governments, institutions, and the private sector is essential. Sharing best practices and resources will enable institutions to adopt effective strategies and learn from one another. Joint research initiatives can help identify innovative solutions and drive academic progress. Building regional and global networks is crucial for facilitating communication and collaboration among educational institutions.

National governments should implement supportive policy frameworks that enable universities and HEIs to collaborate internationally. Promoting capacity-building programmes will equip educators and administrators with the necessary skills to leverage digital tools effectively. Leveraging technology to facilitate collaboration can enhance connectivity and support joint initiatives. These efforts should align with UN and UNESCO guidelines and frameworks, providing a unified approach to ensuring quality, equity, and innovation in education through technology.

Establishing policies that encourage the development and sharing of high-quality open educational resources is crucial for equitable access to digital learning materials across regions. Additionally, regional and global frameworks are needed for the recognition and accreditation of digital credentials and micro-credentials, ensuring that qualifications earned through online education are widely accepted and recognized.

Expand the regional and/or global reach of higher education through strategic digitization

Digitization has significantly enhanced the global reach of higher education, enabling students worldwide to access academic opportunities. The pandemic accelerated virtual internationalization, integrating an international and intercultural dimension into education (Bruhn-Zass, 2023). Digital platforms allow universities to offer international experiences without physical mobility, breaking geographical barriers and attracting diverse learners. Online courses, virtual exchanges, and collaborative digital projects immerse students in multicultural environments, enriching their educational and cultural perspectives. Furthermore, digital resources can enhance access to global research and facilitate cross-border collaborations, driving innovation. Strategic digitization ultimately fosters a more inclusive, interconnected, and globally accessible academic landscape.

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4 QUALITY EDUCATION

Sustainable
Development
Goals