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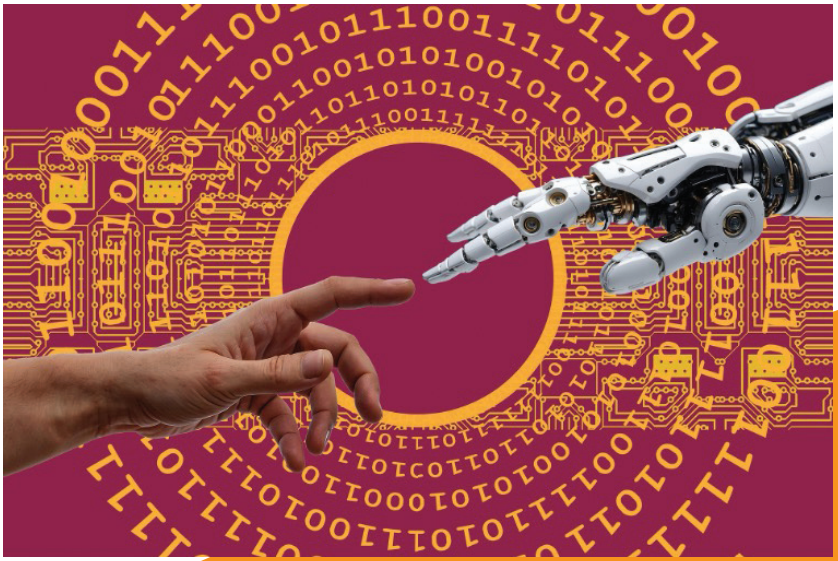
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation



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This publication has been sponsored by the ASEM Education and Research Hub on Lifelong Learning (https://asemlllhub.org/).

Universität Innsbruck
1st edition

innsbruck university press, Karl-Schönherr-Straße 3, 6020 Innsbruck
Tel. +43 512 507-31700, iup@uibk.ac.at, www.uibk.ac.at/iup
Print: Prime Rate Zrt., Budapest
ISBN 978-3-99106-195-3
DOI 10.15203/99106-195-3

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ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-01

Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation

Adeline Y. S. Goh, Chompoonuh K. Permpoonwiwat, Natasha Kersh, Annette Ostendorf, Karen Evans, and Sophia Ho

Introduction

The Research Network on Workplace Learning (RN2) of the Asia-Europe Education and Research Hub for Lifelong Learning (ASEMLLL) focuses on learning in, for and through workplaces across Asia and Europe. Workplaces exist not simply in companies and public services, but equally across a wide range of organisational and social contexts, including in non-profit-making NGOs, Universities and Colleges, and in diverse forms of self-employment. They offer very different kinds of learning opportunities- some are rich in learning opportunities, others offer little in the way of support for learning; some provide structured work-related education and training for employees, whereas in others, learning is integrated into the flow of working processes. Through exchange of information, workshop discussions and joint studies of how workplace learning is provided, practised and understood in Asia-Pacific and European countries, the network aims to build up a shared body of knowledge that is empirically-based, contextualised and theoretically-informed.

The network was established in 2005, and since then, its membership has expanded to 25 countries. Our network consists of members representing countries in Asia and Europe (and beyond). Members are now active in Austria, Australia, Brunei, Canada, China, Cuba, the Czech Republic, Denmark, Finland, France, Hungary, Georgia, India, Ireland, Italy, Japan, Latvia, Lithuania, Laos, Malaysia, Romania, Singapore, South Korea, Thailand, United Kingdom. The work of the Research Network has centred on a series of collaborative projects, leading to the publication of a series of five anthologies, including the present volume, which represent staging posts in our shared work and network development.

In the first network anthology (Chisholm et al. 2007), national perspectives on workplace learning research were brought together by founding members of the Network in an initial mapping of the field. In the second and third anthologies,

network members explored questions of work motivation and spaces for learning at work in 'Decoding the meanings of learning at work in Asia and Europe' (Chisholm et al. 2012) and in 'Workplaces as Learning Spaces' (Ostendorf & Permpoonwiwat 2017) through surveys and case analysis in member countries.

The most recent anthologies both address challenges for workplace learning that have occurred during times of disturbance and upheaval at the global level. Our VET resilience inquiry was launched at the start of the global coronavirus pandemic, COVID-19, resulting in the fourth anthology (Evans et al. 2023), which offers a longitudinal perspective on how different VET systems and stakeholders navigated the crisis from its onset through to the recovery phases. The ENRICH project, the subject of this fifth anthology, followed post-COVID in response to rapidly changing scenarios in the uses of digital technologies and innovation in learning environments and in working lives.

Members of the ASEM Network 2 on Workplace Learning are all experts who research and teach at higher education institutions on topics of workplace and lifelong learning and vocational education and training, who collectively decide on projects and topics. At a 3-day workshop in Innsbruck in 2023, members worked together to debate new research priorities, arriving after much deliberation at a research question to be explored collectively:

How can the inclusive use of digital technologies and innovation enrich learning at work and empower workers?

Our aim in this anthology is to showcase research and analyses of workplace learning developments in Asia and Europe (and beyond), shedding light on specific contextual and cultural factors that come into view when questions are asked about digital inclusion and empowerment of individuals and teams through innovative workplace practices.

Network members were invited to put forward ideas and outline plans for investigating aspects of the inclusive use of digital technologies and innovation, utilising and building upon their existing research activities and resources involving partners and students where appropriate. This approach recognised that the contributions would be diverse, but connected by perspectives on human-centred technology and innovation. These perspectives have included the ethical approaches and practices that enable the equitable access and active participation of current and future workers and the notions of socially embedded capability, building on Boyadjieva and Ilieva-Trichkova (2021). Contributions have addressed multiple contexts in which adult learning occurs, from in-house workplace learning in

companies and educational institutions to university programmes that prepare future workers through various forms of work-integrated learning.
Network members have used a combination of methods, including literature reviews that draw on sources in local languages. Review and analysis of relevant literature has been a key element, combined with methods such as expert interviews, case studies, secondary analysis of existing data sets, local surveys and related ASEMLLL discourses on Artificial Intelligence applications.

Comparing perspectives from Asia, Europe and beyond

We recognised from the outset that our research question could itself be explored through the use of the digital tools whose use our collaborative study is investigating. Even elementary use of desk-top AI tools instantly generates broad characterisations of similarities and differences, convergences or divergences between Asia and Europe. Divergent priorities can be gleaned from multiple publicly available reports. Europe, for example, places greater emphasis human-centric regulation and privacy, while Asian nations (particularly in the ASEAN region) tend to prioritise rapid adoption and economic "catch-up" through infrastructure and fintech. Europe is characterised as being ‘Rights-Centric’ as the European Union prioritises consumer protection and fundamental rights, while frameworks like the European Accessibility Act (EAA) and the General Data Protection Regulation (GDPR) mandate accessibility and privacy as legal requirements for both public and private sectors. Asia is characterised as ‘Growth-Centric’, as many Asian economies, such as those in ASEAN, focus on pragmatic, flexible guidelines to facilitate innovation. Priorities are often placed on integrating technology into sectors like agriculture and finance to drive immediate economic growth, sometimes at the expense of standardised rights frameworks.
Differences in digital infrastructure and connectivity are also highlighted. In Southeast Asia, the digital divide seems to widen during crises (like the pandemic), as countries with less developed infrastructure lag significantly behind leaders like South Korea, China and Singapore. Europe shows a greater degree of convergence across EU Member States. Questions of affordability and accessibility arise everywhere, particularly where the cost of data and devices is high for low-income populations.
If we ask how digital technologies can empower or disempower workers in real-life workplaces, we uncover accounts of the two faces of digital technologies - twin effects that are opposites, co-existing in the present, significantly enhancing worker capabilities while simultaneously introducing new forms of strain and control.

Impacts of digital technologies in Asia and Europe are mediated through distinct regulatory, cultural, and economic frameworks and conditions, leading to different forms of worker empowerment and disempowerment. In both developed European and Asian countries, digital transformation is strongly associated with rising wages for high-skilled workers who can navigate advanced AI and automation.

Yet job insecurity also appears to be increasing. Even with strong protections, European workers face "platformisation", where algorithms increasingly provide coordination and managerial control and potentially reduce worker autonomy. Additionally, surveys suggest that European workers are sceptical about whether their employers will provide the training necessary to help them keep pace with AI, particularly when replacing workers may be easier than investing in their skills. One dimension of comparative interest is the dominance of workplace cultures that normalise high-intensity working. The working culture in many Asian tech hubs often normalises high work intensity and long hours, facilitated by digital tracking. The same can also be observed in Silicon Valley companies and multinational firms that operate in Europe. Moreover, some models of digital sovereignty in the region emphasise state and corporate control over data, which can reinforce top-down surveillance in the workplace.

In Asian and European regions and indeed globally, inclusive digital technologies are seen as having the potential to enrich workplace learning by removing physical and cognitive barriers, enabling personalised educational pathways, and fostering collaboration. By moving away from "one-size-fits-all" approaches, organisations can cater to diverse learning styles, neurodiversity, and physical disabilities. Strategies for enriched Workplace Learning typically advocate personalised pathways, collaborative platforms, and immersive simulations where Virtual Reality and Augmented Reality can provide risk-free environments to practice complex tasks. For organisations, improved retention and data-driven improvement are often cited benefits, providing feedback and analytics which are claimed to enable Human Resource Management and Learning & Development teams to identify knowledge gaps and refine training materials. Enrichment of the learning environment often focuses on design, formats and degree of interactivity.

But despite lip service often given to human centredness, relatively few sources take a genuinely person-centred view, prompting researchers bridging computer, data and learning sciences, such as Littlejohn (2023), to demonstrate how ‘Digital Technology Systems Are No Substitute for Human Agency’ with accompanying proposals for workplace learning design that emphasise relational agency.

Our inquiries into the contrasting contexts of Asia-Pacific, Europe and beyond could move beyond such generalisations to view learning applications from the inside-out,

through extended dialogue between ideas and evidence, based on multiple empirical encounters.

Researching workplace learning transformations through networked, collaborative projects

Through our experiences of carrying out collaborative projects, we have been increasingly cognisant of the scale of the challenges involved in undertaking inquiries into the realities of workplace learning between Asia and Europe (and beyond). How spaces for learning are understood differs considerably between the countries represented in the network, or rather, between the societies and cultures that these countries represent. Some of these differences may reflect the defining features of 'Asian' as opposed to 'European' civilizations and their contemporary economic and political structures. Others reflect variations in cultural economic, political and social features within Europe and within Asia. Accounting for these undoubtedly complex patterns is a matter of ongoing debate within the ASEM Lifelong Learning Hub.
Four guiding commitments continue to shape the network's approach to developing its activities, building on principles collectively established and developed over its lifetime (see Evans, 2025). Firstly, we need to use empirical findings to interrogate and rethink underlying assumptions about patterns of differences and similarities between Europe and Asia. Secondly, the collaborative nature of the research ensures that different perspectives have initially equal claims to legitimacy and are open to interrogation from potentially divergent standpoints. Thirdly, the representation of diversity and variety takes priority, with the network committed to inclusive approaches and favouring methodological pluralism.

Transformations in Workplace Learning: Context of the ENRICH project

Workplace learning has undergone a significant transformation in recent decades, driven by accelerating technological innovation, globalisation, and shifting organisational expectations. The emergence of digital technologies offers new opportunities to enhance learning and development in organisations, empowering workers. Yet, alongside these opportunities lie challenges, such as ensuring equitable access to digital resources, addressing ethical dilemmas, and mitigating the risk that technological advancements might inadvertently exacerbate existing inequalities or create new forms of exclusion. This necessitates a nuanced exploration of inclusiveness within these evolving learning ecosystems (Lemmetty, 2024). This

anthology examines learning at work through the lens of human-centred technology and innovation, drawing on the concepts of inclusive use and Boyadijeva's socially embedded capability to focus on empowerment across diverse contexts of adult learning, including the workplace.

Boyadjieva and Ilieva-Trichkova's (2021) concept of social embedded capability serves as the unifying theoretical lens for this anthology. Drawing on Amartya Sen's (1999, 2009) capability approach, they argue that capabilities are not simply a matter of skills and competences. Their development is inextricably linked to the social and contextual factors that shape the opportunities individuals have to achieve valued ways of being and doing. In other words, capabilities are the freedoms and opportunities individuals possess to achieve outcomes they value, and these are significantly mediated by four interwoven dimensions: individual agency, workplace arrangements and cultures, technological infrastructures, and broader policy and socio-economic contexts.

Individual agency concerns workers' ability to engage with learning opportunities, to innovate, and to apply knowledge in meaningful ways, while organisational structures encompass workplace practices, organisational culture, and collaborative networks within and beyond the workplace that influence individuals' capability to learn. In addition, broader social systems include access to digital tools, societal norms, and labour market structures and policies (Holford et al., 2023). Across the chapters in this anthology—whether the context is vocational education and training systems, higher education institutions, or nonprofit organisations—the contributors show, to varying degrees, that learning is most empowering when it is socially supported, institutionally facilitated, and aligned with individual aspirations and organisational needs.

The concept of inclusive use further extends the socially embedded capability framework by introducing an ethical dimension that emphasises equitable practices and approaches. These measures promote equitable access to, meaningful engagement with, and beneficial learning outcomes from digital technologies for all workers, especially those who may be marginalised (McGrath, 2012; Svensson et al., 2023). This concept is therefore vital for understanding how different groups of employees, particularly those historically marginalised, can be integrated into digital learning environments in ways that prevent deepening existing disparities. However, we must be mindful that inclusivity is not merely about providing technical accessibility.

Several chapters in this anthology demonstrate how inclusive digital practices can empower workers through robust professional development programs in digital technology, thereby bridging the digital divide and fostering a sense of agency among

employees. Digital platforms, AI-enabled tools, and collaborative technologies can support flexible learning pathways, amplify marginalised voices, and create new spaces for learning and reflection. At the same time, we are reminded that not all digital interventions inherently lead to equitable outcomes. Authors in this anthology show that digital technologies can just as easily exacerbate exclusion, particularly when design and implementation fail to consider the diverse needs and capabilities of the workforce. From a socially embedded capability perspective, these risks arise when digital innovation is treated as neutral and inevitable, rather than as a set of socially situated choices with distributive consequences. Hence, inclusive use is adopted as a normative orientation to provide insights into how learning environments can be designed, governed, and experienced to enable genuine empowerment and mitigate exclusionary effects within contemporary workplaces. In doing so, this anthology reinforces the argument that we need to look beyond merely enriching work through technological advancements and consider the ethical implications and institutional responsibilities involved.

Capability, Digitalisation and Workplace Learning

The capability lens allows us to ask not simply what skills are developed, but who is enabled to learn, under what conditions, and to what ends. These questions run, implicitly and explicitly, across the chapters.

In *Chapter 1*, Margaret Malloch explores how the inclusive use of digital technologies and innovation shapes workers' learning, environments, and sense of self across aged care, construction, and higher education in Australia. The author draws on qualitative instrumental case studies and narrative inquiry to examine workers' lived experiences of learning through digital technologies in both metropolitan and rural contexts. Using the concepts of lifetech and capability as an interpretive lens, the chapter shows how participants actively engage in workplace learning, using digital tools to enhance their capabilities and professional identities amid local and global challenges.

Chapter 2 explores how digitalisation is reshaping the regulatory frameworks of Germany's dual system of commercial education. Through a systematic analysis of revised training regulations and curricula for office managers and industrial clerks, Ute-Maria Lang and Annette Ostendorf examine how the 'digital condition' is embedded within occupational standards. This embedding signals clear processes of upskilling, with greater emphasis on autonomy, responsibility, and participation in decision-making. The chapter demonstrates how regulatory frameworks actively reconfigure learning and competence requirements for office occupations in a digitally transformed workplace.

In *Chapter 3*, Adeline Goh examines how adult educators' use of digital technologies for workplace learning is shaped by the social environments and structures in which they are embedded. Drawing on a qualitative case study in Brunei, the chapter explores how organisational cultures, relationships, and institutional conditions influence digital learning practices. The findings identify key barriers and facilitators to inclusive digital use, offering insights into how more equitable and collaborative learning cultures can be fostered. The chapter then proposes a framework for organisations and policymakers seeking to support inclusive workplace learning for all workers.

In *Chapter 4*, Sophia Ho examines how Canadian non-profit organisations use generative artificial intelligence to advance equity, diversity and inclusion (EDI) in the workplace. Drawing on interviews with workers in community services and higher education, she explores both the opportunities and ethical risks associated with GenAI. The findings suggest that GenAI can support worker empowerment and organisational EDI goals but may also undermine them if adopted uncritically. The chapter, therefore, underscores the importance of human oversight, robust ethical safeguards and trust in the responsible use of GenAI.

Chapter 5, by Xiaohua Jiang and her colleagues, features a case study of Shanghai University of Engineering Science (SUES). The findings show how this Chinese Applied University draws on its applied orientation to connect AI education more closely with industry needs. Some tensions are revealed in balancing disciplinary specialisation with interdisciplinary integration and in deepening collaboration. As AI-related competencies have focused on the cultivation of talent capable of applying AI across disciplinary and practical contexts, the challenge is to develop integrative professionals with the creative, problem-solving metacognitive capabilities necessary to bridge AI technologies and real-world systems

In *Chapter 6*, Meivys Pacz Paredes and Pedro Yturria Montenegro analyse the development of digital competencies among university teachers and researchers and examine their implications for advancing open science and open education. Drawing on literature from 2019–2023, the study identifies extensive research on digital competencies but also notes persistent resistance within the academic community to the democratisation of knowledge. Despite these challenges, the open science movement has strengthened research dissemination and international collaboration. This underscores the need for further research with active engagement from educators and institutional decision-makers.

In *Chapter 7*, Hanna Toivianinen presents a scoping review that maps research on the digitalisation of work in Finnish workplaces, examining how the inclusive use of digital technology is addressed in workplace learning. Four approaches—effects,

competence, adoption, and agency—highlight a spectrum from imposed requirements to the development of workers' transformative capacities. Drawing on cultural-historical activity theory, the review explores how digitalisation can support professional practice and work-related learning. Inclusive digital practices pose dual challenges: building workers' own capacities and enabling them to foster broader digital inclusion. While some studies address supportive cultures and policies, greater attention is needed to socio-material solutions that strengthen continuous learning and empowerment.

In *Chapter 8*, Irina Maslo and Svetlana Surikova draw on concepts guided by the central framework to examine how informal and non-formal adult learning can expand teachers' agency and capabilities. Grounded in a capability-based understanding of empowerment, the chapter situates teacher learning within the Latvian sociocultural context. It highlights how ethically informed, inclusive learning environments can strengthen teachers' professional freedom and support sustained professional development at work.

In *Chapter 9*, Daiva Bukantaitė, Laurynas Gulevičius, and Vidmantas Tūtlys from Lithuania explore the empowerment of musicians through the introduction of digital technologies in a symphony orchestra. Drawing on a review of scientific literature and quantitative empirical analysis, the authors show how digitally mediated practices can enhance musicians' autonomy, motivation, and creative engagement. They argue that meaningful empowerment through digitalisation depends not only on the availability of technologies but also on broader cultural and organisational adaptations that support collective learning, sustain professional agency, and improve the overall quality of orchestral practices.

Integrating socially embedded capability, personal and relational agency, and cognitive-behavioural perspectives on deep learning, Tay Wan-Ying and Chen Zan illustrate how AI can support reflection and collective sense-making at work. Drawing on cases from three occupational sectors in Singapore, *Chapter 10* shows that AI interacts with trust, judgment, and human relations in complex ways. The authors argue that AI should be framed not as a tool for efficiency alone, but as a means of expanding human capability through inclusive, participatory, and human-centred organisational design.

In *Chapter 11*, Soo Koung Jun of South Korea examines how digital and AI technologies are reshaping teaching competence in Korean higher education, with particular attention to the role of Centres for Teaching and Learning. Drawing on case studies of two universities, the chapter shows that while most academics display moderate digital competence, a small group drives pedagogical innovation. The

findings highlight digital competence as integral to teaching quality and student learning, and argue that these centres play an important developmental role.
Building on survey data from a group of employees, including LGBTQ+ professionals and executives, Chompoonuh K. Permpoonwiwat, Minh-Tam Bui, and Thunyathorn Valapaichitra examine the professional experiences of LGBTQ+ workers in Thailand's IT sector in *Chapter 12*. The chapter highlights the tension between social tolerance and limited legal protections, whereby the industry may appear supportive, yet challenges around gender expression and identity persist. To reduce occupational segregation and enhance job satisfaction, digital platforms and inclusive policies can be leveraged.
Chapter 13 examines how higher education can better bridge academic learning and employment through practice-based approaches. Drawing on qualitative case studies from two English universities, Natasha Kersh and Andrea Laczik explore how students, academics, and employers co-create learning spaces that integrate theory, practice, and work-related experience. The findings highlight the importance of boundary-crossing across intermediary spaces linking education and work, supported by innovation, diversification, and digital technologies. While grounded in the UK context, the chapter offers insights relevant to graduate employability debates across ASEM countries.

Capability, Inclusivity and Agency

When read collectively, the chapters in this anthology give rise to three interrelated and mutually reinforcing themes. These themes emerge inductively from the diverse empirical settings and conceptual arguments presented across the 13 chapters. Broadly, they are linked by a shared theoretical concern—whether loosely or directly—with 'socially embedded capabilities' and 'inclusive use.'

Capability development under conditions of digital intensification

The first theme concerns how human capabilities are developed, reshaped, and contested under conditions of accelerated digitalisation. Across the chapters, we see that digitalisation is not introduced merely as a set of new tools or technologies; rather, it entails a reorganisation of work practices. It recreates environments as socio-technical systems that increasingly blur the boundaries between work, learning, and everyday life. On another note, becoming digitally competent, although widely discussed, is not a straightforward process; it only emerges as a capability when individuals are supported by their institutions, given time, recognised professionally, and empowered to use these digital skills in their work. Without these conversion

factors, expectations of digital innovation risk narrowing academic agency, reinforcing performativity, and intensifying work. Hence, capability development becomes inseparable from the infrastructures through which digital work is organised. Beyond these infrastructures, digital upskilling is also governed by institutional regulations, occupational standards, and policy priorities. From another perspective, digitalisation can also intensify existing patterns of stratification, privileging certain forms of competence within an occupation while marginalising others.

Inclusive use as a relational and ethical practice

Rather than assuming that digital technologies are inherently inclusive or exclusive, the chapters show that inclusion depends on how these technologies are integrated, governed, and embedded in work practices. More specifically, inclusion is conceptualised as an outcome of organisational structures, pedagogical intent, and participatory learning arrangements. For example, digital technologies can support organisational learning and equity-oriented practices when their use is guided by explicit ethical commitments and collective sense-making. Beyond expanding technical competencies in digital environments, they can also foster confidence, a sense of belonging, and professional identity in the workplace.

Agency and institutional mediation in digitally transformed workplaces

Digital tools can reshape learning and performance in ways that both enable and constrain agency. They show that individual agency in digital teaching and learning is shaped less by digital competence and more by institutional cultures, leadership practices, and systems of evaluation. Workplace digitalisation further demonstrates that being digitally competent does not automatically translate into greater agency or empowerment at work. Instead, it requires supportive organisational cultures, inclusive practices, and opportunities for meaningful participation. A similar tension is foregrounded in one of the chapters, which shows that AI-enabled systems can open new spaces for learning and creativity while intensifying surveillance and standardisation. Taken together, these perspectives highlight how digital intensification goes beyond reshaping what workers are expected to learn; it also transforms how learning is governed, recognised, and experienced.

Engaging with Utopian-Dystopian imaginaries

As editors, we invite our readers to engage and (re)interpret the above narratives as utopian and dystopian ramifications of digitalisation. Before doing so, however, we want to draw on John Field's work on lifelong learning, which provides a critical conceptual companion to the capability approach. Field argues that lifelong learning

discourse, like the narratives above, has long oscillated between utopian and dystopian imaginaries (Field, 2006). In its utopian form, lifelong learning is framed as a vehicle for empowerment, democratic participation, social inclusion, and personal fulfilment, while in its dystopian form, it becomes a mechanism of accountability, labour market conformity, and continuous self-evaluation.

This tension is clearly evident across the chapters in this anthology. The utopian horizon is visible where digital technologies expand socially embedded capabilities, where learning is supported, inclusion is substantive, and agency is promoted. Across diverse contexts—from vocational and technical training systems, universities, and non-profit organisations to marginalised worker communities—the chapters show that digital innovation can enrich learning when embedded in ethical practice.

Where dystopian dynamics surface, digitalisation raises expectations without creating opportunities to expand agency. For example, chapters on digital teaching competencies implicitly reveal how continuous demands for innovation and AI integration may undermine professional autonomy, particularly when institutional support is lacking. In the same vein, regulatory approaches to digital upskilling risk reframing lifelong learning as an obligation rather than a right. This concurs with Field's perspective on lifelong learning, which illustrates how becoming digitally competent in the workplace can become a moral imperative tied to employability, shifting responsibility from institutions to individuals. In this dystopian imaginary, learning is less about empowerment than about adaptation to increasingly competitive labour markets. In such cases, workers are required to adjust endlessly to technological change, while structural inequalities remain pervasive.

Beyond Utopia or Dystopia: Maximising opportunity in the digital era

On reflection, rather than subscribing to either utopian or dystopian narratives, this anthology seeks to open up the discussion as an analytical and political resource. We show that digitalisation in workplaces is shaped by how learning is governed, valued, and embedded within social relations. From a capability perspective, the central task is to maximise individuals' real opportunities to learn and to act, rather than merely expanding formal access to learning. This should be understood as a collective endeavour rather than reduced to an individualised coping strategy in the workplace.

Our anthology advances the notion that maximising opportunities in the workplace to enrich learning requires attention to areas such as inclusive organisational cultures, supportive regulation, ethical AI governance, and recognition of diverse identities and forms of knowledge. We therefore suggest that the future of digitalisation in the workplace does not lie in choosing between optimism and critique, but in deliberately

shaping the social and institutional conditions under which learning enhances human freedom.

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ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-02

Challenges of the 21st Century: Work, Lifetech and Capability

Margaret Malloch

To consider empowerment of workers by inclusive use of digital technologies and innovation and their impact on their learning and sense of self, this chapter explores the stories of workers in three different sectors in Melbourne, and a rural region in Victoria, Australia. Aged care, construction and higher education provide a cross section of key industries/professions, each experiencing challenges locally, nationally, and internationally.
Qualitative instrumental case study research is employed, drawing upon literature in the field and exploration of the experiences of the purposively recruited workers.
Narrative inquiry frames the semi-structured interviews and thematic analysis of the participants' stories of impact and sense of 'empowerment' engendered from using digital technology and innovations.
The concepts of lifetech and capability provide an interpretive lens to these workers' individual and workplace experiences and learning. All demonstrated commitment to active learning in their workplaces and beyond, utilising digital technology to enhance their lifetech learning with capability.

Introduction

Hampstead Sunday 22 December 1818

My Dear Brothers,
…several things dovetailed in my mind, & at once it struck me, what quality went to form a Man of Achievement especially in Literature & which Shakespeare possessed so enormously—I mean Negative Capability, that is when man is capable of being in uncertainties, Mysteries, doubts, without any irritable reaching after fact & reason – (https://www.poetryfoundation.org/articles/69384/selections-from-keats's-letters)

The world today is at an intersection between technological advances which could improve the quality of life for more people, address climate change and sustainability, albeit with threats of increased unemployment, devaluation and struggles to survive. Dystopian images of a populace divided into rich, digitally educated and impoverished lower classes are already a reality. Utopian hopes are for improved global health, wellbeing, and environment.

This chapter explores how inclusive use of digital technologies and innovation may enrich workers' learning and agency thus 'empowering' them in the context of 21st Century work and learning.

The use of digital technologies in our work is constantly evolving, in function, scope, sophistication and complexity, challenging workers to adapt, to keep learning. Positive developments benefit society particularly in health, environmental sustainability, communication, and transport. The Covid19 pandemic added to the speed of innovation and uptake of communication technologies particularly with the virtual replacing face-to-face interactions. We move on, operating increasingly in a hybrid environment blending technology and human interactions, questioning as to the impact on our workplace learning and whether this may empower or diminish us. Our work and our lives are conducted in a different place and space from that of earlier generations.

Throughout history, there have been constant adaptations through industrial revolutions which brought both opportunities and losses. Humans have invented, implemented, and adjusted to technology developments. The industrial revolution from the 1700s marked an increase in the pace of such development and change (Schwab, 2016). The advent of manufacturing processes impacted on transport, production, communication, and quality of life. There were also downsides: the images of workers termed luddites smashing weaving machines in northern England and France, in rebellion against factory owners focusing on profit and employment of workers with minimum skills, excluding the better qualified workforce (Conniff, 2016). This tension between profitability of a capitalist system to one of a more equitable mode of operation for the means of production, distribution and exchange is long standing and still challenges society today (The Oxford Dictionary of Phrase and Fable, 2006).

The first three Industrial revolutions focused on industrialisation and manufacturing, automation effected by electronics and information technology, the fourth moving into more virtual realms, the internet of things, Artificial Intelligence (AI), and robotics, disrupting industries in every country (Schwab, 2016).

These developments have been overtaken by the dominance of digital technology, with tools invented to conduct and manage housing, businesses, communication,

health, education, travel, government, information access, banking – all aspects of daily life. 'Digital technology, as the core pillar of the digital economy, covers cutting edge fields such as big data, artificial intelligence cloud computing, the Internet of Things, and blockchain.' (Li, Li, Xu & Ye, 2024, p.240) Using sensors and smart terminals, data is drawn from the physical world, industry, the environment, consumer behaviours and geographical information, all of which can be 'mined' for correlations, patterns, and trends (ibid, p.241). Benefits of cost reduction, networking, data sharing, production efficiency, sharing of data on production, sales, inventory and collaboration are noted.

The locking down and reduced physical movement of populations during the Covid - 19 pandemic of the early 2020s sparked a rapid uptake of digital communication across this broad spectrum of activity. Melbourne, capital of the state of Victoria, experienced 262 days of lockdown in six separate periods, the most in the world; the shift to widespread use of digital technology was rapid and extensive (Macreadie, 2022).

We have moved beyond machines which aid or replace human endeavours, whether in domestic or manufacturing work and activities to highly sophisticated modes of communication, information and knowledge owned by technological oligarchs - individuals wielding massive powers to shape and influence society at all levels. Schwab, in 2016, referred this as Industry 4.0 (n.p.):

Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.
(https://www.weforum.org/stories/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/)

The 'zeitgeist' is one of increasingly rapid digital technology developments, so rapid they may leave many individuals behind, and governments appearing to struggle to legislate protections. Neverthless, the European Commission (2022) has passed a Digital Services Act and a Digital Markets Act to protect and provide a fairer market for users. Australia introduced a digital duty of care with age requirements for under 16s in social media use, released a voluntary AI safety standard which is to be followed by mandatory guardrails for high-risk settings, is part of an OECD Global Partnership on AI and plans to develop a National AI Capability Plan (Parliament of Australia, 2025).

Workplace learning ~ The first challenge

Governments, industries, and enterprises historically and currently look to the development of skilled workforces to achieve their goals for productivity and competitive advantage internationally. Workplace learning, the first challenge in this chapter, is integral to this. Illeris describes workplace learning as 'an obvious form of vocationally oriented learning and qualification', when the term came into common usage in the 1990s (2011, p.32). It is positioned in relation to formal and workplace learning – the technical organisational learning environment, the social cultural environment, and the interaction between the learner's work identity and their competence development.

Many employers have preferred to have 'on-the-job training' rather than workers away at an educational institution, with training to be focused narrowly on specific work roles at that point in time. In one organisation in Townsend, Waterhouse & Malloch's study into employers' attitudes to qualifications, an employee reported seeking permission to do a computer course; it was refused as not directly related to their role. There was no awareness of near future trends in skill demands (2005).

Work, paid and voluntary, can entail development of individuals' identity, fulfilment and sense of agency entwined with learning in the workplace. A more expansive definition is that: 'The workplace is conceptualized as an environment in which people learn because it provides opportunities for them to (co-)participate in activities and practices.' (Fuller, Munro & Rainbird in Rainbird, Fuller & Munro, 2004, p.8)

Billett (2007) takes the description further:

The engagement in work of any kind leads to particular and possibly significant legacies in terms of Individuals' development, in ways that are generative of close links between individuals' sense of self and their work. Consequently, work and learning are so intertwined as to almost inevitably link individuals to their work activities in some way (p.188).

These processes are interlinked with the individual's agency, their sense of self and worldview (ibid, p.188-189).

Cairns and Malloch refer to workplace learning as being for, at and through work, then take this conceptualisation further, viewing learning 'as the outcome of an enabled active intentional interactional engagement in experience and thinking' (2011, p.9). Work, place, and learning are interwoven, with learning integral to every aspect of life. Now, in the 21st century, learning is increasingly interwoven with virtual place (See Figure 1).

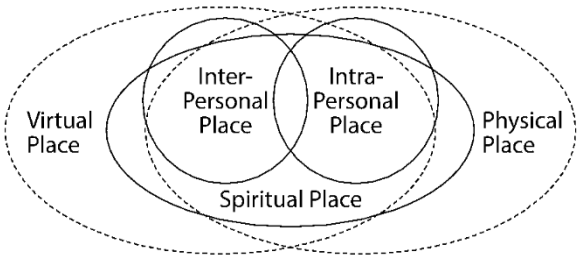

Figure 1: Intersections of place in the lifespace. Own illustration based on Cairns, L., & Malloch, M., 2011, p. 8.

The second challenge ~ Lifetech

Historically, work and workplaces have changed rapidly and inexorably in this 21st Century bringing serious challenges to individuals, organisations and globally. How these are addressed impacts on our learning, particularly the how, what, why, where, and when.

The virtual world now embraces all aspects of work, place, and learning, as illustrated in Figure One. Hence, in considering the impact of digital technology, workers' learning needs to be considered in a context which embraces the personal, physical, and spiritual places and spaces as well the digital.

Throughout millennia, humans have been engaged in lifelong, lifewide and lifedeep learning. They also engage in the 21st century challenge, lifetech, which is more than being *tech savvy;* it is integral to all human endeavours, from rudimentary activities, such as developing tools, to navigating complex and sophisticated artefacts in daily life. It is a fourth dimension of learning, ongoing throughout the life course. Cairns and Malloch (2024) define it as:

Lifetech is about knowing and using all aspects of relevant technology and understanding the impact and complexities beyond technological elements being seen solely as tools/machines. Lifetech in the twenty-first century, encapsulates the intertwining of all aspects of what the term technology could cover, along with Artificial Intelligence and so many of the more recent terms such as Internet of Things (IOT), Deep Machine Learning, Blockchain and Robotic development and application. (pp.65-66)

Lifetech represents a second challenge for workers, to be able to use technology confidently, successfully and with care. There are concerns as to employment, relevance, privacy, accuracy, stress, ownership of creative output, ethical usage costs, and for educators, issues in the use of AI (Makol, 2025).

The third challenge: Capability

Capability is the third challenge for learners in the workplace and beyond, representing a goal for broader and deeper engagement with learning, work, and life rather than the global emphasis on gaining competence and skills.
The concept of capability evolved over several centuries, from English literature (Hamlet) and landscaping (Lancelot 'Capability' Brown, the 18th century landscape architect) to the further development of the term as used by Sir Toby Weaver in an address in 1973 on Higher Education and the Polytechnics, and in turn further developed by the Royal Society for Arts, Manufactures and Commerce (RSA) in the 1990s (Cairns & Malloch, 2024).
Stephenson, working with the RSA on Capability, posited that:
Capable people not only know about their specialisms; they also have the confidence to apply their knowledge and skills within varied and changing situations and to continue to develop their specialist knowledge and skills long after they have left formal education (Stephenson 1998, p.3)

Cairns and Stephenson situate the concept firmly in a holistic application to capable people, organisations and processes, their work and learning (2009, p. 16).

Capability is a holistic concept which encompasses both current competence and future development through the application of potential.
The concept is applicable across both individuals and organisations

- *the capacity to operate in both familiar and unfamiliar situations*
- *the utilisation of creativity and imagination/innovation*
- *being mindful about change and open to opportunities/uncertainties*
- *being confident about one's abilities*
- *being able to engage with the social values relevant to actions*
- *engaging with learning as a self-directed process*
- *operating to formulate and solve problems*

Digital technology's inexorable march

To be flexible, adaptable, competent, and capable learners in the workplace, confident to engage in lifetech, an encouraging and supportive workplace would be beneficial. However, what is happening in the 21st century workplace? As the Luddites fought for recognition of their skills and opportunities to continue working (Conniff, 2011), workplaces and workers in this century face ongoing difficulties and shifts in how they work, the tools and equipment to be used, where to work - the office, home, outdoors, the training that may or may not be available, the job that may not exist, the monitoring of outputs and outcomes, and lack of recognition. Organisational capabilities, culture, performance, knowledge management, risks, power dynamics, policy implications on, for example, security of worker data, preparing workers for the future, lifelong learning, education and the future reshaping of the workplace are all concerns and challenges (Kraus, Ferraris & Bertello, 2023, p.3)

Industry 4.0, with extensive digital technology innovations, is described as a major disruption transforming production, management, and governance. A low skill/low pay, high skill/high pay labour market is envisaged (Schwab, 2016). Predictions for Industry 5.0 and 6.0 by Chourasia et al, (2022) are for a changed work culture for humans, using brainpower to direct machines via digital technology, and more advanced manufacturing. Their vision for IR6.0 is described as futuristic, with emphasis on operations controlled by human minds, carried out by robots and bringing together 'sustainability, anti-fragile goals, and digitization' (p.444). Customer service, cutting edge technology and harmony with nature, are amongst their ideas. One could argue that IR5.0 and 6.0 are with us now.

From Dystopian to Utopian ~ the dark and the light

Digital technological advances whilst promising many improvements, instil fears and uncertainty. Predictions of a populace divided into rich, digitally educated and impoverished lower classes are already a reality with an increasingly greater divide between the very rich and the precariat – the working poor.

Literature in the field presents a binary of dystopian and utopian interpretations of digital technology advances in the workplace with health, education, and business sectors prominent examples. The dark view is of a bifurcated society with high level technological and specialised skills in demand, and an underclass of gig, occasional workers.

Considering the dark side through research into HR professionals, Bamel, Kumar, Lim, Bamel, & Meyer (2022, p.7), identified workers' wide-ranging concerns

including anxiety, privacy, wellbeing, job ambiguity, job redundancy, job remuneration, and job security. Employment is a key concern, predicting both major losses and gains.

The World Economic Forum Future of Jobs Report (2025) provides employment trend data, collected from over 1000 employers representing 14 million employees, across 55 international economies, 60% of whom are expecting to transform their businesses by 2030. Predicted is a loss of 22% of today's jobs and creation of the equivalent of 14% of today's total employment which would be 170 million jobs; 8% or 92 million jobs are expected to be displaced resulting in growth of 7% - 78 million jobs (p.5). The report estimates 39% of workers' skill sets will be changed or outdated by 2030, with clerical and secretarial experiencing the highest work opportunities decreases. Unemployment in low-income countries and youth unemployment was higher than in high income countries. Zirar, Imran, & Islam (2023) provide an extensive list of skills or tasks already taken by digital technology and AI:

monitoring, near vision, control precision, multi-limb coordination, arm-hand steadiness, deductive reasoning, information ordering, manual dexterity, operating vehicles and equipment, getting information, identifying objects and actions, planning and prioritising work, determine compliance of information with standards, analyse data, documenting information, interacting with computers, handling and moving objects, and processing information, self-control, independence, persistence, operation and control, selective attention, equipment inspection, performing physical activities, repeating tasks, being accurate, and using safety equipment.

Table 1: Skills and tasks already carried out by digital technology and AI

Workers worry about AI replacing their employment. Makol's study on the use of AI by educators, students, and other stakeholders, identified several common concerns. These included equity and access, bias and fairness, privacy and data quality of content, security, teacher preparedness, and professional development, loss of human interaction, ethical use of data, cost and infrastructure, evaluation and assessment, and cultural and social implications (2025, pp. 576-577).

For higher education, Kraus, Ferraris & Bertello (2023) raise concerns for students relying too much on accessing new knowledge digitally and not developing critical thinking. Labelling the current technological era as 'techo-capitalism', a Melbourne University academic (Robert A, 2025, p.19) views academics and universities as unprepared to address AI. Pedagogy and assessment are concerns and examinations

suggested to address originality. The quality of a qualification gained by reliance on AI is considered of questionable value. Students' learning capability is diminished. Universities are grappling with these issues, gradually developing policies and checks.

Artificial Intelligence – friend or foe

Definitions of AI emphasise digital technology innovation and human interface.
AI is a very recent innovation in 21st Century digital technology which uses data and algorithms to perform human-like tasks independently by learning and interpreting data. It can perform an increasing number of work actions such as planning, scheduling, marketing, cognitive therapy, customer service, and chatbots (Zirar, Imran and Islam, 2023, p.2).
AI refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. These machines are designed to perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation (Makol, 2025, p.575).
AI use spreads rapidly, with several skills and tasks performed by human workers being overtaken by digital technology. The fear of unemployment may be counterbalanced by supporting education and training, professional development, and mentored development to work with AI. Ethics and social values could be incorporated. Questions of veracity, diminishing analytic skills, too great a reliance on digital interface, and lack of support in the workplace, are counterbalanced by arguments for more collaborative and encouraging workplaces and policies.
AI has been developed and controlled by monolithic BigTech companies, predominantly American, making huge profits and dominating internationally. The concept of colonialism is utilised as a metaphor to critique this global digital domination in Mejias and Couldry's work on Big Data. The seizing of land created extraction of enormous wealth, a parallel to the Big Tech companies whose wealth is bigger than most stock markets. The data grab, or data colonialism, is likened to the land grab, with similar stages to explore, expand, exploit, and exterminate; globally. We have given our data free to big corporations; it is grabbed and converted (2024). As colonialism caused suffering, the Big Tech companies exercise increasing power over people's lives, with surveillance, facial recognition, workplace monitoring; AI having power to disrupt our known world. There are benefits to the few, losses, exploitation, and a lack of control for the many (ibid, 2024).

The utopian and the light

With a more utopian perspective, positives for employment lie in health and aged care sectors. An aging population requires more healthcare, creating more employment opportunities. A smaller working age population in high income countries also contributes to employment. The Future of Jobs Report (World Economic Forum, 2025, p.5) notes that these factors create demands for network and cybersecurity and 'human skills of resilience, flexibility, agility, leadership, and social influence', 'curiosity and lifelong learning,' in other words, capable people. Jobs predicted to grow in the immediate future include those focusing on renewable energy, environmental engineering, electric and autonomous vehicle specialisation, climate stewardship, technology related work, delivery, farms, construction, sales, food processing, care, nursing, social work, counselling, personal care, and teachers (ibid, 2025, p.5).

Potential achievements of 'greater agility, automation, collaboration, efficiency, flexibility, innovation, and productivity in work' are viewed as positive developments (Bamel et al, 2022, p.2) requiring professional development and training for upskilling, reskilling, and transitions (Marsh et al, 2022). AI is regarded as useful for professional development and training, curriculum interaction and partnerships with industry and tech companies (Makol, 2025). The dark side, the negative effects of digital technology are important to acknowledge and address (Marsh et al. 2022, p.1, p.14).

Other recommendations move to a more integrated incorporation of digital technology and its use by workers. Zirar et al. (2023) argue that workers need to be provided with the skills needed to co-exist with AI in 'a symbiotic relationship' (p.3). They identified four themes for workers and AI – distrust from seeing AI as a job threat, being enticed to use AI to augment abilities, need for technical, human and conceptual skills to coexist with AI, and ongoing reskilling and upskilling required for a 'symbiotic relationship with AI' (Zirar et al., 2023, p.7).

From detailed analysis of Gallop research into the future of work and employee empowerment and satisfaction, Makridis and Hun Han (2021) argue employees should be able to experiment with new technology especially when supported by supervisors (pp.3, 8). Technological change can 'increase job quality and provide employees with greater flexibility and autonomy.' (p.10). However, 'greater engagement or purpose through their work' (p.10) was not evident. Billett advances that work in the digital age requires technological competence, the ability to adjust to changes in how work activities are carried out, such as the gathering of information

for decision making, carrying out occupational tasks, and interactions between workers and others (2025, p.42).

His recent research into digital work and learning by healthcare workers utilised five European countries' data from the OECD Program of International Assessment of Adult Competence (PIAAC) Second Cycle (2025, p.44 - 45). Workers ranging in age and role levels were surveyed; 86.9% reported engaging in routine problem solving and 58% in non-routine problem-solving involving weekly innovations. Digital technology usage became embedded in regular routines; adjusting to operate competently, with agency and capacity. These skills and approaches form a basis for increased learning during their working lives, with potential impact on quality of client and patient care.

From a major project into the use of AI in 240 VET German schools, Deitmer and Seimer, (2025) identified that in 12 of these, teachers and students were the drivers for use of AI in school and companies they worked with. Teachers used the tools primarily for preparation and content research whilst students used AI tools to support self-directed and group learning and for information. Several recommendations resulted from their research: the need for increased technical competence for mid-level technical professionals, continuous training for teachers, redesigned educational concepts to improve technical skills, use of teaching models, stronger data protection and management, institutional networking, internal professional development, ethical procedures, transparent funding, inclusion in the regulated curriculum and importantly recognition of the socio - political context. Interdepartmental interaction and communication, competence centres established within VET schools and an AI café as collaborative space were recommended. Effects of overuse were important to monitor. (2025, pp. 75 – 76). These two studies provide positive examples of the integration of digital technology and AI into everyday use in healthcare and vocational education settings applicable to other contexts.

The study

To explore the empowerment of workers by inclusive use of digital technologies and innovation and their impact on workplace learning, an instrumental case study was selected to provide insight into the issue (Stake, 2003). As Stake stated, 'each case study is a concentrated inquiry into a single case', (ibid, p.136), which is complemented by employing narrative inquiry to frame the semi-structured interviews and thematic analysis of the participants' stories (Braun and Clarke, 2006). Narrative inquiry is a way of understanding peoples' lived experiences and practice, over time, in different social contexts and places (Clandinin, 2019, p.14 -

15). Her 'metaphor of journeying with narrative ideas', … 'over time, place and relationships …' (ibid, p.5) resonates with the workers' lived reality of 21st century challenges of work and technological changes.

Using purposive sampling, six participants from the aged care, construction, and higher education sectors, were sourced from the researcher's professional network and interviewed via zoom with transcription enacted, on their experiences of digital technology in their work and learning.

These sectors are a cross section of key industries/professions, each experiencing challenges for their organisations in addition to increased use of digital technology. An ageing population will substantially increase demands for care. Recent legislation (Australian Government, 2024) adds pressure, aiming to increase individual data collection and to use AI to process applications for care. The building of housing for a burgeoning population, increasing prices and difficulties in obtaining skilled workers and materials is pressuring this industry. Digital technological advances are evident in every aspect and stage of construction. 'Workers will need to upskill in new areas such as digital twin technology, asset management software, building information modelling (BIM) and Computer Aided Design (CAD) software' (Victoria State Government, 2022, p.7). AI, robotics, and sustainability are increasingly important. Higher education, especially international education, has been a major export earner for the Victorian economy. Use of digital technology is increasing, with hybridisation the norm for online and face to face delivery. The most recent is AI.

The narratives

The participants' stories illustrate their experiences of challenges of learning for work and beyond, approaches to digital technology, and sense of self-efficacy, empowerment, lifetech and capability. They are Stella, a sessional academic, Gerald, a semi-retired construction industry consultant and doctoral graduate, Dani, a doctoral student teaching part time, Peter, the Chief Executive Officer (CEO)/owner of an Engineering company, Joy, an aged care support worker and Freda, CEO of an Aged Care facility. Their perceptions of digital technology echoed the positives and concerns for workers evident in the literature; it is a resource, saved time and effort, and is used in a variety of forms and functions. Concerns were expressed as to employment, organisational financial viability, problems in accessing relevant systems and information, and accessing meaningful professional development. They recommended that clear policies and processes for use be established and care taken in relation to risks and ethics. Each has a passion for workplace learning which embraces digital technology. Lifelong learning, curiosity, being early and flexible

adopters, and individual research into technological innovations were strong. They were all confident with few expressions of anxiety. Some organisational and political barriers were identified, such as being out of step with changes in workplace leadership, business competition, and lack of government support.

Participant	Background	Lifetech	Empowerment	Observations
Stella Portfolio worker, casual employment in four universities, Melbourne	Undergraduate degree in information technology PhD in pedagogical frameworks for teachers, Career in secondary, TAFE and higher education teaching in IT	Confident and innovative in using digital technology Creative approaches to teaching and problem solving	Addressing workplace and technological issues has shifted from human support to use of inadequate IT tools Protocol changes not communicated to staff: *It's like you are an automaton.* Staff/student interactions and feedback diminished.	Expertise not acknowledged, hard to get a longer-term contract possibly as an older female worker. *Digital technology is supposed to release you, but as a sessional academic it's left you less powerful. IT and AI should empower us but it's trying to treat us like marking machines.* Stella is capable, innovative, professional and committed to learning and teaching.
Gerald Construction industry consultant Melbourne	Construction Apprenticeship with the National Trust, ran own business, became a vocational teacher, manager in the TAFE sector, Consulting	Confident, innovative, and experimental user of digital technology, introducing new approaches to learning and teaching gradually, using mobile phones in assessment exercises. He values and	An early adopter. Introduced successful programs for students and staff using digital technology. Despite setbacks and blocks, Gerald remains optimistic and positive. A committed lifelong learner, of formal, informal,	Encountered major barriers, Assessments via a mobile phone program ended by a new Director: *Why would carpenters have mobile phones?* A lack of higher management support in TAFE was common.

	completed master's and doctorate on construction industry training	encourages a climate of communication and development with colleagues	workplace, lifespace, and lifetech learning.	Gerald also observed: *ChatGPT doesn't reference and is often wrong… It's a good tool but you need knowledge behind it.* *He recommends a digital signature for it and AI.*
Dani International Doctoral student and teacher of English as a Second Language Melbourne and Vietnam	Studying at a major university, masters in TESOL, PhD	An active, thoughtful, and critical user of digital technology, demonstrating expertise in a range of tools in studies and teaching; for work, training was provided, for study it wasn't. Using ChatGPT and AI make his work more productive and save time.	*It is important nowadays to embrace it, to be able to see what is good and use it.* Personal knowledge and background drive usage. *It's like a colleague or critical friend – people may not have time to chat with you* - *AI and I have a close relationship – I think it empowers me to do more things.* Professional and thorough.	He recommended that universities and colleges should have a clear framework on AI and digital technology providing staff and students with clear operational structures. Pedagogy and curriculum need to be developed. Students need to be more sophisticated users of AI. Staff should also meet formally for proper face to face discussions.
Peter CEO/owner of major engineering company Rural region	Peter left school at 15 to work on the family farm, then found his métier in construction, starting his own business. He now heads a major	The company had to evolve and go with digital technology. It is easier to keep records: *in engineering and pressure welding a lot of reporting is needed.* Digital technology saves time and effort,	*We're becoming so smart we're doing ourselves out of a job*- there were 140 – 200 employees a decade ago, now only a dozen. Mobile phones were used to follow instructions to quickly install a	With no access to the National Broadband Network, speed of data is an issue; mobile phone coverage is intermittent. They are planning to use AI in the near future.

	engineering business	clerical tasks are now digitised. A depth of knowledge, rich experience, learning about digital technology keeping up with trends, and a passion for lifelong learning result in a high sense of self efficacy and strong sense of empowerment.	new Swedish rolling machine. Workers are mentored in use of digital technology.	Peter noted that now *anyone could become a welder via the internet.* As a parting observation: *perhaps we will all be replaced by robots in the future!*
Joy Vocational qualifications essential for her work Rural region	Joy has a Certificate III in Individual Care and Support and works in a rural aged care service as part of a team of four supporting 15 of the 90 residents. Previous study was a diploma in Hospitality, including computer studies in Thailand.	Digital technology is a key part of the work, iPads and mobile phones are essential for monitoring, reports, checking and schedules and updates. Mentoring and a buddy system when starting the job helped to gain confidence. Regular training is provided.	*Joy feels empowered by being able to track and upload to her personal device, her schedule, work hours and pay. This contributes to a feeling of control of her work data, and the work itself.*	The area has power blackouts so paper-based reporting backups are required. Training is carried out regularly including on new technology. Everything is technology, more and more. Joy has passion for her work; the support role needs people who are gentle and care for people. Rejecting completely the idea of having robot carers, she stresses that human interaction is important. You have to listen.
Freda CEO aged care facility Rural region	Freda has a master's degree in business management and completed	*Covid thrust us into the 21st century.* Technology is employed to save	*I make an effort to understand and use things to feel confident – maybe less so as I age.* Intelligent and	Employee numbers are steady, however she envisages a shift in job designs, eg. payroll, and more

	a short TAFE IT course early in her career. She is the CEO of a rural aged care facility with 180 employees and nearly 200 residents. She is mindful of her, and the Board's responsibilities.	time and operate more effectively. ChatGPT is used in *a constrained way.* Training is provided for staff. Using Copilot enables her to do two things at once. AI is used judiciously, checked through research and own knowledge. Staff use it to write with more confidence and better.	incisive utilisation of digital technology is made by Freda and her staff. Encrypted technology is used as cybersecurity is a concern.	part time and carer roles. *Never take anything for gospel from AI – always test it.* All use of digital technology is carefully considered, checked and if used, implemented carefully and judiciously. *When I buy a mug, it is real, when talking about digital technology – it's a bit like mercury in that it moves so quickly - hence a real sense of powerlessness.* Self-described as *'not an early adopter'*, she is a very careful and capable user of technology.

Table 2: Participants' responses.

Learning from the narratives

Were these workers empowered? The use of the term 'empowerment' is challenging; it has almost become a cliché. The Cambridge Dictionary (2025) defines it as: *the process of gaining freedom and power to do what you want or to control what happens to you; the process of giving a group of people more freedom or rights: and Empowerment of the individual is an important tool for facilitating quality of life.* (https://dictionary.cambridge.org/dictionary/english/empowerment)
Empowerment through lifelong learning is interpreted by Boyadjieva & Ilieva-Trichkova (2023) as 'having two sides: a subjective one, referring to an individual's capability to gain control over the environment with the aim of improving their own well-being and that of society, and an objective one, reflecting the available opportunity structures' (p.140) and the subjective side an expansion of agency,

process freedom, capabilities and opportunity for freedoms at both individual and societal levels.

Self efficacy is also an important element: Bandura (1977) identified four key sources contributing to personal efficacy: 'performance accomplishments, vicarious experience, verbal persuasion, and physiological states' (p.191) with positive achievements encouraging further efforts. This aligns with the concept of Capability promoted by Stephenson, (1998), Cairns and Stephenson (2009) and Cairns and Malloch (2024) for the development of capable individuals, communities and organisations.

Empowerment and a sense of self efficacy are evident in the narratives, at individual and organisational levels, to research and develop new approaches for work, access valued employment information, work faster, organise data efficiently, enjoy working with a colleague to solve digital problems, make positive impacts improving assessment processes for apprentices and teachers, and conduct cutting edge welding on a major transport project. Learning for, at and through the workplace was evident for each participant. The inclusive use of digital technologies enriched their workplace learning, their lifetech and capability.

Each has a passion for workplace learning and curiosity which embraces digital technology, lifetech and lifelong learning. They are flexible adopters, incorporating the technology into their work and study. Each appeared confident and in their own work roles, formal and informal learning, were committed to keep learning about digital technology, from using a work phone and iPad to record each shift to introducing sophisticated processes in a large organisation. In a variety of ways, each demonstrated innovative and creative practice. And referring to Stephenson's definitions of capability (1998), they have the confidence to know their specialisations, use their knowledge and skills in different situations, continuing learning, engaging with social values, learning as a self-directed process and to formulate and solve problems (Cairns and Stephenson, 2009). The participants in this study demonstrated capability in their own milieu and beyond.

The participants' experiences of professional development and training depended on workplaces' approaches. Whilst the two CEOs facilitated training for digital technology, those in education had to be self-directed learners, drawing on their curiosity, knowledge, willingness to experiment and share their learning. Available opportunity structures (Boyadjieva & Ilieva-Trichkova, 2023) were not consistent. Responsible and ethical use of digital technology by individuals was emphasised, and the need for up-to-date policies at organisation and government levels stressed.

Barriers and reliance on self-directed learning point to a patchwork of use and understanding of digital technology, with the tertiary education sector, university, and

TAFE institutions, appearing to lag. The universities and institutions they worked for had barriers to effective use of digital technology whilst slowly developing policies. Governments are cautious in developing legislation and boundaries.

Where to now and in the future… a new industrial revolution or new feudalism?

With increasing costs of living, political uncertainty, wars, extremes of wealth and poverty and climate change, the technological innovations may be destructive or helpful. Not every individual, business or organisation has ready access. Nor are businesses, organisations and institutions necessarily concerned with worker welfare or for learning in the workplace; their focus is to be profitable and thrive. Supporting learning in the workplace is not necessarily a priority. There are negative impacts on individuals which challenge privacy, mental health, identity, self-efficacy, and capability. Given that this study is a few years post the lockdowns experienced by the three Melbourne participants, Gerald, Stella and Dani, and the lesser rural lockdowns experienced by Joy, Freda and Peter, it is difficult to hypothesise as to what effect these had individually and as workers; the world has shifted and increasingly communication is electronic, each of us in our own bubble, trying to navigate the complexities of life in the virtual world, with limited external assistance, subjected to scams, to social media abuse, and to rogue programs such as Robodebt, a major Australian government abuse of unemployment benefits recipients.

There is perhaps a general passivity about digital technology use, it is seductive to slip into X (formerly Twitter) and Facebook, where every detail of daily life can be shared. Privacy is breached by the collection of data by the tech companies; people voluntarily share too much daily minutiae. Work processes appear to be changing, largely irrespective of worker engagement. The rapid adoption of digital technology during the Covid19 pandemic has not slowed, like mice on a wheel, we run to catch up, not reaching a destination.

For current and forthcoming generations, education and training need to be more balanced and sophisticated. Curricula, pedagogy, school policies all require updating to address digital technology. Teachers need more skills and knowledge to work with it. Two studies on vocational education and training point to practical models to guide development and inclusive use of digital technology and AI. Heindl, Bley & Miesera, (2025) from research into the hospitality sector argue that there need to be ‘deep and didactic changes in vocational education’ (p.123) with an emphasis on systematic skill development. They recommend ‘stronger integration of future- oriented skills’ which include ‘creativity, reflection ability, and willingness for lifelong learning’ which

would 'help prepare professionals for digital change in a sustainable way' (p.123), all with general applicability.

Attwell, Deitmer, & Bekiaridis, (2025, p.34) in a consideration of digital and sustainable economic development of VET make practical commendations for action:

- include AI competences in initial VET teacher training,
- utilise Open Educational Resources,
- develop online continuing professional development for AI in VET programmes,
- collaborate between industries, crafts, VET schools, training centres to develop new projects, curricula, and use of AI in different occupations
- utilise the Massive Open Online Course (MOOC) free online courses in English and German.

These are useful recommendations for VET, workplace learning and training and professional development in other organisations and institutions. Relevant training up front, sharing, communication, and support provide the opportunity to build a community in which individuals can 'cope and flourish' (Marsh et al, 2022, p.15). Providing positive organisational support, mentoring, training, and formal acknowledgement of teachers' efforts and time taken to employ digital technology in their work, need to be addressed.

The dark side of digital innovations such as worker stress, overload, and excessive use, Marsh et al., (2022) recommend, can be countered with resources such as, individual mindfulness, coping approaches, computer self - efficacy, training, and organisational ICT support, job autonomy and technology as a resource and transformational leadership (pp.10-11). These are positive strategies, which along with greater organisational active acknowledgement of health and wellbeing could support workers in transitioning to a more informed and inclusive utilisation of digital technology and AI.

Further efforts should be made. In writing of new social relations and the future of work, Joyce, Umney, Whittaker & Stuart, (2023) take a third way, focusing on the social shaping of technology rather than the well-established binary approaches employed in much of the literature. They consider the complexity of change in sociotechnical systems tends to be ignored (p.147), and argue that social shaping of technology, race, gender, and the non-technological, power relations, social interaction, structural conditions, labour process, social, institutional, and cultural situations, need to be included in research, development and implementation of technology, especially digital technology. For the present and the future, initial training, sharing resources, communities developing alternate internet options, collaboration between industries, organisations, professions and institutions, support

for those unable to engage due to disadvantages, respect for privacy, wellbeing, ethical usage, and sustainability on a global scale may be too much to wish for (Mejias & Couldry, 2024). A further aspect to factor into individual, workplace and societal integrity is what Schwab referred to as the blurring of the lines between the physical, digital, and biological. This fusion of mind, body and digital technology is well underway (2016). Therein lies a major challenge for learning and living in the workplace and beyond with lifetech and capability.

Individual creativity, imagination, and capability in the ethical and transparent development and use of digital technology and AI in the workplace and in life need to be recognised, supported, and celebrated contrary to institutions and organisations wanting to focus on productivity and profit through a blinkered view as to what a more transformational and open environment could achieve.

Postscript: *It is ironic that as I write this, Australia experienced a telecommunications outage which meant emergency services could not be contacted. Four people died. A major professional services company provided the Australian government Department of Employment and Workplace Relations with an AI created report littered with errors and non – existent academic references. Thus far it has provided a partial refund.*

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-03

The Digital Condition, Upskilling and Empowerment in the Regulatory Instruments Governing Vocational Education and Training in Germany: The Example of Office Occupations

Ute-Maria Lang and Annette Ostendorf

This article examines the influence of digitalisation on the regulatory bases of dual commercial education in Germany, including training regulations and framework curricula, which are binding for the joint educational mandate of companies and schools, as well as official implementation guidelines. In a systematic document analysis, two newly revised occupations (office manager and industrial clerk) were analysed to determine how characteristics of digitalisation – in line with Stalder's (2018) concept of 'digital condition' – are reflected in them and to what extent qualitative changes in the requirements can be identified. The analysis reveals that the digital condition is well-established within these regulatory frameworks, leading to clear signs of upskilling in the occupational profiles. Taking responsibility, working independently, and participating in decision-making processes are requirements for office jobs in the digitalized world of work.

Keywords: digital condition, training regulation, framework curriculum, office occupation, upskilling, German dual vocational education

Introduction

The work of Autor et al. (2003) and the very famous, albeit heavily criticised, study by Frey and Osborne (2013), which estimated the extent to which jobs can be replaced by digitalisation, have ignited heated international debates about changes in jobs, occupations and skills as a result of digitalisation. The German dual system of vocational education and training (VET), which prepares a significant portion of future employees at the levels of skilled labour and administrative work, is heavily

affected by digitalisation. The key challenges facing the German dual system in this regard are its capacity to meet industrial service needs, the attractiveness of the system (as measured by young people's willingness to enter the system and employers' willingness to offer apprenticeships), and the degree to which digital technologies are applied (Yang et al., 2023: 7ff.). These challenges also relate to commercial vocational education. It is assumed that the digitalisation of the world of work and life will have a considerable impact on commercial training, both at the regulatory and micro levels of teaching and instruction (Seeber et al., 2019). Several studies have addressed the changing skill requirements in the digitalised economy (Jordanski, 2019; Leiß & Rausch, 2023; Leiß et al., 2022, Ostendorf, 2017). The impact of digitalisation on office occupations has recently been examined in more detail in the German context, particularly by von Bach et al. (2022).

By examining recent data on the number of apprentices in the German dual system, it became evident that commercial occupations disproportionately and severely declined from 2003 to 2023. The underlying reasons for this phenomenon were multifaceted (e.g. demographics, sectoral economic performance and competition from bachelor's degrees, see for example Haasler, 2020). However, it is reasonable to assume that the effects of automation and digitalisation also play an important role. Table 1 provides a comparative overview of key commercial and technical training programmes.

	2003	**2013**	**2023**	**Absolute difference from 2003 to 2023**	**Percentage difference from 2003 to 2023**
Bank clerk	39,297	35,616	21,573	−17,724	−45.1
Office manager	99,054	79,899	56,625	−42,429	−42.83
Industrial clerk	50,505	53,703	42,150	−8,355	−16.54
Mechanical technican	20,292	26,490	26,988	6,696	32.99
Electronics technician	40,137	33,591	42,198	2,061	5.13
Total number of apprentices in the German dual VET system	1,581,630	1,391,886	1,216,560	−365,070	−23.08

Table 1: Apprentices in some key commercial and technical training programmes from 2003 to 2023, own calculations. Source: BIBB (2023).

While the declines in the number of apprentices are quite pronounced, the numbers in some technical training programmes have increased. However, the total number of apprentices is decreasing.

The international academic literature highlights dual vocational training as a potential strategy for addressing the need for upskilling in a digitalised world of work (Li, 2024). In this context, upskilling refers not only to individual learning but also to the collective skill level of employees in specific fields. On an individual level, digitalisation in the workplace can lead to varying changes in qualifications. Both deskilling, caused by the automation of cognitive and manual tasks through digital systems (similar to a re-Taylorisation), and upskilling, resulting from increased complexity in job requirements, are conceivable outcomes (Gössling & Ostendorf, 2021).

Research on the impacts of digitalisation, further intensified by the emergence of generative AI, on occupational competencies and working conditions must determine the level at which its approach must be focused. Qualification research often addresses the issue on an abstract, cumulative level by analysing job profiles for employment categories. By contrast, interpretive qualitative empirical research often examines the issue from the perspective of those affected, using phenomenological or ethnographic methods (e.g. Karhapää et al., 2025). Quantitative surveys typically capture the appraisal of those involved.
However, particularly intriguing is the interplay between changes in occupational requirements, not only as a specific situational snapshot or an abstract estimate/statistical analysis but also in terms of their long-term integration and significance for a transformed work culture shaped by ‘the digital condition’ (Stalder, 2018; see detailed discussion in Chapter 3).
It is therefore particularly important to analyse the so-called regulatory frameworks in vocational education and training, which contain expert knowledge and a certain degree of forecasting when it comes to a transformed work culture. Regulatory frameworks include training regulations and vocational school curricula that guide the objectives and content of education. These frameworks are binding for all companies in Germany that offer dual vocational training. Commercial occupations that have recently undergone reorganisation are especially noteworthy in the context of the dynamic development of digitalisation, as they should already reflect the dynamics of digital transformation. The two research questions are as follows:

1. To what extent are the constituents of the 'digital condition' reflected in the restructured job profiles of selected commercial professions?

2. What changes in qualification level can be identified and what does this mean for employee empowerment?

Thus, we focused on the meso-level of regulatory frameworks through a qualitative empirical document analysis, with particular attention to office-related occupations. Specifically, we examined recently restructured occupations: the newly revised training programme for office managers (3 years, European Qualification Framework (EQF) Level 4) from 2025 and the newly revised training programme for industrial clerks (3 years, EQF-Level 4) from 2024.

Regulatory Instruments in Commercial Vocational Education and Training: Origins and Significance

Pfeiffer et al. (2024) adopted a sociologically informed yet interdisciplinary approach, conceptualising digitalisation as a systemic transformation. The aforementioned approach is characterised as a process of change that '(...) alters work processes at the organisational micro-level, value chains and industry structures at the meso-level, and the institutional system of the labour market' (Pfeiffer et al., 2024: 7; own translation). This transformation has been enabled by technological advancements, socially prepared and discursively negotiated by a wide range of stakeholders (Pfeiffer et al., 2024: 7). In the context of changes in VET, particular importance is attributed to the spaces where these negotiations are most prominently manifested, namely the 'occupational profiles' that guide the curricular implementation of dual vocational education through training regulations and framework curricula. Within micro-, meso- and macro-level logic, these profiles, as regulatory frameworks, are situated at the meso-level. Occupational profiles, training regulations and framework curricula constitute quasi-institutional structures. In addition, the implementation guidelines for new or revised occupations, published by the Federal Institute for Vocational Education and Training (Bundesinstitut für Berufsbildung [BIBB]), play a significant role in shaping vocational training practices. These regulatory frameworks (including the implementation guidelines) are highly relevant for managing the digital transformation at specific workplaces, as they shape the employees' competency profiles (see also Zarnow et al., 2020). While their revisions do not reflect immediate, day-to-day changes due to multi-year update cycles, they provide insights into the deeper, long-term orientation of vocational skill development goals. The revision of these frameworks incorporates findings from qualification research, vocational education policy (involving both employer and employee representatives) and

vocational didactics. In Germany, new occupational profiles or revisions of existing ones are developed through highly complex, multistage processes (BIBB, 2017). These processes are institutionalised and operate on the principle of consensus. The latter means that once the highly controversial processes have been completed, all stakeholders commit to these occupational profiles, which are specified in training regulations and framework curricula, and implement the training jointly. In a preliminary phase, various developmental and research activities are conducted, and social partners (trade unions and employers) agree on key parameters. This is followed by the actual drafting of the training regulations from which the vocational school curricula are derived. The process culminates in the ministerial approval phase and publication. Subsequently, materials for implementation are developed (Elsner & Kaiser, 2013). This entire process typically takes one to two years. Owing to the extensive development process, which involves various stakeholders, particularly social partners and occupational associations, and is accompanied by scientific oversight from the BIBB, training regulations (and vocational school curricula) also reflect expert assessments of the current economic situation and projections for future developments. The intervals between revisions vary. For example, the occupational profile for office managers was revised after twelve years, whereas that of industrial clerks was updated after 22 years. As such, training regulations and framework curricula remain in effect for relatively long periods. However, they are formulated in a way that allows for flexible adjustments by trainers and teachers. They should be interpreted as ‘minimum standards’ (Zarnow et al., 2020: 252).

Digitalisation in terms of 'the digital condition'

First, it is necessary to clarify what is meant by *digitalisation*. It is challenging to define this term because of the wide range of phenomena it encompasses. Thus, in our research, we adopted a more abstract interpretation that frames digitalisation as a cultural condition. Drawing on Stalder (2018), we interpret culture as a dynamic field of negotiation. We prefer this approach because it allows for the examination of work practices (e.g. office work) in their continuous and increasingly technology-driven dynamics of change. These changes elicit constant ‘responses’ from employees, which are tied to learning processes and, in turn, give rise to new forms of work. This perspective goes beyond merely focusing on digital technologies to which employees are ‘exposed’. It also considers the emergence of new standards, processes, and work practices. In addition, it is important to recognise that analogue and digital elements coexist, making their relationships a significant factor to consider.

Stalder (2018) associates the digital condition with three key forms that distil the diversity of related phenomena into their essential characteristics. We aimed to build on this framework, applying it specifically to office work programmes and current advancements in digital technology, to make it actionable for our document analysis.

Referentiality

This refers to the use of existing resources and their meaning for productive purposes through digital applications. In the context of office work, the focus is on filtering, researching and utilising information for work processes. Cultural objects, such as texts or data, are no longer viewed in isolation but are instead interconnected through recombination or linking.
In this context, enterprise resource planning systems (ERP), such as SAP, have long been of particular importance (Seeber et al., 2019). In recent times, the potential of AI has been introduced as a further element in this field. Large language models (LLMs), such as ChatGPT, and similar systems have become assistants in the office environment. While Stalder (2018: 77) acknowledges that any material used productively has a history— 'even if its traces are lost in clouds of uncertainty'— these 'clouds' have been further intensified by the emergence of generative AI, whose handling of data for the creation of artefacts remains completely inaccessible to the user. In office work involving AI, critical evaluation and the assignment of meaning are particularly important, which implies a high level of cognitive demand. This not only includes interpreting the results generated by AI but also mastering the art of prompting, which places increased demands on (domain-specific) linguistic skills. Furthermore, meaning is created in a dialogic manner. This necessitates appropriate communication to contextualise the content produced by AI, whether through interaction with the AI itself or with colleagues. As a result, communication skills in the digitalised workplace become a multidimensional competency, encompassing interactions with both human and non-human actors.

Communality

Digitalisation is also transforming the nature of 'communities of practice' in office environments by enabling communication that transcends temporal and spatial boundaries through digital tools. Video conferencing, hybrid forms of communication, collaborative work on platforms and in cloud environments, and home office arrangements have become everyday practices. Since the COVID-19 pandemic, these tools and practices have become integral to office life. This shift has led to new forms of collaboration and requires enhanced self-organisation skills.

Furthermore, these factors influence occupational identity development and the manner in which individuals position themselves within the organisational structure.

Algorithmicity

Algorithms play a central role in office-related information processes. They simplify tasks such as handling large datasets or extracting patterns. LLMs are an example that have further enhanced this capability. In office environments, algorithms are particularly useful for tasks such as correspondence. For example, foreign-language correspondence has been fundamentally simplified through tools such as DeepL or similar applications. Business letters can now be generated with ease, although they still require thorough critical review. LLMs are especially valuable for creating 'drafts', making control tasks and critical judgment increasingly important. Another significant aspect is data security, which remains a key concern for office employees. These three aspects—*referentiality*, *communality*, and *algorithmicity*—were used as references in the analysis of the regulatory frameworks for recently restructured office occupations in Germany. They guided the interpretations of digital aspects and their evolution.

Method

The empirical research design of this study was interpretive and qualitative, employing what is referred to as the document analysis of genuine documents (Billups, 2019; Döring & Bortz, 2016; Glaser, 2013; Noetzel, 2018). Genuine documents are characterised by the fact that they are not created during the research process but already exist. The document analysis method is particularly suitable in this context because Germany's strong institutionalisation provides robust and universally applicable documents produced by official bodies (e.g. ministries and the BIBB; see also Yang et al., 2023). These documents also allow for the tracking of changes in occupational profiles over time.

For the material selection process (Mayring, 2014, 2015), this study focused on textual, official documents including training regulations, framework curricula and implementation guidelines. Training regulations and framework curricula are legally binding for the learning venues: training regulations govern company-based training, while framework curricula apply to vocational schools. By contrast, the implementation guidelines, although issued by the BIBB and thus official in nature, are intended as support materials for implementation. These guidelines are primarily directed at companies and influence trainers' practices, making them significant but non-binding framework documents.

The documents were analysed in their original German versions, and the results were subsequently translated into English. Each occupation analysed was treated as a distinct case. The present study examined two cases: 'office manager' (Case A) and 'industrial clerk' (Case B). A detailed list of the documents analysed can be found in the table in the appendix.

The analysis was conducted on the entirety of each document, including all sections, such as preambles and elective qualifications. This comprehensive approach allowed to capture the full scope of developments. The coding process was structured around the three deductive categories derived from Stalder (2018): *referentiality*, *communality* and *algorithmicity*. First, all documents were read through several times. The initial search focused on digitalisation in the broadest sense. For an initial review, the following keywords were included: digital*, IT, cloud, software, system, tech*, media, data, information*, machine, collaborative, hybrid, remote, platform*, automat*, algorithm*, analysis, transformation, and artificial. These keywords were selected based on the code definitions of the deductive categories *referentiality, communality* and *algorithmicity*. The code definitions were reread at the beginning of each coding phase to ensure consistency. Anchor examples were used to provide a foundation for the analysis. Anchor examples are concise excerpts of the deductive codes, which were selected by both authors following an initial review of the data. Table 2 shows the code definitions as well as the anchor examples.

Category	**Code definition**	**Anchor example**
Referentiality	(Cultural) objects (texts, data) are no longer isolated, but constantly placed in context through recombination, linking, etc. Use of existing material for productive purposes. High cognitive and linguistic demands.	‚(…) bring together complex information, information structures and data sets from different sources and systems and make them analysable.' (AO_IK_24: 12)
Communality	New types of social organisation and collaboration through digital networks. Changes to communities of practice and the office through digital tools and communication that is not limited by time or location. Changed forms of collaboration. Increased demand for self-organisation. Possible influence on professional identity development and personal positioning.	'Plan, process and organise tasks together with stakeholders, including those from other departments and business areas, also using digital media.' (UH_Büro_25: 62)

Algorithmicity	Increasing control of processes/decisions by algorithmic systems (structuring, forecasting, semi-automated processes). Algorithms as important drivers in work-related information processes. Work made easier by processing large amounts of data or correspondence work. High demands on control capabilities and critical judgement. Data security is important.	‚(…) design interface-optimised, automated sub-processes, ensuring that the correct sequence of process steps is observed.‘ (AO_IK_24: 12)

Table 2: Code definitions and anchor examples for the coding process. Own source.

The data analysis for the document analysis was performed using MAXQDA, following Mayring's (2014, 2015) approach after finishing the deductive coding. This approach aims to uncover the substantive meanings within texts, which, in the context of the digital condition, helps identify specific terms, concepts or competencies that have been newly introduced or modified in the regulatory frameworks. Mayring's (2014, 2015) method involves four steps: 1) paraphrasing, 2) generalising to the level of abstraction, 3) first reduction and 4) second reduction (Döring, 2023; Mayring, 2014, 2015). For each training occupation and category, a table was created using the Smart-Coding tool (MAXQDA), which was then transferred into a MS Word document to facilitate the reduction steps.

Results of the Document Analysis

The presentation of the research findings follows discussion of the research design, structured around the deductive categories of the digital condition. As shown in the German data excerpt, the category of *referentiality* was coded 109 times; *communality*, 45 times; and *algorithmicity*, 89 times.
In all regulatory documents for both occupations, the broad term 'digitalised working world' was frequently used, underscoring its centrality in the updated training frameworks. Digital competencies are integrated as cross-cutting skills, knowledge and abilities that are to be taught throughout the entire training period, regardless of the elective qualifications (AO_Büro_25: 3; AO_IK_24: 3). The framework curriculum expands on this perspective by defining the acquisition of skills in the context of the digitalised working world as an integral part of the so-called learning fields (the didactic structure of the framework curricula).

Case A: The digital condition in the regulatory instruments for the training of office managers

One of the most frequently coded aspects under *referentiality* is the acquisition and evaluation of information, understood as a continuous reorganisation and interrelation of information. This can be described as a form of information literacy, which refers to the ability to effectively handle and process information. Examples include the acquisition and verification of external information (AO_Büro_25: 16), including search strategies and quality criteria (UH_Büro_25: 62).
In the context of information literacy combined with *algorithmicity*, examples include the use and operation of customer relationship management systems (UH_Büro_25: 33) or search engines (UH_Büro_25: 62). Control and regulation of data and information also play a role, including developing strategies for resolving communication disruptions, implementing access protection concepts (UH_Büro_25: 62), understanding cyber fraud and attacks (UH_Büro_25: 29) and assessing risks associated with digital media and IT systems (AO_Büro_25: 16).
The overarching term efficiency enhancement describes processes that are simplified or improved through digitalisation. Examples include the use of digital communication platforms (UH_Büro_25: 62), digital systems for time and event planning (RLP_Büro_KMK_25: 23) and digital marketing (RLP_Büro_KMK_25: 14). Efficiency is further supported by data-driven decision-making, such as analysing market research and customer data to assess market conditions (RLP_Büro_KMK_25: 14) or monitoring the project status as well as conducting variance analyses in projects (RLP_Büro_KMK_25: 24). Spatial aspects of work are also addressed as follows:
They plan the design of their workplace (office concepts, home office, mobile work) considering ergonomic, ecological and organisational aspects.
(RLP_Büro_KMK_25: 10, own translation)
Data protection and security are recurring themes. These include digital presentations (RLP_Büro_KMK_25: 11), the (digital) storage of documents and records (RLP_Büro_KMK_25: 11) and knowledge about handling intellectual property, copyright and the General Data Protection Regulation (UH_Büro_25: 61). Digital tools, such as document management systems (UH_Büro_25: 29) or customer relationship systems (UH_Büro_25: 33), are frequently mentioned.
Digitalised communication and project works are supported by project management software, communication platforms and time management apps (RLP_Büro_KMK_25: 9; RLP_Büro_KMK_25: 10; RLP_Büro_KMK_25: 24; UH_Büro_25: 64). The importance of choosing communication channels appropriate

to the audience is also emphasised (RLP_Büro_KMK_25: 12; UH_Büro_25: 64). Under collaboration, all codes describing the nature of *communality* are grouped. This includes cooperative work involving compromise (RLP_Büro_KMK_25: 11) and taking responsibility and adhering to agreements (RLP_Büro_KMK_25: 24).
A strong connection to lifelong learning is also established as follows:
Apply learning and work techniques as well as methods of self-directed learning, use digital learning media and recognise and derive the requirements of lifelong learning. (AO_Büro_25: 17, own translation)
Interface management is another significant aspect. In the context of the office manager training programme, interface management refers to the organisational and coordinating aspects of the *communality*, described as follows:
They inform themselves about the importance of interfaces in process handling and information transfer. They identify interfaces between processes, using manuals, procedural instructions, and digital guides. (RLP_Büro_KMK_25: 22, own translation)
Plan, process, and design tasks together with stakeholders, including those from other work and business areas, also using digital media. (AO_Büro_25: 17, own translation)

Case B: The digital condition in the regulatory instruments for the training of industrial clerks

In the newly restructured regulatory instruments for the training of industrial clerks (2024), various forms of *referentiality* can be identified. In addition to aspects such as information literacy and data protection/security, other dimensions have emerged, including communication and collaboration, the interplay of digitalisation and sustainability, and referentiality in digitised business processes. Here too information literacy is explicitly emphasised and linked to specific requirements*:(...) research and obtain information from digital networks as well as verify, evaluate, and select information, including external information*. (AO_IK_24: 12, own translation)
(...) consolidate complex information, information structures, and data from various sources and systems to make them analysable. (AO_IK_24: 12, own translation)
As with the previously analysed Case A, data protection and security are central themes. Here, particular emphasis is placed on responsibility in handling data (RLP_IK_KMK_23: 4; RLP_IK_KMK_23: 10). The connection between digitalisation and sustainability is highlighted, particularly in areas such as payment and delivery terms (RLP_IK_KMK_23: 12) and production programmes or manufacturing processes (RLP_IK_KMK_23: 15). Most codes belong to the aspect

of digitised business processes. *Referentiality* is evident in operational application systems (AO_IK_24: 12), customer inquiries (RLP_IK_KMK_23: 12), procurement options (RLP_IK_KMK_23: 13), ongoing bookkeeping (RLP_IK_KMK_23: 14), various forms of computer-integrated manufacturing (UH_IK_24: 30) and logistics and transport, as the following statement suggests:

They gain an overview of storage systems and facilities, as well as picking methods. They explore in-house transport systems, including networked and autonomous systems, as well as multimodal transport routes. (RL_IK_KMK_23: 16, own translation)

Tasks involving evaluation and judgment point to demanding activities that require critical thinking. *Algorithmicity* becomes evident in the control and regulation of algorithmic systems within project work, as explained in the following passage:

They apply creativity techniques, document work progress, and monitor project status regarding deadlines and goal achievement, including through the use of digital media. (RLP_IK_KMK_23: 11, own translation)

High demands are placed on automation and process optimisation. This includes the design (AO_IK_24: 12) and assessment of the digital maturity of subprocesses in automated activities (UH_IK_24: 53) or the digital determination of the overall needs and consumption structures for service delivery (RLP_IK_KMK_23: 13). Data-driven decision-making also plays a role:

Contribute to the digitalisation strategy and support decision-making, such as through utility analyses. (UH_IK_24: 53, own translation)

Communication and collaboration, as part of *referentiality*, overlap with the dimension of *communality*. This includes selecting appropriate communication channels or contacts (UH_IK_24: 44) and ensuring the flow of communication in collaborative work (RLP_IK_KMK_23: 11).

Passages related to *communality*, such as the following, are also evident in the industrial clerk regulatory instruments:

Students document their work results and present them, including digital media. They act in a team-oriented, independent and responsible manner, applying work and learning strategies. (RLP_IK_KMK_23: 10, own translation)

The organisational and coordinating aspects of *communality*, in the sense of interface management, are reflected in tasks such as selecting appropriate communication channels for specific target groups (AO_IK_24: 13), collaborating in cloud environments (UH_IK_24: 44) and addressing production issues, as follows:

For disruptions in production, they develop solutions and communicate them with the relevant interfaces. They also use IT systems from production and work in a self-organised team. (RLP_IK_KMK_23: 15, own translation)

Through the digital networking of manufacturing and control processes, industrial value creation processes are characterised by changes. (...) New business models based on networking, cloud technologies and e-commerce are gaining importance. (...) In practice, this need is often described as a requirement for 'networked thinking', with graduates being envisioned as 'interface managers'. (UH_IK_24: 7, own translation)

Collaboration requirements are also evident in sales-related tasks:

Carry out order entry and schedule coordination relevant to sales with internal and external interface partners, ensuring the flow of information and data quality. (AO_IK_24: 9, own translation)

Comparative Summary

A re-examination of the initial research question, 'To what extent are the constituents of the 'digital condition' reflected in the restructured job profiles of selected commercial professions?' leads to the following comparative conclusions:

The digital condition is indeed strongly represented in the occupational profiles. *Referentiality*, as defined by Stalder (2018), is treated in the documents as a cross-cutting theme encompassing both technical and methodological competencies. After the second reduction, the following overarching themes related to *referentiality* can be identified: information acquisition and evaluation, data protection and security, the use of digitised tools, digital communication and project work, and digitally supported learning. Overall, media literacy is considered a fundamental prerequisite in both training occupations. This also includes maintaining digital training records or e-portfolios, which could be used across learning environments, such as schools and workplaces (see UH_Büro_25: 72).

The findings on *referentiality* suggest that the recombination of data or information is, in some cases, linked to a new form of *communality*. The overlaps, as seen in examples of project management or the organisation of work processes in general, indicate that these two aspects are at least partially interrelated. A new form of communality in the regulatory instruments for the training of office managers and industrial clerks can be summarised under the headings of collaboration and interface management. The sections on interface management reveal that the requirements are moving towards interdisciplinary thinking, independent action and mediation between different systems and actors.

For both occupations, *algorithmicity* is highly significant in the areas of information literacy, control and regulation, and data-driven decision-making. In the office manager regulatory instruments, the additional theme of efficiency enhancement is

prominent, whereas in the industrial clerk programme, this is reflected in a slightly modified form as automation and process optimisation.
One area that is underrepresented is work involving AI. This is surprising, given that large language models, such as ChatGPT, were already available on the market during the development phase of the regulatory frameworks (release of ChatGPT: November 2022). This reflects the caution in immediately integrating new technologies into vocational education. However, in principle, the open formulations in the documents allow for technological changes to be incorporated into training practices. AI applications will shape and deepen the culture of digitality. In principle, the three basic phenomena remain as Stalder described them. The regulatory basis of vocational training in German office professions already clearly reflects this culture. AI applications will change processes and will have to lead to informal learning in the workplace. It should not be forgotten that in Germany, broad job profiles are trained in conjunction with an educational entitlement in order to enable precisely this adaptability of employees and their lifelong learning.
The scope for action available to the vocational teachers and trainers responsible is so great that new developments can be taken up on an ongoing basis. Flexible and high-quality further training for teachers and trainers is important in this regard, as is enabling them to learn alongside their students in their workplaces.

Upskilling in Office Occupation Training

At the outset, the research question regarding identifiable changes in the qualification level (corresponding to cognitive complexity), was also posed. All instances where a higher level of demand could be inferred were marked. Quantitatively, 185 instances of coding indicate evidence of upskilling. The formulations in the analysed documents clarified that significant upskilling, driven by the digitalisation of the work environment, is evident in the regulatory instruments for both occupations. This becomes particularly apparent when comparing older and newer versions of regulatory frameworks. The most striking examples are presented in Table 2. Comparable passages from the documents are juxtaposed, and it is evident that upskilling has been implemented in the form of expectations for responsibility and proactive engagement.

Document	*Old* Regulatory Instruments	Document	*New* Regulatory Instruments
Training Regulation Office Management (2013):	'Identify risks to safety and health in the workplace and take measures to prevent these risks.' (AO_Büro_13: 12)	Training Regulation Office Management (2025):	'(…) take technical and organisational measures to prevent risks, as well as psychological and physical stress, **for oneself and others, including preventive measures**.' (AO_Büro_25: 16)
	'Apply methods of independent learning, use occupational information and apply learning and work techniques.' (AO_Büro_13: 13)		'Apply learning and work techniques as well as methods of self-directed learning, use digital learning media, and **recognise and derive the requirements of lifelong learning**.' (AO_Büro_25: 17)
Training Regulation Industrial Clerk (2002):	'Accept orders.' (AO_IK_02: 2770) 'Coordinate order processing with internal and external service providers, schedule and process orders.' (AO_IK_02: 2770)	Training Regulation Industrial Clerk (2024):	Carry out order entry and **schedule coordination relevant to sales with internal and external interface partners, ensuring the flow of information and data quality**.' (AO_IK_24: 9)
	'Consider the effects of information, communication and cooperation on workplace climate, work performance, and business success.' (AO_IK_02: 2769) 'Explain the influence of information and communication systems on business processes, operations and workplaces in the training company.' (AO_IK_02: 2768) 'Consider communication tariffs and costs.' (AO_IK_02: 2768)		'(…) **select and effectively use** appropriate analogue or digital communication channels, considering the target audience and the context.' (AO_IK_24: 13)

Table 3: Upskilling in office occupation training. Source: See documents in the Appendix. The correspondding passages in the updated regulatory frameworks are highlighted. The quotations in the table were translated by the authors.

In addition to more demanding tasks (upskilling), the emphasis on more responsible, independent action is linked to a form of empowerment in the sense of integration into decision-making processes. This raises the question of the extent to which these demanding qualification requirements correlate with the prior education and cognitive resources of apprentices. The proportion of trainees with university entrance

qualifications is relatively high in both occupations. For office managers, the share of apprentices with university eligibility was 33.8% in 2023 (2013: 31.7%), whereas for industrial clerks, it was 61.9% in 2023 (2013: 66.6%) (BIBB, 2023).

Limitations of the Study

This study has several limitations. For instance, no comparison was made between training regulations and framework curricula, which could have highlighted the differences between workplace- and school-based training. Furthermore, only two office occupations were examined, both of which are relatively demanding and tend to attract a high proportion of apprentices with university entrance qualifications. Methodologically, the upskilling aspects could have been coded in a more comparative manner. Of course, the analysis of regulatory frameworks is merely a useful 'auxiliary construct' for examining the changes brought about by the digital condition in the workplace. Complementary, concrete workplace studies are necessary to observe the actual implementation of these changes. This was beyond the scope of the present study.

Conclusion

The World Economic Forum (2025: 5), in its ‘Future of Jobs’ report, states that 60% of companies expect to transform their business operations by 2030. AI, information processing, robotics, automation and energy issues are among the key drivers of this transformation, with corresponding impacts on the world of work. The demand will primarily be for ‘(...) technology-related skills, including AI and big data, networks and cybersecurity, and technological literacy, which are anticipated to be the top three fastest-growing skills’ (World Economic Forum, 2025: 5). Broad occupational profiles that intensively address digital transformation, promote independent and lifelong learning, foster new forms of communality, address data security issues and emphasise information literacy appear to be well positioned for this transformation, even though the effects of working with AI have not yet been fully captured.
Nevertheless, the current observation by the World Economic Forum (2025) should also be considered in the German context. The largest decline in jobs is expected in office and administrative roles.
Our study also highlights how upskilling is implemented in the regulatory instruments. Upskilling effects are often assumed only superficially, but the document analysis clearly identifies them. These upskilling effects may contribute to maintaining flexibility in jobs and enabling workers to adapt to innovations such as

AI. In addition, fostering the ability for lifelong learning is crucial to intensify informal skills development in this regard. Arntz et al. (2025: 37) found that 'the spread of AI technologies at the workplace level appears to be occurring more rapidly than at the firm level. Most AI users primarily use applications that were not formally introduced by their employer.'

The constituents of the digital condition is now clearly visible in vocational regulatory instruments. This is linked to upskilling processes. Both the clear reflection of a changed digital work culture as an expression of a general cultural and social change in regulatory instruments and the expanded professional requirements offer potential for empowerment, but also have the potential to increase performance pressure and surveillance. This makes it all the more important to adhere to the guiding principle of broader vocational '*Bildung*' that addresses adaptability, the development of a reflective self and lifelong learning.

Currently, there are more studies on digital technologies than on their impacts on office work or critical aspects of employee development (Pennathur et al., 2024). Thus, a significant need for further research remains.

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Appendix: List of the Documents examined

Case A. Office Managers		
Training Regulation (Company Side)	Framework Curriculum (Vocational Schools)	Implementation Guidelines
‚AO_Büro_13‘: Bundesrepublik Deutschland (2013). Verordnung über die Berufsausbildung zum Kaufmann für Büromanagement und zur Kauffrau für Büromanagement. [Regulation on the vocational training for office managers] (Büromanagementkaufleute-Ausbildungsverordnung – BüroMKfAusbV). Bundesgesetzblatt Teil I, 2013(72), S. 4125–4148. https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/regulation/bueromanagement_ao_2013.pdf ‚AO_Büro_25‘: Bundesrepublik Deutschland (2025). Verordnung über die Berufsausbildung zum Kaufmann für Büromanagement und zur Kauffrau für Büromanagement. [Regulation on the vocational training for office managers] (Büromanagementkaufleute-Ausbildungsverordnung – BüroMKfAusbV). Bundesgesetzblatt Teil I, 2025 (62), S. 1-17. https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/regulation/Kfl_Bueromanagement_2025.pdf	‚RLP_Büro_KMK_13‘: Kultusministerkonferenz (2013). Rahmenlehrplan für den Ausbildungsberuf Kaufmann für Büromanagement und Kauffrau für Büromanagement [Framework curriculum for the vocational training of office managers] (Beschluss der Kultusministerkonferenz vom 27.09.2013). Sekretariat der Kultusministerkonferenz. https://www.kmk.org/fileadmin/Dateien/pdf/Bildung/BeruflicheBildung/rlp/Kaufleute_Bueromanagement_13-09-27_idFv_25-03-20-mitEL.pdf ‚RLP_Büro_KMK_25‘: Kultusminister-konferenz (2025). Rahmenlehrplan für den Ausbildungsberuf Kaufmann für Büromanagement und Kauffrau für Büromanagement [Framework curriculum for the vocational training of office managers](Beschluss der Kultusministerkonferenz vom 27.09.2013 i. d. F. der Bildungsministerkonferenz vom 20.03.2025). Sekretariat der Kultusministerkonferenz. https://www.kmk.org/fileadmin/Dateien/pdf/Bildung/BeruflicheBildung/rlp/Kaufleute_Bueromanagement_13-09-27_idFv_25-03-20-mitEL.pdf	‚UH_Büro_14‘: Bundesinstitut für Berufsbildung (2014). Kaufmann für Büromanagement / Kauffrau für Büromanagement. Ausbildung gestalten. [Office managers. structuring vocational training] 1. Auflage. Bielefeld: Bertelsmann Verlag. ‚UH_Büro_25‘: Bundesinstitut für Berufsbildung (2025). Kaufmann für Büromanagement/ Kauffrau für Büromanagement. Ausbildung gestalten. [Office manager. structuring vocational training] 1. Auflage. https://www.bibb.de/dienst/publikationen/download/20495

Case B. Industrial Clerks		
Training Regulation (Company Side)	Framework Curriculum (Vocational Schools)	Implementation Guidelines
‚AO_IK_02‘: Bundesrepublik Deutschland (2002). Verordnung über die Berufsaus-bildung zum Industrie-Kaufmann /zur Industriekauffrau. [Regulation on the vocational training for industrial clerks] Bundesgesetzblatt Teil I, 2002(51), S. 2764–2773. https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/regulation/industriekaufmann_2002.pdf ‘AO_IK_24’: Bundesrepublik Deutschland (2024). Verordnung über die Berufsausbildung zum Industrie-Kaufmann und zur Industriekauffrau. [Regulation on the vocational training for industrial clerks] (Industriekaufleuteausbildungsverordnung – IndKflAusbV). Bundesgesetzblatt Teil I, 2024(94). S. 1-13. https://www.recht.bund.de/bgbl/1/2024/94/VO.html	‚RLP_IK_KMK_02‘: Kultusministerkonferenz (2002). Rahmenlehrplan für den Ausbildungsberuf Industriekaufmann/Industriekauffrau [Framework curriculum for the vocational training of industrial clerks (Beschluss der Kultusministerkonferenz vom 14.06.2002). Sekretariat der Kultusministerkonferenz. https://www.bibb.de/dienst/berufesuche/de/index_berufesuche.php/regulation/industriekaufmann_industriekauffrau.pdf ‚RLP_IK_KMK_23‘: Kultusministerkonferenz (2023). Rahmenlehrplan für den Ausbildungsberuf Industriekaufmann und Industriekauffrau [Framework curriculum for the vocational training of industrial clerks] (Beschluss der Kultusministerkonferenz vom 15.12.2023). Sekretariat der Kultusministerkonferenz. https://www.kmk.org/fileadmin/Dateien/pdf/Bildung/BeruflicheBildung/rlp/Industriekaufleute_2023-12-15-mitEL.pdf	‚UH_IK_03‘: Bundesinstitut für Berufsbildung. (2004). Erläuterungen und Praxishilfen: Industriekaufmann/-kauffrau. [Explanations and practical aids: Industrial clerk]. https://www.bibb.de/dienst/veroeffentlichungen/de/publication/download/1895 ‘UH_IK_24’: Bundesinstitut für Berufsbildung (2024). Industriekaufmann und Industriekauffrau. Ausbildung gestalten. [Industrial clerk. Structuring vocational training]. https://www.bibb.de/dienst/publikationen/download/19751

UH=Unterweisungshilfe (instructional aid), RLP=Rahmenlehrplan (framework curriculum), AO=Ausbildungsordnung (training regulations)

Acknowledgment: we declare that the foreign language processing of this text was supported by the AI DeepL.

Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-04

Towards an Inclusive Integration of Digital Technologies for Workplace Learning in Brunei

Adeline Yuen Sze Goh

In this evolving digital era, the adult learning landscape has undergone transformations, which demand an in-depth understanding of the complexities involved in each individual's lifelong learning journey (Goh, 2022). In other words, the digital age has reshaped how adults engage with information, acquire new skills, and construct their identities to adapt and remain agile in changing life circumstances. In parallel, adult learning as part of the lifelong learning agenda is central to many countries' policies and initiatives at national, regional and international levels. Whilst the concept of lifelong learning initially revolved around personal development and growth, it has become increasingly and inextricably linked to digitalisation, which is marked by a shift in policy emphasis towards its economic relevance. On one hand, this shift could offer opportunities to enrich workplace learning and empower workers. On the other hand, it may lead to unequal access to and participation in workplace learning due to barriers such as digital literacy, socioeconomic status and organisational culture. Using Boyadjieva and Ilieva-Trichkova (2021) theoretical framework of 'social embeddedness of capability', this study aims to explore the relationship between individuals' use of digital technologies for workplace learning and the social environments and structures in which they are embedded. This study employs a qualitative case study methodology to explore the nuances of social embeddedness and digital learning amongst a group of adult educators in Brunei. The findings of this research could help identify key barriers and facilitators to the inclusive use of digital technologies for workplace learning, which would be valuable in promoting more equitable and synergistic learning cultures. Furthermore, broadly, these findings will be instrumental in guiding organisations and policymakers towards fostering an inclusive workplace learning culture that supports all workers.

Keywords: Digital Technologies, Digital Competence, Workplace Learning, Individual learning journey

Introduction

The widespread adoption of digital technology has reshaped society in recent decades, transforming how we communicate, work and engage with information. This wave of digitalisation has also made a profound impact on the professional landscape of adult learning and education, by creating new opportunities and at the same time challenges to many (Jütte and Wildemeersch, 2017, Harteis and Billett, 2022). Such transformation has also shifted the roles of adult educators (King, 2002), increasingly requiring them not only to use digital tools but also to integrate them into their work practices. On the one hand, digital technologies are profoundly reshaping educational paradigms, offering innovative avenues for instruction, student support, and personalised learning experiences (Belzer et al., 2022). On the other hand, they risk widening inequalities by privileging those with robust infrastructure, strong institutional support, or higher levels of prior digital competence. For many adult educators working in the lifelong learning sector, the challenge is not merely to upskill and reskill in terms of using digital technology, but more about negotiating the workplace complexities that emerge from the integration of these tools into established pedagogical frameworks and organisational cultures as part of their lifelong learning journey (Billett, 2021). Moreover, as research has shown, adult educators are rarely passive users or adopters of technology (Kreijns et al., 2013; Alanoğlu et al., 2021); instead, engagement with technology could be shaped by a complex interplay of individual agency, institutional support, and broader socio-economic factors. Against this backdrop, this chapter adopts Boyadjieva and Ilieva-Trichkova's (2021) theoretical framework of the social embeddedness of capability. Building on Sen's (1999) and Nussbaum's (2011) capabilities approach and its extension in education by Unterhalter and Walker (2007), Boyadijeva and Illieva-Trichkova shared the same view that capabilities are not merely individual attributes, which cannot be understood in isolation from the social environments in which they are formed.

In this line of thinking, capabilities are relational and institutionally embedded, i.e. they emerge from the interaction between an individual's personal characteristics and the opportunities and constraints presented by their social, economic, and political contexts. However, they argue that there is a need to extend the capability to capture the interactive relationship between individual capabilities and social structures, i.e. the notion of 'embeddedness' captures the analysis of participation in adult education. This theoretical lens is particularly pertinent for understanding the different layers and nested structures of lifelong learning, which function at micro, meso and macro levels to better understand the rationale for differences in participating in lifelong learning

activities (see Boeren, 2017). However, as they made clear, Boyadijeva and Illieva-Trichkova's research findings show that the broader picture of participation in adult education is influenced by multifaceted and complex factors, a gap emerges that requires further research on the diversity of factors at the different levels and their interactions to better understand individual agency in adult education. This study aims to address this gap by looking at the factors at a micro and meso level, which helps to better understand how adult educators develop and integrate digital competencies, moving beyond a simplistic view of skill acquisition to encompass the nuanced interplay between individual dispositions to digital learning, workplace culture, institutional support, and broader systemic influences. Put simply, in terms of digital learning, this means recognising that providing access to digital training is insufficient, unless educators are afforded the social, cultural and organisational contexts and conditions to use them effectively.

The chapter, therefore, aims to tease out the nuances of social embeddedness and digital learning amongst a group of adult educators in Brunei. It examines how they learn to use and integrate digital technologies in their everyday working lives, how their digital learning journey is shaped by institutional infrastructure and workplace cultures, and how they exercise their agency to negotiate opportunities and challenges in their workplaces. In so doing, it seeks to identify both the barriers and facilitators to inclusive digital learning, to inform policy and practice that can support more equitable and synergistic workplace learning cultures (James & Biesta, 2007, Goh, 2021). The guiding questions framing this chapter:

How do adult educators learn to be digitally competent within their workplaces over time, and how do their experiences evolve? How do the infrastructure factors enable or constrain these learning experiences?

The chapter begins by exploring the current literature review, situating the study within debates about digitalisation, workplace learning and professional development of adult educators. Subsequently, it delves into the theoretical framework, positioning the paper through the lens of the Social Embeddedness of capability approach, as developed by Boyadjieva and Ilieva-Trichkova (2021), highlighting how adult educators' capacity to participate is both individually and socially mediated. It then presents the methodological approach, detailing the qualitative research design and data collection methods employed to explore the learning of digital skills amongst a group of adult educators in Brunei. The chapter presents two short illustrative vignettes that bring forth the varied learning journeys, challenges, and strategies of digital learning in practice. Following these vignettes, a short analytic reflection is

presented to show how institutional cultures, peer networks and individual agency intersect to shape capability. Subsequently, a discussion synthesises these narratives to identify common patterns and differences or tensions, and concludes by considering the implications for policy and practice, more specifically, how adult education systems can strengthen environments that support educators' ongoing digital learning meaningfully.

Reframing Adult Educators' Digital Learning

The digitalisation of education has emerged as a central agenda in many international policy discourses, like the OECD and European Commission, which emphasise the urgency of embedding digital competence frameworks in education such as the DigCompEdu (Punie et al., 2017). Given the importance, the professional learning of adult educators has become both a pedagogical imperative and a socio-political concern. Moreover, adult educators are increasingly expected to acquire and apply digital skills not as an ancillary, but as a compulsory disposition of professional competence. Whilst the existing digital competence frameworks offer clarity and comparability, they also risk reducing digital professional learning to checklist exercises, emphasising measurable competencies over the relational processes through which educators negotiate digital practices. These views present a simplified view of how adult educators acquire digital competencies in overly technical or instrumental terms. Such perspectives stem from the assumption that equipping educators with training sessions, online platforms, and resources will be sufficient to foster digital literacy and integration, often overlooking the nuanced interplay of individual dispositions, institutional support, and broader socio-economic contexts that shape these learning trajectories (Boyadjieva and Ilieva-Trichkova, 2021).

Under this rhetoric lies a more complex set of issues concerning how adult educators learn to engage meaningfully with digital technologies in their workplaces, i.e. moving from just acquiring digital skills to being digitally competent. The policy discourses framing these imperatives operate within what can be described as 'sociotechnical imaginaries': visions of digital transformation that consider digitalisation as a purely technical challenge, where it is linear, skill-based and measurable. According to Selwyn et al. (2023), such 'sociotechnical imaginaries' tend to neglect the lived realities of digital users, in this case, adult educators and the social contexts they are in. In addition, such views could obscure the structural inequalities that shape who can genuinely participate in digital learning. For example, some adult educators often work in resource-constrained workplaces where access to infrastructure is uneven, and institutional support is limited. Additionally, there are

common assumptions that the skills acquisition follows a linear progression, with access to technologies and institutional guidance being sufficient for capability development, and adult educators will have a positive orientation to learning to be digitally competent in line with the institutional goals. This assumption contradicts the findings of research; although workplaces are sites of learning, they don't afford learning opportunities equally (Fuller & Unwin, 2003; Mendoza-Chan & Pee, 2024). This inconsistency, as this chapter aims to illustrate, necessitates a deeper understanding of how adult educators learn to be digitally competent, where Boyadijeva & Iileva-Trickova's (2021) social embeddedness of the capability approach is relevant, as a means to understand how to be digitally competent is shaped by the complex interplay of individual agency and the institutional support and broader socio-economic factors.

Learning to be a digitally capable worker in the workplace

Within the literature, there is a growing body of discourse that affirms individuals learn to use digital technologies in informal ways. Much of this informal learning often occurs in workplaces, where it is shaped by the culture, practices, and social interactions (Eraut, 2004, 2007). This often involves collaborative learning, peer support, and experiential engagement with new technologies situated within the context rather than formal training programs (Kyndt et al., 2009). This form of situated learning highlights that learning is embedded in every practice, social relationships and cultural norms of the institution rather than isolated individual endeavours (Hodkinson et al., 2008; Goh, 2013; Tynjälä, 2008). However, the social learning of these digital technologies is often overlooked by organisational cultures that prioritise compliance over innovation, and by formal professional development trainings that offer standardised and decontextualised digital training (Littlejohn and Margaryan, 2014). In digital learning, peer collaboration, mentorship and participating in communities of practice have been identified as critical enablers of skill development. However, workplace learning is also influenced by infrastructure factors and institutional culture (Hult & Byström, 2021). This necessitates a shift from merely providing access to digital tools to fostering an environment where social interaction and practical application are prioritised to achieve digital competence.

Thinking tool: Social embeddedness of capability

In advancing Sen's (1999) and Nussbaum's (2011) thinking on capability (see Chapter 1), Boyadjieva and Ilieva-Trichkova (2021) shared three key points:

Functionings (e.g. to become digitally competent), capabilities (the freedom or opportunity to achieve these functionings, considering the personal, social and institutional constraints) and Agency (the capacity of individuals to make choices and act upon them). Additionally, they claim that capabilities cannot be bracketed off from the social and institutional context in which individuals operate. That is, the social embeddedness of capability provides a thinking tool to understand that an individual's ability to use digital technologies competently in the workplace is shaped not only by individual digital skills and attributes but also by the organisational culture, access to resources and social relationships. This integrated lens offers an understanding of digital learning that accounts for both personal agency and the relational context.

By framing capability as both enabling and constrained by social embeddedness, this approach unmasks the subtle ways in which institutional culture, social relationships and wider socio-economic structures shape individuals' learning journey (Goh, 2022) to become digitally competent in the workplace. More broadly, it shifts the analytic focus from a narrow conception of digital skill acquisition, which most research tends to do, to a more holistic understanding of learning as a relational and contextually situated process. This perspective, therefore, provides a robust framework for analysing the complex dynamics influencing adult educators' integration of digital tools, moving beyond simplistic notions of individual technological proficiency, which is linear and individualised, to consider the broader systemic factors at play. Hence, to understand how digital transformation unfolds in the workplace, it is more analytically useful to focus on digital competence rather than digital skills. On one hand, digital skills, whilst necessary, are best understood as the technical ability to perform discrete tasks. On the other hand, digital competence emphasises the integration of technical know-how with judgement and collaboration within the organisational context. It accounts for the social and institutional conditions that enable employees to convert skills into effective practice, which this chapter aims to explore to understand how educators use digital skills meaningfully to make genuine contributions to digital transformation.

There is a growing body of research on adult educators' experiences of digital learning. These studies often highlight how rapid digitalisation created new imperatives for professional learning but also developed inequalities between institutions and individuals regarding access to digital resources and training (Rott & Schmidt-Hertha, 2024). In the midst of this professional digital learning, adult educators exercised agency in navigating the evolving technological landscape, leveraging both formal and informal learning opportunities to enhance their digital competencies. Additionally, Gourlay and Oliver (2018) demonstrate that digital competence is not merely a set of technical skills, but rather a dynamic and socially

constructed capacity that evolves through ongoing engagement with digital practices within specific contexts. These findings challenge the adequacy of sociotechnical imaginaries and promote the need for interpretive approaches to understanding lived experiences, relational dynamics and workplace cultures.

Despite a growing body of research in digital learning and adult education, several gaps remain. There are limited case studies, narrative accounts that capture the lived experiences of adult educators and studies that explicitly integrate capability and embeddedness in understanding individuals' 'learning as becoming' (Hodkinson et al., 2008; Goh, 2022), digitally competent in the workplace. Therefore, this study aims to address this gap by exploring how adult educators learn to be digitally competent within their workplaces over time, and how their experiences evolve. How do the infrastructure factors enable or constrain these learning experiences?

Digital transformation in Brunei

Digital transformation has been central to Brunei's aspiration to become a Smart Nation. To realise this ambition, the first five-year Digital Economy Masterplan 2025 (Digital Economy Council, 2021) was introduced. In alignment with this plan and Brunei Vision 2035, or Brunei Wawasan 2035 (National Task Force, n.d.), the Ministry of Education launched the Digital Transformation Plan 2023–2027. This transformation agenda requires shifts in skill needs and the redesign of work practices within organisations (see Goh, 2023a, 2023b).

As the largest provider of TVET in Brunei, the Institute of Brunei Technical Education (IBTE) has outlined in its 2025–2030 strategic plan (IBTE, 2025) a focus on developing a future-ready workforce and fostering dynamic industry collaborations. This vision implicitly aligns with the country's digital transformation priorities. At IBTE, digital transformation is taking shape through the adoption of digital tools in programme delivery and participation in regional capacity-building initiatives, such as digital leadership workshops for TVET leaders. These efforts signal both the opportunities and implementation challenges of aligning institutional practice with broader reform frameworks. As in many other countries, issues of inclusion and equity are central to policy and practice as Brunei advances its digitalisation agenda, particularly in relation to the integration of digital technologies in TVET.

Methodology

To capture the lived realities of how adult educators learn to become digitally competent in their workplaces, through both informal and formal learning, this study adopts an interpretive qualitative research design. This paper is part of a larger study on the lifelong learning journey of individuals, including a group of adult educators in this digital era which uses a combined life-history approach and longitudinal interpretative lifecourse approach to understand how adults engage with and leverage learning opportunities in this digital age. Preliminary findings were presented at the Research in Work and Learning conference detailing the complexities of learning through the life course in the digital era (see Goh, 2024). It was conducted across two years, with three rounds of interviews. This longitudinal approach allows insight into how digital learning unfolds.

It also addresses the tendency in most research to capture snapshots rather than processes of digital learning. These adult educators worked in diverse institutional contexts, including higher education, vocational and technical education, and training organisations in Brunei (Goh and Paryono, 2024). A purposive sampling strategy was used, aimed at ensuring diversity in terms of age, career stage, and different roles, reflecting the diversity of the adult education workforce in Brunei.

Data was collected using semi-structured interviews, with questions designed to elicit narratives of digital learning that focused on four dimensions - infrastructure, professional learning activities, individual dispositions to digital learning over time and workplace cultures. These interviews were subsequently transcribed verbatim after each round of interviews. Each subsequent round of interviews followed up on earlier accounts, enabling participants to revisit their learning journey, reflect on any changes since the previous interview meeting, and articulate how their experiences had unfolded across time. Such an iterative approach not only strengthened the longitudinal design but also allowed participants to learn and co-construct their narratives. The longitudinal design enabled temporal mapping, tracing how participants' narratives shifted across the three interviews. Case stories were written using thick descriptions (Geertz, 1973) to get a deep understanding of individuals' digital learning journey.

Ethical approval was granted. Research participants were informed of the purpose of the study and consented to the participation. In all the transcripts and reporting, pseudonyms were used. On another note, this study makes a methodological contribution by longitudinal qualitative inquiry with a capability analytical framework. This integration challenges dominant policy discourses that consider digital skills as competencies to be measured or the completion of training. Rather

than measuring their digital competencies, the methodology emphasises the voices of adult educators, which captures not just their digital competencies but how they learn to negotiate identity, meaning and professional recognition in the digital era, which is often neglected in technocratic accounts.

Findings

Amir

Amir has worked for over a decade and now holds a middle-management position in a vocational training institute. The pandemic significantly accelerated his learning and integration of digital tools, compelling him to adapt to online teaching and administrative duties rapidly. During the pandemic, he recalled using digital platforms like Microsoft Teams every day. "*Meetings, student consultations, even casual check-ins. It wasn't perfect, but we all adapted*". For a time, this digital pivot created a sense of illusion that digital tools had seamlessly integrated into the fabric of everyday work practices. However, Amir later observed that many of his senior colleagues have reverted to pre-pandemic, face-to-face methods, highlighting a deeper resistance or discomfort with sustained digital engagement.

'Although they say everything is now moved online, but we still have to print out everything and sign everything on paper. We haven't grasped it [digitalisation of work practices], I don't think we can let go of it yet… things got back to how it was and has stayed stagnant to pre-covid times…'

This observation, Amir noted, could be due to people's resistance to change, *"I think they are holding on to that physicality, marks are keyed in online, but we still print it out and sign it. And we still need to file it when we can do it digitally"*.

Such a dual nature of digital practice limited the visibility and impact of digital adoption and created a façade, where Amir's skills rarely translate into meaningful practice.

'We have had AI [Artificial Intelligence] workshops recently, but most of the time, day-to-day work still relies on paper. You could say we are digitally enabled, but the reality is that the administrative backbone hasn't caught up. We are only "digital" on the facade, but the backend we are still very paper-based.'

Whilst the college had invested in digital tools, the culture around digital adoption was still in transition. This could stem from the lack of a systematic approach to transition to fully digital workflows, creating a paradoxical scenario where digital

tools were used but then undermined by adherence to traditional paper-based processes, and it exacerbated a subtle inequality amongst the staff, as the younger generation was digitally adept, whilst the older generation of adult educators struggled and was often reluctant, needing guidance. Despite these struggles, they relied on informal peer learning, asking younger colleagues for help in navigating the digital platforms. Additionally, the digital infrastructure of the college needed to be improved.

'A major reason for senior staff to be resistant to changing their work practices was probably due to the fact that the internet is not great. Maybe that's when the instructors feel that it's a hassle to find a good connection, or they have to use their personal bandwidth to connect. I think that's where it's a hindrance for them.'

The digital resource existed, but it was unstable, limiting its transformation into a functioning, i.e. reliable online administration. This perpetuated a cycle of limited digital engagement, hindering the full realisation of digital transformation benefits within the institution (Antonopoulou et al., 2023). This resistance aligned with broader challenges in higher education regarding digital transformation, where established practices and insufficient technological infrastructure often impede the adoption of new digital workflows (Jackson, 2019). Such issues, which undermined digital adoption, were normally exacerbated by the lack of digital understanding among educators and inadequate training (Saini et al., 2024), leading to a disparity between anticipated digital transformation and actual preparedness within institutions.

In the first interview, the college hadn't implemented a structured digital upskilling programme; instead, training was based on request. Towards the second interview, Amir was encouraged to see that their college has started offering training recently on the use of AI tools. But most still hinged on the reactive approach, as Amir noted,

'so when you have a problem, you ask the IT team how to solve it, and if they can't solve it, they just give you a ticket until they can solve it. There's no structured training, unless you ask for it. And then it's not very organised. So, on a just-in-time basis. So if you have a specific problem, the IT team will show you how it is done.'

In a way, the IT team provided support and informal guidance to those who needed help with digital skills. For Amir, he saw value in using digital technologies like AI, and it motivated him to learn these skills and use them as part of his work practices:

'What motivates me to learn and improve my digital skills is the streamlining of my work processes…to make everything more organised in my work.'

For example, he felt responsible for encouraging digital adoption, but the seniority of his colleagues challenged his authority:
'Most of them have been teaching longer than I have been working here… They are respected, they are set in their ways, and they see these platforms as extra work. But I am slowly encouraging them…slowly introducing digital into the workflow …to streamline the workflow and make it easier for everyone.'

He learns his digital skills for work mostly through informal learning, and it is self-directed learning:
'For teaching, I find it's not so much needed, as the subjects that I teach are workshop-based. What I know, I learn from online resources mostly… It is more self-directed learning…'

Amir's story raises the significance of the collective dimension of capability, where skills become capabilities only when embedded in enabling structures and supported by work cultures. Having a role in the management team caused tensions between his disposition to learning and what he wanted to achieve in the workplace. That is, Amir's own agency was central to the process, but his effectiveness in using these digital tools meaningfully to achieve what he intended to do was shaped by the dispositions of his colleagues in learning and adopting digital skills, training support from his workplaces and structural constraints.

Mawar

Mawar was in her late thirties, an adult educator working in a mid-sized vocational training college that caters to professionals seeking to upgrade their skills. Unlike many of her colleagues, she was digitally adept. Long before the pandemic, she had been experimenting with learning apps, online platforms and following educational technology forums to design interactive lessons,
'I enjoy figuring things out. If I hit a brick wall, I would obsessively go online, and I would be researching, how do I do this? I think that curiosity helps… As I am teaching students on performing a work task using a system, we need to use a similar system which is used in the real workplace. We don't have this system, so I decided to build one…'

Her self-directed motivation and confidence were visible before and after the pandemic.

"Everything *was based online as I was trying to build a system which did not exist online yet, so I had to research as I needed to find the information and then apply it to the area of my work to see whether it fit. So everything was built stage by stage…".*

In addition, when classes shifted online, Mawar quickly mastered how to teach online using the different apps to engage her students. Her digital competence led to her appointment as the college's digital contact person, responsible for supporting staff in learning and adopting digital tools and coordinating internal training.
Mawar recognised that digital adoption was shaped by experience, confidence levels and access to support:
'I think my colleagues will be open to moving into digitalisation of work practice, if it were marketed to them that it will make their lives easy…But with people, I think, again, how to make the unfamiliar familiar, which is the main thing here. "If you are not used to it, everything is going to be hard. If you are used to it, then it becomes the norm. They need to want to learn to use the digital tools and use them in their work. If they don't use them, even though they have the skills, they won't get it… Also, they need to have support to learn them [the skills]'

With the training and support, the workplace culture has recently become more open to change. Management had introduced training sessions on AI tools, which had been received with cautious optimism amongst the older colleagues. Yet the actual practices of staff often lagged behind the ambitions of policy due to limited infrastructure and resources.
'We have training, and we also have online self-guided training where staff can watch a video and go through it at their own pace. Everyone in my department technically has equal access to learning opportunities. Everyone gets to learn to use the digital tools at the college…But it's not really about access to training, it's about whether people actually adopt the skills into their teaching and daily practices"

For Mawar, training was never the main issue. She relies on informal and self-directed learning:
'I have tried online learning. When the internet was not reliable for students, I had to find a way to engage students… There was this one particular module that was endorsed by a [name of organisation] …and on the course, there was a video of a lady teaching about all these elements of the destination marketing organisation. So I am like…we could really use this online module for our own students, as it was a free access MOOC [massive open online courses] …, and if I don't know something, I will research it. I will Google, test it out and find a way.'

In her role as digital contact person, Mawar also attended training courses outside her college, where she learned about the new digital tools which can be used in her teaching. which she had become a resource person, guiding colleagues through digital processes, and troubleshooting problems when they arose. Yet, there were still limits. The internet connection at the college remained patchy and digital systems lagged: '*the students and staff have a phone, a laptop, but the only problem is the internet. Even though we have internet in school, the system is slow, because we are talking about so many people using the same bandwidth…*'

Despite these constraints, Mawar found ways to create her own digital space to keep her learning active and relevant. She saw the benefits of using digital tools, which could dramatically lessen her workload for routine tasks and make more use of this time for other tasks. She continued to engage students with interactive digital tools, which gives her the confidence to keep going. In this way, Mawar's capability was thus partially realised through her engagement with her students, even if not fully embedded in the work practices. Although such conditions further added to the challenges within the workplace, where the absence of structured and consistent institutional training is provided within the college, informal learning was more obvious and prevalent. Mawar's dispositions reinforced her identity as a digital guide.

Individual Agency, Workplace Culture and Digital Infrastructure

Amir and Mawar's stories illustrate the nuanced ways in which capabilities to learn and use digital skills in the workplace are socially embedded. Drawing on Boyadjieva and Ilieva-Trichkova's (2021) framework, we unpack the different levels to illuminate the intricate interplay between the different factors, such as individual agency, peer support, workplace culture, institutional infrastructure and broader societal factors, in facilitating the learning and integration of digital tools in the workplace. Rather than focusing on the background, such as education, gender, or age, this analysis foregrounds the significance of individuals' positionality within the workplace, i.e. the roles they occupy and the opportunities these roles afford for the meaningful use of digital skills. This analysis will delve into how these factors collectively influence the learning, adoption and sustained integration of digital tools, identifying barriers and enablers within diverse educational contexts. There are similarities and differences between how Amir and Mawar navigate their workplace learning, but both stories highlight that having access to learning digital skills is only a part of digital transformation; equally important is the opportunity to translate those skills into meaningful workplace practice.

Amir and Mawar demonstrate personal motivation and initiative in engaging with digital learning opportunities. Amir was motivated to learn for his work and to support his role, even though he experienced constraints in applying his digital skills influenced by the structural and the workplace culture. Mawar, on the other hand, was self-directed, actively seeking informal learning opportunities and experimenting with new digital tools before sharing them with her colleagues. Despite structural constraints, she continues to demonstrate confidence and persistence to enhance her capability in learning and using digital skills, allowing her to apply learned skills in practical ways and to support others. She was able to use the digital tools strategically for her teaching.

On another level of analysis, the workplace culture emerges as one of the key influences in whether having digital skills translates into capabilities. Although there is no formal support group to discuss and learn together, Amir's story shows the importance of having informal learning networks – like the IT officer and peer support, where he guides those who need help. However, some senior staff are resistant to the adoption of digital technologies, which constrains the collective adoption of digital practices, influencing Amir's ability to fully convert his digital skills to practices. Mawar's workplace, in contrast, is a fair example of an expansive learning environment, which extends her digital learning. Her role as the department's digital contact person allows her to guide colleagues through new tools. Her role not only consolidates her own learning but also allows her to translate her skills into meaningful practices, i.e. to enable and develop her colleague's capability.

Both Amir's and Mawar's stories reveal that institutional structure also influences the shaping of digital learning outcomes. In Amir's college, though offering formal training, it still maintains paper-based administrative practices, which could have influenced the dispositions to learning digital skills. Consequently, in both workplaces, institutional support, such as learning opportunities, is not consistent, and learning to use digital skills depends largely on individual initiatives. For example, Amir would rely on his IT officer's advice, whilst Mawar would learn on her own to navigate through her challenges. In both stories, their learning of digital skills is largely self-directed, whilst illustrating agency, also highlights that the need for tailored, context-driven support is important for adult educators who are new to digital skills, as they won't know what they need to learn, and thus may remain unaware of the potential of digital tools to enhance their pedagogical approaches.

Mawar operated within a more supportive institutional context, where the college provides AI training accessible to all staff, and her expertise was acknowledged as a valued resource. Nonetheless, infrastructure constraints, such as inconsistent internet connectivity, prevented the universal adoption of digital tools amongst colleagues.

This could lead to inequality in access to online learning opportunities. Amir's and Mawar's stories illustrated that institutional policies and infrastructure act as enablers and barriers, mediating the extent to which digital skills become real capabilities. This emphasises that even with individual digital literacy or those wanting to learn digital skills, the lack of reliable and ubiquitous internet access or adequate hardware within an educational setting can present challenges in successful practical application and benefits of digital tools, creating a significant digital divide that affects both educators and learners, especially amongst the senior staff members.

Beyond the workplace, societal and policy-level factors further shape capability realisation. Although these factors were not captured in the interview, both Amir and Mawar operate within the national digital transformation framework (MOE, 2022), where there are existing plans to promote digital literacy and AI adoption in education. These two stories show the different implementation stages and the non-linear process of these policies. Such findings reinforce that the learning to become digitally competent is influenced by the interplay of individual agency, relational networks (e.g. community of practice) and infrastructure, extending beyond individual efforts to include broader structural and systemic conditions that shape the learning outcomes of individuals.

Conclusion

The paper begins with trying to understand how individuals learn to become digitally competent in the workplace, through the lens of the social embeddedness of capability. The contrasts between the two vignettes signal the non-linearity of learning digital skills, drawing on the central argument of this chapter – that the capability to be digitally competent is not just about individual's access to skills training and learning opportunities, it's about the whole ecosystem; relationships, workplace culture, infrastructure and broader policy that manifest these learning into meaningful digital practices.

This study, therefore, challenges the argument that individuals are responsible for their own digital skills development. The vignette shifts us to think about the factors influencing this learning process. Amir's experience was shaped by challenges such as access to formal training, a workplace culture which was resistant to new practices and a gradual policy implementation, which influenced the pace of change. Although he has the digital skills, there was not much opportunity for him to build on his digital competence, where he could meaningfully and confidently use those skills in this workplace. In contrast, Mawar's learning of digital skills was supported by her workplace culture. This allowed her to move beyond skill acquisition into building on

her digital competence. However, the capability of learning these skills was also influenced by infrastructural issues. That is, the findings reinforce the view that digital skills workplace learning is a collectively mediated outcome, which hinges on the synergy of all the factors at different levels. Both the stories reveal how they drew on their experiences and what they hope to do to navigate present workplace demands, with their actions shaped by institutional opportunities, workplace culture and the evolving digital landscape, in Evan's (2017) term, bounded agency.

The findings also introduce an important temporal insight into the framework. Boyadjieva and Ilieva-Trichkova (2021) note that capabilities are embedded in evolving social contexts, and these findings confirm that capability realisation is dynamic, not static. Amir's college was slowly integrating digital practices, training was becoming routine, and workplace culture was slowly shifting. His capability, then, may be more realised in the future to become digitally competent. On the other hand, although Mawar may seem to be digitally competent in her workplace, it does not guarantee sustainability. Infrastructure challenges could hinder long-term sustainability, and her ability to use her digital skills meaningfully could be vulnerable to institutional policy change. This chapter adds to the ongoing debates about the digital transformation of workplaces. By framing digital workplace learning through this socially embedded capability lens, this study repositions the challenge of becoming digitally competent as a question of opportunity: *who is afforded the conditions to flourish, and who is left with unrealised potential? And how does this influence the digital transformation of workplaces?*

Recommendations

The findings point to a set of recommendations captured in an inclusive framework that aligns with the implementation of digital transformation in the workplace. This framework captures the different, synergistic and interrelated levels needed to create opportunities for individuals to become digitally competent within their workplaces. At the individual level, we need to promote a learning culture of self-directed learning, supported by a community of learners. At the relational level, mentorship should be introduced so that learning becomes a shared practice and supports collective reflective practice (Goh, 2019) as part of team learning (Goh and Lim, 2024) and community learning culture. At the institutional level, policies should incentivise digital expertise, provide accessible training opportunities, and ensure robust infrastructure. Finally, at the societal level, national strategies should address structural inequalities in connectivity and resourcing that could act as barriers to

participation for all, for example by providing lifelong learning opportunities (Goh, 2023).

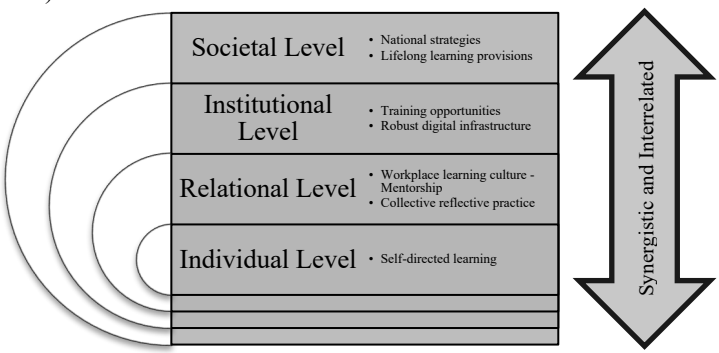

Figure 1: An inclusive framework to build digital competence of individuals in workplaces.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-05

Leveraging Digital Technology for Empowerment - Insights from Canadian Nonprofit Organizations in Applying Generative Artificial Intelligence (GenAI) to Strengthen Equity, Diversity and Inclusion (EDI) Practices

Sophia Ho

Many Canadian nonprofit organizations embed equity, diversity and inclusion (EDI) in their values to allocate resources to empower workers and promote equitable opportunities for growth. Digital technology serves as a double-edged sword - it can be leveraged to promote organizational initiatives that support EDI, yet it can also inadvertently work against these very values. This study examines how Canadian nonprofit organizations consider employing digital technology, specifically generative artificial intelligence (GenAI), to facilitate the organization's EDI missions. Three workers from the community services and higher education sectors were interviewed to share their perspectives on the use of digital technology, including the opportunities and challenges, the ethical concerns involved, and their potential future applications. The findings indicate that, while digital technology, particularly GenAI, can support Canadian nonprofit organizations to advance their EDI missions and empower workers, it can also be the same tool to jeopardise those missions if not used responsibly and without proper safeguards. Afterall, human oversight is critical for the responsible implementation of GenAI in EDI-related work, and the human element remains essential for building trust among end users.

Keywords: equity, diversity and inclusion (EDI); generative artificial intelligence (GenAI); Canadian; nonprofit; worker empowerment

Introduction

"In Canada, our diversity is our strength. Our social, political, economic and cultural progress is not made in spite of our differences, but thanks to our differences." said the Honorable Jean-Yves Duclos, Minister of Families, Children and Social Development (Employment and Social Development Canada, 2019).

Canada is a country where diversity is celebrated. According to Statistics Canada (2022), among nearly 37 millions of people living in Canada, there are 450 ethnic or cultural origins, 200 places of birth, 100 religions, and 450 languages spoken. Citizens are encouraged to "keep their identities, take pride in their ancestry, and have a sense of belonging" (Canadian Heritage, 2025). Diversity in Canada also extends to sexual orientation, age, and family structures.

Canada is the first country worldwide to formally recognize multiculturalism through legislation. The Canadian Multiculturalism Act, enacted in 1988, was established "for the preservation and enhancement of multiculturalism in Canada" (Canadian Multiculturalism Act, 1988). Based on the Act, the Government of Canada's multiculturalism policy has several key objectives: to recognize and preserve the multicultural heritage of Canadians; to promote the full and equitable participation of individuals and communities of all origins in the development and shaping of all aspects of Canadian society; to assist individuals and communities in eliminating barriers to their participation; and to ensure that all individuals receive equal treatment and protection under the law, while respecting and valuing their diversity (Canadian Heritage, 2024).

The reality is, like many other countries, Canada is not free from inequality and systemic racism. In 2021, 751 unmarked graves were discovered at the site of a former residential school in the province of Saskatchewan (BBC News, 2021). Residential schools in Canada were operated primarily by religious authorities. Between 1863 to 1998, indigenous children were forcibly removed from their families and sent to these institutions, where they were forbidden from speaking their languages or practicing their cultures and traditions. The aim was to assimilate them into mainstream Canadian society, often through mistreatment and abuse. Many children never returned home. In response to the discovery, then-Prime Minister Justin Trudeau issued a formal apology for the residential school system (Prime Minister's Office, 2022). This tragic history serves as a sobering reminder that there is still much work to be done in addressing systemic barriers and advancing diversity, equity, and inclusion in Canada.

Equity, diversity and inclusion as an independent yet interrelated concept

Equity, diversity and inclusion (EDI) is often misunderstood as a single, unified concept, as the terms frequently appear together in news, social media, and academic literature. Occasionally, the order of the terms varies, such as DEI (diversity, equity, and inclusion); off and on, additional concepts are included, resulting in acronyms like EDIB (equity, diversity, inclusion and belonging), JEDI (justice, equity, diversity, inclusion) or EDID (equity, diversity, inclusion and decolonization). This paper focuses specifically on equity, diversity, and inclusion as three distinct yet interconnected concepts. It is important to note that there are no universally agreed-upon definitions of these terms, as their meanings continue to evolve and vary depending on social, cultural, and historical contexts. For Canada, the federal government established the Interdepartmental Terminology Committee on Equity, Diversity and Inclusion to define key EDI-related terms. The following are the definitions:

Equity is the principle of considering people's unique experiences and differing situations, and ensuring they have access to the resources and opportunities necessary to attain just outcomes. Equity aims to eliminate disparities and disproportions that are rooted in historical and contemporary injustices and oppression (Translation Bureau, 2025).

Diversity refers to the variety of identities found within an organization, group, or society. Diversity is expressed through factors such as culture, ethnicity, religion, sex, gender, sexual orientation, age, language, education, ability, family status, or socioeconomic status (Translation Bureau, 2025).

Inclusion is defined as the practice of using proactive measures to create an environment where people feel welcomed, respected, and valued, and to foster a sense of belonging and engagement. This practice involves changing the environment by removing barriers so that each person has equal access to opportunities and resources and can achieve their full potential (Translation Bureau, 2025).

Equity, diversity, and inclusion are interconnected yet distinct concepts. A visual representation, adapted from Burnette (2019), who was influenced by the work of Toronto-based Turner Consulting Group, demonstrated how these concepts intersect in organizational settings (see Figure 1).

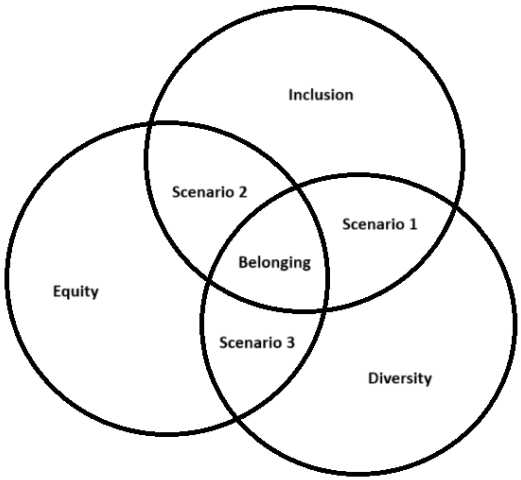

Fig. 1: Interrelationship between the concepts of equity, diversity and inclusion.[1]

According to Burnette (2019), to understand the interrelationship between equity, diversity, and inclusion in an organizational setting, consider three organizational scenarios, each lacking one of the EDI elements:
Scenario one - when equity is missing: while an organization may recognize diversity and inclusion, it does not provide equitable access to opportunities for individuals; power remains concentrated within the dominant group. As a result, the voices of diverse individuals are unlikely to be meaningfully heard (Burnette, 2019).
Scenario two - when diversity is missing: the organization becomes homogeneous, resulting in limited perspectives in decision-making. A lack of diverse viewpoints can hinder innovation, creativity, and responsiveness to a broader range of needs (Burnette, 2019).
Scenario three - when inclusion is missing: even if individuals from diverse backgrounds hold positions of authority, they may not feel empowered to express

[1] Note. Modified from a diagram by K. Burnette (2019), which was inspired by Turner Consulting Group. From It's 2019 and we are still talking about equity, diversity and inclusion, Medium (https://medium.com/@krysburnette/its-2019-and-we-are-still-talking-about-equity-diversity-and-inclusion-dd00c9a66113).

their views fully. Without an inclusive environment where diverse perspectives are genuinely valued and respected, meaningful engagement is stifled (Burnette, 2019).
According to Burnette (2019), when organizations intentionally embrace all three EDI elements, they foster a culture of belonging. Individual's perspectives are not only valued but also integrated into organizational processes, and individuals have equitable access to opportunities to contribute and thrive.

Theoretical approaches to promote equity, diversity, and inclusion

The workplace offers an excellent ground for promoting EDI, as it should reflect core Canadian values through the ways workers treat, interact with, and communicate with one another professionally. Promoting EDI is not merely a slogan; it requires organizations to invest in transforming existing practices and workplace culture to ensure that the benefits translate into worker empowerment.
According to the theory of generative interactions proposed by Bernstein et al. (2020), the first step toward fostering an EDI culture is to overcome exclusionary dynamics—such as self-segregation, communication apprehension, stereotyping, and stigmatization—through adaptive cognitive processing and targeted skill development. Once these barriers are addressed, organizations must implement practices that support the conditions for generative interactions. These include pursuing a shared organizational purpose, fostering sustained collaboration among diverse team members, ensuring equitable opportunities for all individuals to contribute to the organization's success, and creating a psychologically safe environment that promotes interdependence and the development of self-efficacy.
Principles from design education provide practical guidance for developing effective, values-driven practices that promote EDI within organizations (Rossi, 2024). Design education encompasses knowledge ecosystems in which learners acquire the skills and understanding through interactions to create meaningful products and services. By applying design education principles to EDI promotion, the EDI-related knowledge within this ecosystem can guide the development of practices that empower underrepresented groups to contribute their unique perspectives. The flow of EDI-related knowledge can enhance workers' reflective and creative practices, helping them innovate, solve problems, and collaborate effectively. The expansion and exchange of the EDI knowledge also fosters greater cultural awareness, which further cultivates an engaging, inclusive work environment.
Additionally, the capability approach also offers a valuable perspective for promoting EDI within organizations. According to Boyadjieva and Ilieva-Trichkova (2021), the capability approach enables individuals to expand and exercise both agency and

capabilities within their environment while pursuing personal well-being. The approach focuses less on the functioning of individuals and more on whether the individuals have the actual freedom, or capabilities, to achieve. The capability approach provides a framework for understanding how adult education can promote equity, diversity, and inclusion in the workplace - organizations need to go beyond simply providing resources, but rather, focus on the actual opportunities they can equitably offer workers to reach their full potential. This includes creating an inclusive learning environment that grants workers freedom to explore diverse learning opportunities, thereby fostering a sense of empowerment and value. Organizations can further support employees by identifying barriers that limit their capabilities and proactively removing them; thus, enabling employees to access greater growth opportunities within the organizational structure.

Leveraging digital technology to advance equity, diversity and inclusion in the workplace

First, it is important to clarify what it means by digital technology. While definitions vary, Li et al. (2024) refers to it as "a collection of technologies centred around digital information processing". Digital technology encompasses the collection of data from the physical world, as well as the storage, processing, analysis, and transmission of that data. It also enables the identification of hidden patterns and trends and supports the conversion of information into multiple formats such as text, images, videos, and sound. Because of its wide-range applications, digital technology plays a pivotal role in transforming the traditional economy into digital. Beyond economic transformation, digital technology generates many positive social impacts worldwide. According to the United Nations (n.d.), digital technology "can help make our world fairer, more peaceful, and more just" by advancing the seventeen Sustainable Development Goals (SDG), which aim to end extreme poverty, reduce material waste, promote sustainable farming, create decent work, lower infant mortality, and achieve universal literacy.

One of the most widely used digital technologies today is ChatGPT, which was launched to the general public in November 2022. Its release sparked extensive discussions across business, government, and society regarding its potential impact on the future of work and everyday life. The primitive form of ChatGPT can be traced back to 2018, when Generative Pre-trained Transformers (GPT) were first introduced by OpenAI as "a type of large language model (LLM) that utilizes deep learning to produce human-like text" (Google Cloud, n.d.). With its ability to generate content in

multiple forms—including text, code, and images—it has found broad applications across workplaces and individual use.

Digital technology provides valuable avenues to support workers in learning and participation. By enabling access to knowledge and information, it empowers workers to perform more effectively in their roles. It also opens pathways for exploring new opportunities, particularly for individuals from traditionally disadvantaged groups, such as persons with disabilities. Through digital tools, systemic barriers can be reduced or removed, allowing equitable access to opportunities that might otherwise remain out of reach. Additionally, digital technology fosters innovation by supporting the generation and implementation of creative ideas (Oldham & Da Silva, 2013). It strengthens team communication and collaboration through improved information sharing, coordination, and decision-making (Lane et al., 2024). Furthermore, digital technology facilitates broad dissemination of information, making employees more aware of organizational activities and opportunities. It can also function as a surveillance tool to identify inequitable practices within the workplace; in such cases, workers can mobilize resources to encourage organizations to reevaluate their cultures and implement changes that advance organizational EDI goals (Szabla, 2024). By expanding access to data for decision-makers, digital technology helps develop work processes that embed EDI values. For example, when EDI is a strategic priority in recruitment, it attracts employees who embrace inclusive values, transforming workplace interactions and positively influencing customers and stakeholders.

Although digital technology offers many advantages to individuals and organizations, it can also exacerbate social inequality: “although we are all in the same water, we are not in the same boat” (Szabla, 2024). Disadvantaged communities have become increasingly vulnerable as inequalities accelerate. Digital technology can perpetuate misinformation, disinformation, and fake news, creating a “faulty information supply chain” that disrupts knowledge acquisition and hinders effective dialogue within and outside organizations (Prager & Bilge, 2024). The spread of inaccurate content often leads to polarization, knowledge resistance and loss of trust. These dynamics can have serious consequences for organizations. Therefore, when implementing digital technologies in the workplace, organizations must carefully evaluate potential risks against the benefits and explore strategies to mitigate these risks while leveraging digital technology to promote EDI within organizations.

Exploring digital technology use in Canadian nonprofit organizations to promote equity, diversity and inclusion

Given the advantages and drawbacks of using digital technology in the workplace discussed in the previous section, this paper presents an exploratory study examining how Canadian nonprofit organizations adopt digital technology to advance the organizational EDI goals. Nonprofit organizations are chosen because they are typically mission-driven and fulfil societal roles such as "service delivery, advocacy, integration, and the development of cultural patterns" (Miller, 2024). They operate to "provide public services to communities where they operate, making them an intermediary between citizens and authorities" (Ciucescu, 2009). By serving diverse needs and interests in the community, nonprofits provide a platform for citizen participation in public life. When nonprofit organizations embrace EDI values to empower workers, it models a more equitable, diverse, and inclusive society while fostering civic engagement and promoting the pursuit of common goods.

Method

In this exploratory study, three semi-structured informational interviews were conducted to examine how Canadian nonprofit organizations implement digital technology to advance the organizational EDI missions. Informants were presented with a set of questions covering topics such as organizational readiness for digital technology, its use in achieving EDI goals, methods for evaluating impact, observed improvements, concerns during implementation, and existing policies guiding digital technology use. Two sets of questions were employed, depending on whether the informants were actively implementing digital technology in their work. (see Table 1).

Question set 1: For organizations that have already implemented digital technology in their practices:	Question set 2: For organizations that are yet to consider implementing digital technology in their practices:
• How does your organization define and prioritize equity, diversity, and inclusion (EDI) in its mission and operations?	• If resources or technical barriers weren't a constraint, how might you envision using digital technology or GenAI to support your EDI goals?
• Can you share examples of digital tools or GenAI systems you've implemented to support marginalized communities or empower staff?	• Are there aspects of your EDI work—such as communication, training, data collection, or community engagement—that could benefit from digital innovation?

• How do you ensure the technologies you use are accessible and inclusive for diverse communities and team members? • What outcomes or improvements have you observed since adopting these technologies in your EDI work? • How do you measure the impact of these technologies on equity and worker empowerment? • How do you address concerns around bias or ethical use of GenAI in your organization? • What barriers have you encountered when integrating GenAI or digital tools into your EDI initiatives? • Has your organization developed specific policies or guidelines for the ethical and inclusive use of GenAI or digital technology?	• How do you currently gather feedback or data to assess the impact of your EDI work? Could digital technologies enhance this process? • What concerns or hesitations do you have about using GenAI or digital tools in your organization's EDI efforts? • How might GenAI tools help address inequities within your organization or the communities you serve? • What support, knowledge, or partnerships would your organization need to feel confident exploring digital or GenAI-based solutions for EDI?

Table. 1: Interrelationship between the concepts of equity, diversity and inclusion.[2]

Informants with experience in equity, diversity, and inclusion were recruited via LinkedIn through direct messaging describing the study. Interested participants were scheduled for a 45-minute virtual interview over Zoom. Question sets were provided to informants in advance, and informants can choose which questions to answer based on the organizational contexts. Both the informants' names and the organizations they represent are kept anonymous in this report. Interviews were recorded and transcribed; after the interviews, informants received Amazon gift cards as a token of appreciation for their time and insights.

[2] Note. Questions were initially generated by ChatGPT and subsequently modified to align with the study's objectives (OpenAI, personal communication, April 26, 2025). The prompt used to generate the question sets was: generate two lists of 10 questions for information interviews: the first list is for a staff member from a Canadian nonprofit organization who has already incorporated digital technology or generative AI (GenAI) into his/her work. The second list is for a staff who has yet to incorporate digital technology or GenAI into his/her work. The goal of the interview is to understand how and whether organizations adopt digital technology or GenAI to support their equity, diversity and inclusion initiatives. The questions should include challenges, outcomes, strategies, and ethical considerations.

Interview one: Director of Diversity, Equity, and Inclusion at a nonprofit organization providing community services

Gail (pseudonym) is the Director of Diversity, Equity, and Inclusion at a nonprofit organization in Toronto, Ontario, Canada, providing community services for infants, youth, children, and families. The organization's mission is to deliver high-impact mental health and developmental services that transform lives. Working closely with community partners in childcare, schools, and healthcare, the organization aims to reduce barriers to access and to ensure seamless services. Promoting EDI is central to organizational success, creating an environment where workers align with EDI objectives, foster belonging, and embody organizational values.

The organization is in the early stages of exploring digital technology, particularly GenAI, to support its EDI missions. Gail mentioned several potential applications:

- Supporting workers or clients with speech disorders by providing coherent notes before conversations.
- Managing schedules for workers with health conditions, such as diabetes, to maintain productivity.
- Reducing administrative and coordination work to improve service quality.
- Bridging communication gaps with the deaf or blind through sign language recognition.
- Enhancing communication through grammar checks and note-taking during meetings.
- Analysing staffing and recruitment data to identify biases in hiring practices.

Gail also expressed concerns about adopting GenAI in her organization - while GenAI has significant potential to automate workflows, it introduces the risk of biased outcomes. This is especially critical given her organization serves the "vulnerable of the vulnerables"—young children with autism and other developmental disabilities—where highly sensitive information is involved. As a result, utilizing GenAI or digital technology requires a very calculated approach to assess what the risks are and weighing them carefully against the potential benefits.

As Gail explained in the interview, "what we end up doing appears to be convenient, actually ends up being exclusionary." For her, it is about adopting GenAI tools cautiously and ensuring that risks are properly mitigated. She provided the example

of using GenAI to read résumés and screen candidates. Without safeguards, GenAI might exclude applicants unfairly by automatically rejecting résumés with gaps in work experience. Yet, such gaps can arise for many valid reasons, such as childcare responsibilities, managing mental health, or undergoing gender-affirming surgery. This way, what might appear as an inclusionary practice using digital technology could, in fact, result in exclusion, undermining the very goals of equity, diversity, and inclusion.

Gail stressed that the value of digital technology depends on its ethical and responsible use, ensuring training data are free from bias so GenAI supports rather than undermines EDI. In conclusion, Gail acknowledged the benefits of digital technology for advancing EDI but emphasized the need for robust checks and balances. She mentioned that her role as the Director of EDI is to focus on identifying risks, mitigating bias, and ensuring GenAI supports ethical EDI practices. She concluded, "I don't want human stupidity feeding into GenAI. I want human intelligence to feed into human intelligence."

Interview two: E-learning Specialist at an university

Lydia (pseudonym) is an E-learning Specialist at an university in Mississauga, Ontario, Canada, designing career courses to support students acquire effective job search skills. She develops e-learning modules focusing on inclusivity and accessibility by applying Universal Design for Learning (UDL) principles which aim "to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (CAST, 2025). Lydia designs courses that "provide means of engagement and representation," addressing diverse learner needs, interests, and abilities.

Lydia highlighted the importance of learners as the agent to direct the learning; learners should be able to choose the learning pace and the learning path according to their preference and style. The options available to learners on what to learn, how to learn and when to learn empowers the learners, removes systemic barriers and allows learning to be as inclusive, diverse and accessible as possible. Digital technology is utilized in e-learning design to create personalized learning experiences that help learners acquire specific knowledge relevant to their needs. Digital technology, particularly GenAI, can personalize e-learning by providing adaptive feedback, interactive scenarios, and chatbots to enhance engagement. Further adoption of digital technology, as Lydia mentioned, could include:

- Translating between languages and into sign language for deaf learners.
- Generating culturally inclusive images, videos, and simplified content to reduce cognitive load for neurodivergent learners.
- Converting text into accessible formats such as lists or flip cards.

Lydia emphasized the importance of training workers to use GenAI effectively. This includes selecting the right tools, evaluating GenAI outputs, prompting effectively, referencing GenAI-generated ideas appropriately, and ensuring ethical use in line with organizational policies. She also highlighted the importance of understanding the audience and their needs. Collaborating with people who have lived experience helps ensure that the course design reflects learners' perspectives rather than assumptions. Without consultation with people with lived experience, e-learning content that is developed may not adequately address learners' needs.

Lydia also highlighted the potential biases embedded in GenAI. For instance, GenAI-generated images can reinforce stereotypes or fail to reflect historical and cultural sensitivities. She shared an experience in which she prompted GenAI to generate an image depicting empathy, but the result was an image of a white woman and a black man facing each other. Given the history of colonization in the Western world, this representation was not an appropriate or culturally sensitive way to convey empathy. On another occasion, she used GenAI to create images for an indigenous learner, GenAI produced visuals featuring indigenous arts that stereotyped how indigenous peoples appear. Lydia cautioned that such outcomes underscore the need for a "human element" in applying GenAI. While GenAI can support e-learning course design, human input remains essential to verify the accuracy, cultural appropriateness, and overall relevance of the GenAI outputs, which is a broader, high-level perspective that GenAI inherently lacks.

Lydia described challenges related to transparency and accountability, noting that GenAI cannot disclose which theoretical perspectives it draws upon when generating content. For example, when she designs e-learning courses for career development, she has no way of verifying which theories inform the GenAI's outputs. Similarly, if a chatbot provides career-related advice to learners, those learners have no means of knowing which career development framework underlies the feedback they receive.

In conclusion, while GenAI offers significant benefits for empowering learners and workers, a human-centered approach is still critical. Organizations should provide training, develop policies, and maintain human oversight to ensure ethical, inclusive, and effective use of GenAI in e-learning.

Interview three: Co-op Student Experience Manager and Ph.D. student at separate universities

David (pseudonym) is a full-time Co-op Student Experience Manager in an university in Kitchener, Ontario, Canada, specialized in Equity, Diversity, Inclusion, and Anti-Racism. He is also a part-time Ph.D. student specialized in social justice education at an university in Toronto, Ontario, Canada. In his dual roles, he uses digital technology minimally, but he envisions potential applications such as:

- Conducting SWOT analyses and suggesting EDI strategies and best practices.
- Collecting and analysing EDI data to identify trends, gaps, and inequities across departments, and suggesting actions to improve representation and balance.
- Creating training materials and reviewing course outlines to ensure diverse perspectives are included.
- Producing accessible communication for equity-deserving groups, e.g., audio emails for visually impaired students and summarized lecture notes for students with learning disabilities.
- Providing personalized feedback to workers, accommodating diverse personalities and neurodiverse learners.
- Supporting his research by suggesting sentence structures, relevant articles, and proper referencing.

David noted significant limitations when implementing GenAI into his work; his GenAI usage was restricted to primarily drafting emails, proofreading, or enhancing writing. “GenAI for me is more for proofreading and polishing, not necessarily creating and drafting.” He found GenAI-generated content for presentations or community engagement superficial, generic, and sometimes inappropriate, thereby limiting its usefulness for relationship-building and advocating for the equity-deserving communities.

David also raised concerns about GenAI biases. “If training data are biased, GenAI may reinforce systemic barriers rather than reduce them.” He doubted GenAI’s ability to account for microaggressions, racism, or ableism. He stated, “using GenAI to combat racism and promote EDI without considering the perspectives of equity-deserving groups can be misleading”. He provided an example: if someone experienced microaggression and there was only one occurrence, GenAI might discount it and treat it as a one-off incident. Consequently, he is not confident in

relying on GenAI for EDI-related tasks, as he considered them too technically complex and ethically sensitive — "a tall order," as he described.
As a Ph.D student, David similarly found GenAI helpful only in limited ways, such as generating literature review suggestions. He observed that much of the content generated by GenAI contains misinformation. When relying on GenAI for referencing, he still needed to verify correctness and accuracy. In his writing process, GenAI served only a supportive role. Concerns about academic integrity, misinformation, and accuracy remain central when applying GenAI on his academic work.
In conclusion, David believed that GenAI could support EDI work better if GenAI reliably incorporates multiple perspectives, such as taking anti-racism and accessibility into considerations. Developing effective practices through collaboration across faculties and in-house expertise is essential to impactfully leverage GenAI to advance EDI missions within organizations. As he stated: "It's a matter of different partners coming together to make GenAI more useful and effective."

Shared insights across the interviews

GenAI as a potentially beneficial tool for EDI and worker empowerment

All three informants noted that digital technology can empower individuals from equity-deserving groups, such as people with speech disorders, learning disabilities, and other forms of disability or neurodiversity. GenAI can translate between sign language and other languages, convert content from audio to visual formats (and vice versa), and create multimodal content that accommodates diverse learning needs, communication styles, and personalities. It can also summarize lecture notes and simplify content for learners with varied abilities and neurodivergent needs. The informants also highlighted that GenAI can collect, analyse, and interpret data related to equity, diversity, and inclusion. It can examine hiring trends to uncover systemic bias in recruitment practices and suggest strategies for organizational leadership to rectify inequalities or close existing EDI gaps.
The interviews highlighted that GenAI has the potential to empower workers and advance EDI goals across diverse organizational contexts. Gail saw potential applications of GenAI for community service delivery and worker empowerment within a nonprofit environment. Lydia, working in a university setting, already adapted GenAI as a supportive tool to design e-learning content that enhances accessibility and inclusivity, guided by Universal Design for Learning principles.

David, also works in a university setting, employs GenAI to improve writing for communications and as a supportive tool during the initial phase of literature reviews. These cases illustrate that GenAI is useful in advancing organizational EDI goals in various nonprofit contexts, from community service-based to education-based environments. Within organizations, GenAI can empower workers by developing EDI-related e-learning courses that raise worker's awareness on EDI-related topics, improving recruitment practices, and providing strategies for management to advance organizational EDI missions. To further empower workers, GenAI can be adopted to enable workers to support their clients with learning disabilities by improving accessibility to resources and communications and can help students with diverse neurodiversity spectrum to personalize their learning experience and to optimize learning.

Concerns about bias, ethics, and organizational readiness

All three informants expressed the concern that GenAI could reinforce systemic biases; when GenAI uses biased training data, the bias would inevitably be reflected on the outputs. Gail noted that using GenAI for résumé screening can potentially lead to exclusionary recruitment practices. Lydia shared an instance in which GenAI-generated images for "empathy" were culturally insensitive. David also noted that GenAI may fail to recognize systemic issues like microaggressions and subsequently treat them as isolated incidents. Ethical digital technology use requires clear guidelines and robust data protection policies. Lydia highlighted concerns about sharing personal or client information with GenAI, as it could potentially breach confidentiality. David emphasized the importance of following institutional guidelines for academic research to ensure proper citation and maintain academic integrity when using GenAI-generated content.

There are also differences in organizational readiness toward adopting digital technology: Gail's organization is in the early stages of exploring whether GenAI would benefit the organization, with a primary focus on managing risks and addressing ethical concerns before adoption. Lydia has already implemented some GenAI tools to support her work, noting that organizational policies and worker's training are essential to ensure proper use and to mitigate risks. David's adoption is limited due to scepticism about whether the benefits of GenAI outweigh the risks, particularly its potential to amplify systemic biases and produce inaccurate outputs. These cases highlight the importance for clear policies and training to guide responsible use. All three informants acknowledged the potential risk of GenAI reinforcing systemic biases: Gail took a cautious yet progressive approach, Lydia is optimistic about leveraging GenAI for worker empowerment and EDI improvement,

while David remains conservative, awaiting evidence of systemic-level EDI benefits before broader adoption.

The importance of human oversight

Although GenAI can support many activities and reduce human workload, all three informants emphasized that GenAI cannot replace human judgment. Human oversight is essential to ensure outputs are ethical, accurate, and aligned with organizational EDI goals. For example, Gail noted that GenAI may screen out résumés with employment gaps, which could create exclusionary practices; checks and balances are necessary to validate context and ensure fairness. Lydia stressed that human review of GenAI-generated e-learning content is critical for detecting nuanced or potentially harmful messages. She also emphasized that inputs from diverse communities is necessary to critically evaluate content and ensure that the content aligns with organizational EDI objectives. Human perspectives are essential in reviewing GenAI-generated outputs to enhance users' confidence and trust.

Connecting interview findings to the theoretical approaches to EDI

The informants' experiences of adopting GenAI to enhance EDI in their workplace align closely with Bernstein et al.'s (2020) theory of generative interactions, which posits that dismantling exclusionary practices is the first step toward transforming workplaces to promote EDI. This transformation can be achieved through adaptive cognitive processing and targeted skill development. Informants highlighted several exclusionary practices, such as clients or workers with speech disorders facing communication challenges in meetings, visually impaired individuals unable to access visual training materials, neurodivergent learners struggling to understand lectures, or those with limited English proficiency encountering language barriers. GenAI offers significant potential to remove these obstacles by providing accessible resources and empowering individuals to fully participate in the workplace. Such interventions foster greater interactions with equity-deserving groups, cultivate psychologically safe environments, build trust, and enable organizations to offer more equitable opportunities for advancement. Ultimately, these efforts can shift organizational culture toward greater equity, diversity, and inclusion.

From a design education perspective explained by Bernstein et al. (2023), all informants agree that GenAI offers significant potential to foster environments where workers can enhance cultural awareness, amplify underrepresented voices, and develop reflective practices that empower workers while creating inclusive and engaging workplaces. Gail emphasized that GenAI tools can empower workers by improving accessibility, thereby supporting more equitable hiring practices. Lydia

applied Universal Design for Learning to meaningfully engage underrepresented workers and increase accessibility on e-learning content. David highlighted GenAI's potential for data analysis and knowledge sharing. These examples demonstrate how GenAI can support workers acquire essential skills and contribute to knowledge ecosystems, enabling them to become more agentic in their learning and to participate more meaningfully by offering their perspectives in a respectful and reflexive environment.

The practices the informants shared in the interviews also align well with the capabilities approach outlined by Boyadjieva and Ilieva-Trichkova (2021). All informants view digital technology, specifically GenAI, as a means to provide workers freedom and opportunities for achievement. Gail noted that GenAI can support workers with disabilities by removing barriers, enabling them to fully participate in their roles. These measures go beyond merely providing resources but focusing on expanding worker's capabilities. In Lydia's example, e-learning content with increased accessibility grants learners' agency - the freedom to choose what, how, and when to learn, significantly removes worker's barriers to participation, provides workers tools to engage meaningfully, and fosters empowerment and self-efficacy. David observed that GenAI can support tailored communication for individuals with different personalities and preferences, empowering workers and curating an inclusive organizational environment with full worker participation.

Beyond individual empowerment, the informants also recognize GenAI's potential to enhance collective empowerment, consistent with the capabilities approach. Lydia emphasized the importance of involving learners with lived experience in co-designing e-learning content. This collaborative process ensures content relevance, validates its usefulness, and amplifies the voices of underrepresented groups by incorporating their feedback. David highlighted the value of cross-department collaboration in sharing best practices for using GenAI in work processes or training development. Such collaborative approaches promote collective empowerment, helping the organization explore ways to remove barriers, expand actual opportunities for workers, and enable accomplishment.

Limitations and future research opportunities

The purpose of this study is to explore how GenAI tools are applied in Canadian nonprofit organizations to empower workers and advance organizational EDI missions. While numerous studies examine the use of digital technology to improve productivity or empower workers, few specifically investigate how digital technology contributes to advancing EDI goals in the nonprofit sector in a Canadian context. The

nonprofit sector is a compelling focus because it is typically mission-driven, aiming to "provide public services to communities where they operate, making them an intermediary between citizens and authorities" (Ciucescu, 2009). Nonprofits provide a platform for citizens to participate in public life, making it essential to foster EDI practices.

Focusing on Canadian nonprofits is particularly relevant given the country's historical emphasis on equity, diversity, and inclusion. For example, the Canadian Charter of Rights and Freedoms guarantees equality rights regardless of race, national or ethnic origin, colour, religion, sex, age, or disability, and upholds freedoms such as religion, expression, and association (Justice Laws Website, 2025). However, the current political climate has seen significant backlash against EDI initiatives, mirroring trends in the United States, with many EDI-related positions eliminated and funding reduced (CBC News, 2025). Consequently, it is increasingly imperative for organizations to demonstrate the impact of EDI initiatives and to explore how digital technology can empower workers, thus creating a more equitable, diverse, and inclusive environment aligning with Canadian values.

This exploratory study is not without limitations. The study involves only three informants, the data collected is exclusively qualitative, and only one researcher was involved in refining the set of questions used in the information interviews. Future research could use a larger sample size to enhance representativeness, employ empirical methods to strengthen validity and reliability, and involve more researchers to provide greater objectivity through triangulation in the research design.

Another limitation in the design of this study is the reliance on ChatGPT to identify common patterns from the three interviews. There are emerging discussions and studies on the pros and cons, advantages and risks of using ChatGPT in data analysis. For example, Morgan (2023) explored the potential use of ChatGPT for qualitative data analysis; the study showed that ChatGPT "performed reasonably well… it was less successful at locating subtle, interpretive themes, and more successful at reproducing concrete, descriptive themes." While using ChatGPT in data analysis may offer potential time savings, it remains a relatively new method that requires further studies to validate its reliability and to minimize risks and biases.

To improve the design of this study, a more traditional data analysis approach could be used, such as manual coding and analysis through applications such as NVivo. Other ways to improve the study design could include involving more researchers to cross-check the data, sharing the analysis with informants to ensure it accurately reflects their perspectives, increasing the sample size, and comparing the results of traditional qualitative data analysis methods with those generated using ChatGPT.

Another future research direction can be on comparing the use of GenAI to achieve organizational EDI missions in the nonprofit versus higher education sectors. From the current interviews, in terms of organizational readiness to adopt GenAI, Gail's organization takes a calculated approach to managing risks and proceeds with caution. Policies and guidelines need to be further developed to provide greater confidence in adoption. Lydia, working in higher education, has positively embraced GenAI and applied it widely in e-learning course design. The university where Lydia works also has policies in place to guide GenAI usage. David, also from higher education but speaking from the perspective of both a staff member and a PhD student, in contrast, has limited use of GenAI in his work. This is not due to a lack of organizational readiness, since the universities he is affiliated with have guidelines for GenAI use; but rather due to psychological or personal readiness in balancing the risks associated with its use. Future research could also explore questions such as: What factors affect organizational readiness to adopt GenAI in the nonprofit versus higher education sector? What are the hindering and facilitative factors? How can nonprofit and higher education industries learn from each other in adopting GenAI at work? What support or resources are needed to promote learning about GenAI adoption across industries? In terms of the generalizability of this study - since the informants were drawn from community services and higher education settings, the findings may not be applicable to other nonprofit sectors such as healthcare, environmental organizations, or arts and culture, let alone for-profit industries like finance, engineering, consultancy, or agriculture. Even within the nonprofit sector, organizations vary widely in mission, size, and clientele. Furthermore, the informants are all located within the province of Ontario, even though they work in organizations across different parts of the Greater Toronto Area. Due to the concentration in one geographical area, the findings do not represent the entire nonprofit sector across the country; nonetheless, they offer valuable guidance for future research, particularly in expanding the study to the national level to include other provinces. To further broaden the scope of research, comparative studies could be conducted across international contexts to examine how digital technology or GenAI contributes to organizational EDI objectives in different countries. Nonetheless, this exploratory study aims to gather preliminary data to stimulate further exploration and research on the use of GenAI in the EDI realm within the Canadian nonprofit context.

Summary and Conclusion

This chapter examines how Canadian nonprofit organizations utilize digital technology, particularly generative artificial intelligence (GenAI), to enhance equity,

diversity and inclusion (EDI) in their organizations. EDI are key Canadian values shaped by its historical context and promoting them in nonprofit workplaces provides a platform to model these values and gradually foster a more equitable, diverse, and inclusive society. Digital technology holds significant potential to support organizations in achieving EDI goals by empowering workers to perform effectively and to explore growth opportunities.

Interviews with Gail (Director of EDI from community service sector), Lydia (E-learning Specialist, higher education sector), and David (Career Services Manager from higher education sector, and Ph.D. student) provided insights on how digital technology is applied on their work to promote EDI, the opportunities and challenges they face, their personal and organizational readiness toward its use, and ethical considerations. Their experiences offer practical yet cautionary guidance on using digital technology to empower workers and advance organizational EDI goals.

The findings indicate that GenAI can be a valuable tool for supporting EDI and worker empowerment. However, privacy and ethical concerns remain, and successful implementation depends on organizational readiness.

Undeniably, human oversight remains indispensable: reviewing and validating work generated by GenAI is essential for ensuring content accuracy and fostering user confidence; human judgment remains a critical element in the GenAI adoption process. It is humans who possess the nuances in knowledge and communication that allow them to judge the appropriateness of GenAI output and to consider the bigger picture in complex scenarios. As mentioned earlier, the nonprofit sector in Canada provides a valuable context for examining GenAI adoption because there are many industries within the sector that work directly with people—for example, patients in healthcare, students in higher education, and indigenous communities in social services. It is therefore important to ask: what uniquely human qualities do workers bring to achieve outcomes that cannot be replaced by digital technology, or that complement digital technology effectively? Exploring these topics within the Canadian nonprofit sector will be unique in the international context, as it can offer a perspective grounded in Canadian values of diversity, equality, freedom, human dignity, and participation.

Acknowledgement

I would like to thank my colleagues in the Research Network 2: Workplace Learning of the Asia-Europe Meeting, Education and Research Hub for Lifelong Learning (ASEM LLL Hub), for the opportunity to contribute to this book, which advances our collective understanding of how digital technology and innovation empower workers

in an international context. Such knowledge is both necessary and timely as we navigate the fourth Industrial Revolution, where digital technology evolves at warp speed while humanity struggles to fully grasp its implications and applications for the benefit of societies. I am privileged to contribute a Canadian perspective to this vast and important discussion. In line with the digital technology trend, this article was reviewed with the assistance of ChatGPT for grammar, word usage, and sentence structure improvement. ChatGPT was also used to generate interview questions and support identifying common themes from the interview data.

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Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-06

Cultivating AI-Integrated Interdisciplinary Talent: A Case Study of Shanghai University of Engineering Science

Jiang Xiaohua, Wang Xiuxiu and Jia Xinyu

As artificial intelligence (AI) reshapes industrial structures and professional roles, universities of applied sciences face growing pressure to rethink how interdisciplinary talent is cultivated. This study explores how Chinese universities of applied sciences respond to this challenge through a case study of Shanghai University of Engineering Science (SUES). Based on semi-structured interviews with university administrators and faculty members, analysis of curricula, and a review of institutional documents, the study identifies five interrelated strategies adopted by SUES: the establishment of modern industry colleges, the creation of AI-related degree programs, the integration of AI into existing curricula, the introduction of innovative teaching practices, and sustained faculty development initiatives. The findings show that SUES draws on its applied orientation to connect AI education more closely with industry needs, thereby narrowing the gap between theoretical instruction and practical competence. At the same time, the case reveals persistent tensions, particularly in balancing disciplinary specialization with interdisciplinary integration and in deepening collaboration between universities and industry partners. By examining these dynamics in detail, this study contributes to broader discussions on higher education reform, university-industry collaboration, and the governance of technological innovation in applied higher education contexts.

Keywords: AI education, applied higher education, interdisciplinary talent cultivation, university-industry collaboration, China

Introduction

The rapid development of generative artificial intelligence (GAI) is transforming economic structures, production processes, and professional practices across the globe (Furman & Seamans, 2019). Recent estimates suggest that GAI could generate

between USD 2.6 and 4.4 trillion in annual economic value by improving productivity in areas such as customer service, marketing, research and development, and software engineering (World Economic Forum, 2023). Similarly, McKinsey (2023) projects that GAI may contribute 0.1 to 0.6 percentage points to annual productivity growth between 2023 and 2040, partially offsetting demographic pressures in advanced economies. Beyond macroeconomic indicators, these projections point to a deeper transformation in how work is organized, increasingly shaped by human-AI collaboration. As a result, AI-related competencies have become a critical source of professional competitiveness, and the cultivation of talent capable of applying AI across disciplinary and practical contexts has emerged as a strategic priority for higher education systems worldwide (Liu & Wang, 2021).

In response to this growing demand, many countries have adopted national strategies to strengthen AI talent cultivation through higher education. In the United States, the *National Strategic Plan for AI Research and Development* emphasizes curriculum reform and workforce preparation as central pillars of AI governance (Wang, 2023). Within the European Union, the Horizon Europe framework supports cross-border research networks and initiatives such as AI4EU, which aim to accelerate multidisciplinary AI applications while promoting ethical and responsible innovation (European Innovation Council, 2025). Japan's *AI Strategy 2019* similarly outlines a comprehensive approach to ensuring that all university students acquire basic AI literacy, while fostering advanced interdisciplinary expertise in fields such as medicine, manufacturing, and the social sciences (Wright, 2024). In China, AI talent cultivation has been elevated to a national strategic level. The *New Generation Artificial Intelligence Development Plan* issued by the State Council highlights accelerated professional training, strengthened university-industry collaboration, and the construction of a multi-level, diversified AI talent development system (State Council of China, 2017). Collectively, these initiatives underscore the central role of higher education in supporting industrial transformation and national competitiveness in the AI era.

Against this policy backdrop, universities worldwide have actively restructured curricula and institutional arrangements to integrate AI across disciplines. For example, the Massachusetts Institute of Technology established the Schwarzman College of Computing with a USD 1 billion endowment, embedding AI education across fields such as economics, biology, and engineering while fostering closely collaborating with industry partners (MIT News, 2018). In China, leading institutions like Peking University became the first to enroll undergraduates in Intelligent Science and Technology, setting an important national precedent for AI talent cultivation(Peking University, 2022). Universities of Applied Sciences (UAS),

characterized by their strong emphasis on practice-oriented education and close industry engagement, have also actively adapted to the AI era. For instance, Haaga-Helia University of Applied Sciences in Finland is leading a multi-institution initiative to accredit a joint Master's programme, *UlysseusAI*, which integrates AI with business transformation competencies to prepare students for digital economic challenges across Europe (Haaga-Helia University of Applied Sciences, 2024). Similarly, Graubünden University of Applied Sciences in Switzerland has introduced a course titled *Artificial Intelligence in Software Engineering*, designed to equip students with applied skills that align with evolving industry demands in AI-driven software development (Greater Zurich Area, 2023).

Despite these developments, integrating AI into higher education remains fraught with systemic challenges. One pesistent tension lies in balancing deep disciplinary specialization with the interdisciplinary knowledge required for effective AI application. Traditional academic structures, often organized around rigid departmental boundaries, can constrain cross-disciplinary collaboration and curriculum integration (Wu et al., 2024). These challenges are compounded by shortages of qualified AI faculty, uneven access to computational infrastructure, and disparities in institutional resources, all of which affect the quality and sustainability of AI education (Özer, 2024; Hutson et al., 2022). Although industry-university collaboration is widely promoted as a solution, aligning academic objectives with rapidly evolving industrial needs remains difficult in practice, particularly in the design and implementation of interdisciplinary curricula (Melde et al.,2022).

While existing research has yielded valuable insights into AI education reform, it has largely focused on national policy frameworks and elite research universities. By contrast, Universities of Applied Sciences (UAS) which are central to workforce-oriented education, local economic development, and the cultivation of applied talents remain markedly underexplored. This omission is consequential given UAS's distinct institutional mandate. Unlike research-intensive universities that prioritize frontier research and high-level R&D talent development, UAS typically operate with limited research infrastructure, heavier teaching loads, and a strong emphasis on practice-oriented skills with immediate industry relevance (Schüll, 2019; Ziegele et al., 2018). As a result, they face a unique set of constraints: UAS are expected to respond rapidly to labor market demands—such as the growing need for AI application developers and practice-ready professionals—yet often lack the financial resources, research capacity, and organizational flexibility available to elite institutions (Virolainen et al., 2025; Ommering & Munneke, 2025).

To address this gap, this study explores how a Chinese University of Applied Sciences navigates these distinctive institutional constraints to cultivate interdisciplinary talent

with AI-related competencies, taking Shanghai University of Engineering Science (SUES) as a case study. With its strong emphasis on engineering education and close ties to industry, SUES provides a critical lens for examining how applied universities pragmatically respond to the dual imperatives of interdisciplinarity and practical relevance. By tracing specific curriculum practices, organizational arrangements, and implementation challenges, the study seeks to shed light on alternative, context-sensitive forms of AI talent cultivation that diverge from the models prevalent in elite research universities, and to inform more inclusive and effective strategies for higher education reform in the age of AI.

Methodology

Case Selection

This study adopts a qualitative case study approach to examine how Chinese Universities of Applied Sciences cultivate AI-enhanced interdisciplinary talent, with a particular focus on Shanghai University of Engineering Science (SUES). SUES was founded in 1978 and formally established in 1985 through a merger with the East China Textile Institute. From its inception, the university has been oriented toward serving regional industrial development by training engineering and management professionals, adhering to the principle of evolving in close alignment with industrial needs. SUES's approach to talent cultivation can be characterized along three strategic dimensions. First, the university emphasizes'One Focus', namely concentrating on high-end equipment industries across land, sea, and air sectors. Engineering serves as the core disciplinary foundation, complemented by management and multidisciplinary integration to support technological self-reliance and industrial upgrading. Second, SUES advances 'Two Alignments' by embedding science , education, and industry within a government-industry-university-research innovation ecosystem. Academic programs in areas such as
transportation equipment and management are closely linked to innovation initiatives and industrial value chains, fostering autonomous and innovative talent. Third, the university promotes 'Three Collaborations' through a cooperative engineering education model that emphasizes coordinated curriculum design, talent development, and applied innovation.

SUES has consistently ranked first among Shanghai's 17 application-oriented universities in the official classification evaluations for 2023 and 2024. The university offers a comprehensive talent cultivation system spanning undergraduate, master's, and doctoral levels, including one doctoral program in Mechanical Engineering, 15 first-level master's programs, 12 professional master's programs, and 64

undergraduate programs, serving approximately 24,900 full-time students. While engineering remains the dominant disciplinary focus, programs in management and art/design provide important interdisciplinary support. Industry integration is further strengthened through long-term partnerships with enterprises such as Shanghai Metro and Shanghai Unicom. Collectively, these characteristics make SUES an exemplary case for exploring how applied science universities in China operationalize AI-enhanced interdisciplinary talent cultivation within a practice-oriented and industry-aligned framework.

Defining the "AI-Integrated Interdisciplinary Talent" at SUES

At SUES, an "AI-Integrated Interdisciplinary Talent" is not simply a student who studies AI alongside another discipline, but a composite professional capable of strategically integrating AI into domain-specific problem-solving. This profile combines three interrelated capacities. First, it requires foundational dual literacy: solid disciplinary expertise in a non-AI field (such as manufacturing, healthcare, or finance) alongside functional AI literacy, including an understanding of machine learning principles, data structures, and intelligent systems. Second, it entails a cognitive fusion mindset, characterized by the ability to reframe complex real-world problems into structured, data-informed models; to exercise critical judgment about when and how AI should be applied; and to situate algorithmic solutions within broader technical, organizational, and ethical systems. Third, it demands integrative praxis ability—the competence to operationalize this synthesis through human–AI collaboration, iterative problem-solving, and cross-functional communication with domain experts, AI specialists, and stakeholders. In essence, SUES seeks to cultivate not "AI specialists with superficial domain exposure" nor "domain experts who can operate AI tools," but integrative professionals who can bridge AI technologies and real-world systems.

Data Sources

Data for this study were collected from multiple sources to enable triangulation and enhance the reliability and validity of the findings. Specifically, three categories of data were utilized. First, institutional documentation included university histories, curriculum frameworks, program descriptions, and official reports related to talent cultivation and educational reform. Second, archival and policy materials emcompassed records concerning AI-related academic programs, industry collaboration agreements, faculty development initiatives, and relevant national and local higher education policies. Third, semi-structured interviews were conducted with a total of eight participants: five university administrators, two full-time faculty

members, and one undergraduate student (Please see table 1 for participants' information). The inclusion of a student voice provides an additional layer of insight into how institutional strategies are perceived and enacted in everyday teaching and learning practices.

ID	Gender	Years of Employment	Title
F1	Male	11	Associate Dean, Electronic and Electrical Engineering
F2	Female	7	Full-time Faculty Member
F3	Female	7	Director, Center for Faculty Teaching and Development
F4	Male	36	Vice President
F5	Female	10	Full-time Faculty Member
F6	Male	12	Academic Affairs Staff
F7	Male	15	Associate Dean, Mechanical and Automotive Engineering
S1	Male		

Table 1: Information of the Participants.

All interview data, together with documentary and archival materials, were systematically coded and analyzed across five thematic dimensions: modern industry colleges, AI program design, curriculum development, innovative teaching practices, and faculty training. This multi-dimensional coding strategy enabled an in-depth examination of how SUES aligns its educational programs with evolving industry needs while fostering interdisciplinary competencies in artificial intelligence.

Findings

SUES has implemented an 'AI+X' strategy aimed at cultivating interdisciplinary AI talent to meet the evolving needs of industry. While this strategy comprises the establishment of modern industry colleges, development of AI-focused programs, provision of AI-oriented courses, and integration of AI technologies in teaching, its effectiveness hinges on navigating the complex realities of institutional implementation. A critical analysis reveals that the strategy, particularly through initiatives like the 5G+AI Industry College, is not merely a descriptive framework but a dynamic response to systemic tensions between academia and industry.

SUES Modern Industry Colleges and the 5G+AI Initiative: Bridging Theory and Practice Amidst Structural Friction

SUES has established five Modern Industry Colleges, among which the 5G+AI Industry College has emerged as a flagship initiative, successfully passing national-level evaluation. Since its official launch in October 2018, the college has focused on

advancing artificial intelligence research while deepening collaboration between academia and industry. It has set up specialized research centers in areas such as Intelligent Media Processing, Intelligent Healthcare, and Intelligent Transportation, and has partnered with leading organizations including Shanghai Unicom, Acoustic Intelligence Labs, and Zhongshan Hospital to build joint laboratories. Supported by China's first fully 5G-covered campus and a range of advanced simulation facilities, the college seeks to offer students immersive, hands-on, interdisciplinary training while accelerating the real-world application of research outcomes.

Yet behind this impressive framework lies a more complicated reality. The creation of joint laboratories and co-designed curricula is not simply a milestone achievement; it is an ongoing process of adjustment and negotiation. Bridging academia and industry requires more than signing agreements—it requires reconciling fundamentally different ways of working. Universities and enterprises often operate on different rhythms and pursue different priorities. Academic institutions tend to follow longer research cycles and multi-layered governance structures, while companies usually prioritize speed, efficiency, and measurable short-term returns. Questions surrounding intellectual property, administrative procedures, and shared accountability can easily slow progress. Even when partnerships begin with enthusiasm, differences in incentive systems—scholarly publications and reputation on one side, commercial value and market competitiveness on the other—can strain collaboration if not carefully managed.

At SUES, these tensions surface in practical ways. A joint project may stall because expectations about IP ownership were not fully aligned, or because industrial development timelines do not match the academic semester schedule. Addressing such issues often requires flexibility: adapting administrative processes to allow tailored IP agreements, coordinating academic calendars with industry project cycles, and recalibrating student project milestones to satisfy both academic standards and enterprise needs. As one university administrator responsible for industry partnerships observed:

'The agreement is the easy part. The real work starts afterward—when we have to synchronize two very different systems. Industry moves in quarters and product cycles; we move in semesters and academic years. If we don't consciously design shared milestones and clarify IP expectations early on, even well-intentioned projects can lose momentum.' (F4)

SUES's commitment to this integrated model is driven by clear strategic considerations. As a University of Applied Sciences, it faces strong expectations to

demonstrate direct relevance to industry and the labor market. Shortening the distance between technological innovation and practical deployment is essential to fulfilling its mission. At the same time, embedding enterprises on campus and involving them in curriculum design helps cultivate mutual understanding. By working side by side, faculty members and industry engineers gradually develop a shared language, which can ease the longstanding tension between academic openness and industrial confidentiality. Administrators also emphasize that sustaining trust requires institutional mechanisms, not just goodwill. Regular coordination meetings, joint evaluation standards, and standing mediation channels for potential IP disputes have become part of the governance structure supporting these partnerships. As another administrator F7 put it, 'We've learned that collaboration cannot rely on personal relationships alone. It needs transparent rules and flexible procedures that both sides recognize as fair.'

In this context, the development of a 5G-enabled smart campus—including facilities such as 5G libraries—represents more than technological modernization. It reflects an intentional effort to create an environment where academic learning and industrial practice intersect naturally. By simulating industry conditions within the university setting, SUES aims to reduce cultural friction and make collaboration more seamless. Ultimately, the 5G+AI Industry College should not be viewed merely as a collection of infrastructure and partnerships. It is an ongoing experiment in managing the inherent tensions of cross-sector collaboration. Its long-term impact will depend not only on facilities or formal agreements, but on the university's ability to remain adaptive, align incentives across different institutional cultures, and cultivate the trust necessary to transform collaboration from a structural arrangement into a sustainable, productive partnership.

AI-Related Degree Program Development and Challenges

The development of AI-related degree programs at SUES can be understood as a process of institutional translation. At the macro level, national strategies such as the New Generation Artificial Intelligence Development Plan and the AI Innovation Action Plan for Higher Education Institutions establish a top-down policy framework that calls for large-scale AI talent cultivation and disciplinary restructuring. However, the implementation of such strategic directives within a university context is not a simple act of compliance. Rather, it involves organizational interpretation, curricular redesign, resource reallocation, and negotiation among competing academic and market logics.

In this sense, SUES's AI-related program development represents both alignment with national policy and a localized process of institutional adaptation. This section

analyzes three interconnected strategies: (1) launching new AI degree programs, (2) upgrading traditional engineering majors, and (3) introducing micro-majors as flexible governance instruments. Together, these strategies reveal both innovation and structural tension.

AI-Related Degree Programs

Establishing New AI Majors. The launch of the Bachelor's Program in Artificial Intelligence in 2021 represents SUES's most direct response to national AI strategy. Guided by the 'AI+X' talent cultivation model (Song et al., 2024), the program promotes interdisciplinary integration by embedding AI within computer science, automation, and engineering rather than treating it as a standalone field. Its objective is to cultivate application-oriented engineers capable of linking algorithmic knowledge with industrial practice. The curriculum is organized into five components: general education, disciplinary foundations, specialized AI courses, practical training, and extracurricular enrichment. Early semesters emphasize mathematics and scientific foundations, while advanced semesters focus on core AI subjects such as Machine Learning, Deep Learning, Computer Vision, Natural Language Processing, and Data Science. Practical elements—including internships and a graduation thesis—run throughout the four-year, 169-credit program.

Dimension	**Courses Included**	**Typical Semesters**
General Education	Ideological and Political Education, Current Affairs and Policy, Military Theory, Career Planning, Mental Health, Labor Education, College English/German, PE, Specialized Courses on the Four Histories, Various Elective Courses (Humanities, Science and Technology, Economics and Management, Arts, etc.)	Semesters 1–8
Disciplinary Foundations	Advanced Mathematics, Linear Algebra, Probability Theory and Mathematical Statistics, University Physics and Laboratory, Circuit Analysis and Laboratory, Object-Oriented Programming, Discrete Mathematics, Introduction to Engineering	Semesters 1–4
Specialized Courses	Core Courses: Python Programming, Algorithms and Data Structures, Data Science and Analytics, Machine Learning, Deep Learning, Computer Vision, Natural Language Processing, Signals and Systems, Embedded Systems etc. Elective Courses: Swarm Intelligence, 5G Communications, Computer Vision for Robotics, Speech Recognition, Virtual Reality, etc.	Semesters 3–6

Practical Training	Military Training, Engineering Fundamentals Training, Electrical Engineering Internship, Various Professional Comprehensive Experiments (Machine Learning, Computer Vision, Natural Language Processing, etc.), Orientation Internship, Observation Internship, On-the-Job Internship, Professional Comprehensive Design, Graduation Project (Thesis)	Throughout program
Extracurricular Enrichment	Innovation and Entrepreneurship Education Courses, Personal Development Programs, Extracurricular Activities	Semesters 1–8
Total Credits	169	

Table 2: Shanghai University of Engineering Science Artificial Intelligence Program Curriculum Structure (Class of 2024)

Upgrading Traditional Engineering Majors. Beyond creating new programs, SUES has pursued a second strategy: the technological upgrading of traditional engineering disciplines. Majors such as Mechanical Engineering have been restructured to include tracks like Intelligent Manufacturing Engineering and Aircraft Manufacturing Engineering. Courses in AI and the Internet of Things have been embedded within established curricula. This process can be interpreted through the lens of disciplinary hybridization. Rather than replacing traditional fields, the university redefines them through digital and intelligent extensions. Such upgrading responds to labor-market transformation while protecting institutional continuity. As faculty member F5 explained:

With industry changing so rapidly, traditional engineering programs cannot remain static. When we conducted a SWOT analysis, we found that our Mechanical Engineering curriculum included less than 30% intelligent manufacturing content, compared with around 55% in similar universities. If we do not transform, we will gradually lose competitiveness.

Micro-Majors as Adaptive Governance Mechanisms. Unlike full degree programs, micro-majors are small, modular, interdisciplinary clusters of courses that grant certificates rather than degrees. They are institutionally flexible and do not require the lengthy external approval processes associated with formal undergraduate programs. From a governance perspective, micro-majors function as adaptive mechanisms. They address what may be termed a temporal mismatch between four-year degree cycles and rapidly evolving technological industries. While traditional majors are structurally stable, emerging fields such as 5G, blockchain, AI, and integrated circuits evolve on much shorter innovation cycles. SUES has launched 31 micro-majors since 2021, including seven in integrated circuits and several in AI-related domains. The

university describes this strategy as "major–micro integration," designed to shorten the lag between curriculum reform and industrial demand. As F4 noted:
Traditional majors like automation remain structurally stable, but industry requirements change very quickly. Micro-majors allow us to respond faster. For students, these certificates function almost like an entry pass in the job market.

The popularity of micro-majors—particularly in integrated circuits and AI—demonstrates their role in facilitating cross-disciplinary mobility. Students from materials science, transportation, aviation, management, and even foreign languages have enrolled. As student S1 observed:
In the micro-major courses, industry experts explain real production processes and practical challenges. That exposure is very different from ordinary classroom teaching.

Structural Challenges and Inherent Tensions

Despite these innovations, the development of AI-related programs exposes several structural tensions inherent in policy-driven reform.
The Integration Dilemma. The "AI+X" model assumes deep interdisciplinary integration. In practice, however, integration is difficult to operationalize. As faculty member F7 reflected: "It's easy to say 'AI plus healthcare' or 'AI plus manufacturing.' The real question is where we integrate—into which assignment, which project, which assessment? Without careful design, students just take separate courses." This comment highlights the difference between rhetorical interdisciplinarity and embedded curricular integration. True integration requires alignment across course design, assessment systems, and faculty collaboration. Otherwise, interdisciplinarity remains symbolic rather than structural.
The Faculty Constraint. AI education is heavily dependent on highly qualified faculty who combine research expertise with industrial insight. However, universities compete directly with industry for such talent. As F3 stated:
Our biggest pressure is people. Strong AI researchers are highly valued by companies. Recruiting is difficult, but retaining them is even harder.
This reflects a broader structural tension between academic institutions and the private sector in knowledge economies. The promotion of "dual-qualified" faculty is a policy solution, but its implementation requires sustained institutional incentives and resource commitment.
The Foundation–Application Tension. Finally, AI education embodies a classic tension between foundational depth and immediate applicability. Market actors often

demand graduates who can quickly deploy specific tools and frameworks, while universities emphasize theoretical grounding to ensure long-term adaptability.

This tension is not temporary; it is constitutive of applied AI education. It requires continuous recalibration of curriculum design and learning outcomes. As F4 summarized:

Launching the major was only the first step. The real test is whether we can continuously adjust it as technology and industry evolve.

Dynamic Adjustment Mechanism for Undergraduate Programs

SUES's *Implementation Measures for the Dynamic Adjustment of Undergraduate Programs* institutionalize responsiveness to social demand by shifting from one-time program approval to continuous performance-based evaluation. The mechanism aligns program offerings with national strategies, regional industrial transformation, and labor-market trends, embedding competition and periodic review into undergraduate governance.

The governance structure is layered. The Undergraduate Education and Teaching Steering Committee provides academic deliberation, while the President's Office makes final decisions. A cross-departmental Working Group analyzes key indicators—enrollment, graduation, employment, further study, and student satisfaction—and proposes adjustments. Colleges implement reforms with input from industry experts. This reflects a hybrid model: strategic direction from the top combined with data monitoring and market feedback from below.

The Warning System. All programs undergo annual evaluation using weighted indicators, including graduation rate (35%), retention rate (15%), employment rate (10%), and enrollment metrics. Programs ranked in the bottom 10% receive an internal warning. A warning does not immediately trigger closure but initiates formal rectification. Colleges must diagnose problems and submit improvement plans, which may involve curriculum redesign, industry collaboration, enrollment adjustments, or faculty reallocation. In this sense, the warning functions as a regulatory pressure mechanism intended to stimulate self-correction. However, the process exposes tensions. Performance indicators—especially employment and enrollment—are partly shaped by macroeconomic conditions. As F7 noted:

When a program gets a warning, it creates pressure… The challenge is distinguishing structural problems from temporary fluctuations.

Suspension and Rectification. Programs that receive repeated warnings (twice consecutively or three times within five years) may be suspended for two years, during which enrollment is halted. Resumption requires internal review; inactivity for five years leads to formal termination. Although designed as a feedback loop for

structural optimization, suspension carries institutional risks. It can disrupt faculty stability, research continuity, and student recruitment pipelines. Reputational damage may persist even after reform. Moreover, exemptions granted to "First-Class" or strategically designated programs reveal a tension between performance-based evaluation and policy protection, indicating that governance is not purely data-driven but also politically mediated.

AI-Related Curriculum Development

SUES has institutionalized AI-related curriculum reform through formal regulatory frameworks, most notably *the Implementation Measures for Evaluating the Achievement of Undergraduate Talent Training Quality (Trial).* At the policy level, the objective is clear: to ensure that curriculum design remains responsive to social needs and aligned with student learning outcomes. However, analytically, these measures signal a deeper transformation—from content-driven curriculum planning to outcome-driven governance structured around accountability, measurability, and continuous improvement.

The curriculum is organized into three broad modules—general education, disciplinary foundations, and school–enterprise cooperative education—reflecting an attempt to balance holistic development with application-oriented training. Programs are encouraged to allocate up to 30% of credits to practice-based learning, including a minimum of eight weeks of full-time internships. Simultaneously, the adoption of Outcome-Based Education (OBE) requires faculty to align course objectives, teaching activities, and assessment methods, submit them for audit, and conduct post-course evaluations to verify outcome achievement.

In theory, this creates a closed-loop quality assurance mechanism. In practice, however, implementation reveals tensions. The requirement to make learning outcomes measurable may incentivize formal compliance rather than substantive integration. As one faculty member (F2) noted in discussing curriculum audits:

On paper, every course can clearly map its objectives to graduation requirements. The real challenge is whether students actually integrate that knowledge across courses. Alignment in documents does not automatically mean integration in learning.

Industry-Education Integrated Curriculum

Industry–education integration constitutes a core strategy in SUES's AI curriculum reform. Enterprises participate in syllabus design, contribute to course delivery through the Industry Expert in the Classroom initiative, and collaborate in evaluating student performance. The university also leverages the *Yangtze River Delta G60*

Science and Innovation Corridor to develop virtual platforms that experiment with digital and project-based teaching models. Structurally, this approach aims to shorten the distance between academic knowledge and industrial application. By embedding production standards and real-world projects into coursework, SUES seeks to cultivate graduates who can transition smoothly into employment.

Yet collaboration entails negotiation between distinct institutional logics. Enterprises prioritize immediate technical applicability, while universities must preserve theoretical coherence and long-term disciplinary development. Rapidly updating course content to match technological iteration risks fragmenting curriculum coherence. As one faculty member (F5) observed:

Too often, applied AI training becomes simply adding more programming courses. But without strengthening capacities for problem modeling and systems integration, students may know the tools yet still struggle to solve real industrial problems.

This comment reveals a deeper implementation challenge: genuine integration requires more than enterprise participation or increased practice hours. It demands pedagogical coordination across modules to ensure that foundational theory, technical tools, and project-based applications reinforce rather than displace one another.

AI Program Curriculum Design

The Artificial Intelligence (AI) major at SUES follows a four-year structure, exemplifying the university's commitment to curriculum innovation. According to the *2024 AI Talent Training Program*, the curriculum adopts a layered structure that integrates general education, disciplinary foundations, professional specialization, practice-based learning, and extracurricular enrichment, ensuring a balance between academic rigor and applied competence.

General Education (45 credits): Courses in ideological and political education (Ideological and Moral Cultivation and Law, Career Planning for College Students), history electives, foreign languages, and physical education. These are designed to foster civic responsibility, historical awareness, and personal development.

Disciplinary Foundations (46 credits): Core scientific and engineering courses such as Advanced Mathematics, Circuits, University Physics Laboratory, Introduction to Engineering, and Foundations of AI, providing students with a strong theoretical and technical base.

Professional Courses (38 credits): Specialized training through required courses like Data Science and Analytics, Signals and Systems, Machine Learning, Computer Vision, and Natural Language Processing, complemented by electives such as Virtual Reality Technology and 5G Communication Technology.

Practice-Based Learning (36 credits): A comprehensive sequence of practical modules, including AI orientation programs, internships, enterprise-based training, and a graduation thesis. These experiences ensure that students can apply theoretical knowledge to real-world challenges.
Extracurricular Learning (6 credits): Opportunities for innovation and entrepreneurship training, as well as general skills enhancement, supporting students' holistic growth and career readiness.
This multi-tiered curriculum is deliberately structured to combine systematic theoretical education with industry-oriented practice, equipping graduates with the intellectual foundation, practical skills, and innovative capacity required for leadership in AI-driven industries. However, the structure still remains better integration, as F5 introduced:
Too often, the applied AI training model is reduced to 'adding more programming courses' while overlooking the essential capacities for problem modeling, systems integration, and engineering implementation. As a result, students may learn to use basic AI tools but remain unable to solve real-world industrial problems.

Innovative Teaching

SUES frames innovative teaching as a strategic response to digital transformation and AI-driven industrial change. Through policies promoting heuristic, inquiry-based, blended, and seminar-style teaching, the university seeks to shift from a "teaching-centered" to a "learning-centered" model. The introduction of administrative measures for online open courses and blended learning formalizes this shift, embedding digital platforms into routine pedagogy.
At the policy level, the logic is clear: digital technologies are expected to increase student autonomy, enhance interaction, and strengthen learning outcomes. Yet implementation reveals that technological empowerment does not automatically produce pedagogical transformation. As F3 (Director, Center for Faculty Teaching and Development) explained:
Many teachers are willing to use digital tools, but using technology is not the same as redesigning pedagogy. The real difficulty lies in helping faculty rethink learning objectives and assessment methods, not just uploading materials online.

Enhancing Digital Teaching Resources

SUES has invested heavily in digital infrastructure, including 13 smart classrooms (four 5G-enabled), lecture-capture facilities, MOOC studios, cloud-based experimental platforms, and virtual simulation projects. These resources signal

institutional commitment to digital modernization and align with national "Smart Education" initiatives.

However, infrastructure expansion raises practical challenges of utilization and pedagogical depth. As F6 (Academic Affairs Staff) noted:

Building smart classrooms is relatively straightforward if funding is secured. The more complex question is how frequently and meaningfully they are used. Technology must be embedded into course design; otherwise, it becomes symbolic.

AI-Enhanced Smart Classrooms

The independently developed ICLASS Smart Classroom System exemplifies SUES's attempt to institutionalize AI-supported teaching. The system integrates attendance management, resource distribution, real-time quizzes, learning analytics, and AI-assisted Q&A. Continuous assessment now accounts for 70% of course grades, reflecting a shift toward formative evaluation.

From a governance perspective, ICLASS operationalizes data-driven accountability: instructors can monitor participation and performance in real time, while students receive immediate feedback. Yet this intensification of data collection also generates new pressures. As F2 (Full-time Faculty Member) reflected:

Real-time analytics help us identify students who are falling behind. But at the same time, both teachers and students feel constantly monitored. It increases transparency, but it also increases stress.

Thus, AI-enhanced classrooms simultaneously enable personalization and amplify surveillance. The technology reconfigures power relations within the classroom, making learning processes more visible but also more tightly regulated.

Students, meanwhile, experience AI tools as both opportunity and challenge. S1 described the learning shift:

The AI assistant helps answer questions quickly, but it also forces us to think more clearly about how we ask questions. If your prompt is vague, the result is useless. So you learn to refine your thinking.

Industry-Integrated Innovation Ecosystem

Beyond classrooms, SUES integrates teaching with industry through digital twin laboratories, enterprise test sites, and real-time production simulations. These initiatives accelerate applied learning and shorten the transition from education to employment.

Yet close industry coupling introduces structural vulnerability. As F1 (Associate Dean, Electronic and Electrical Engineering) explained:

Industry collaboration pushes us to update quickly, which is positive. But enterprises focus on immediate solutions. Universities must also consider long-term research capacity and foundational knowledge. If we move too fast toward application, we risk weakening the theoretical base.

This reflects a classic tension in application-oriented universities: responsiveness versus academic sustainability. Rapid curriculum iteration—updating 30% of content each semester—demonstrates agility, but may strain faculty workload and challenge curricular coherence. Similarly, F4 (Vice President) emphasized the strategic balancing act:
AI is transforming industries faster than traditional curriculum cycles. If universities do not adjust dynamically, they will fall behind. But adjustment cannot mean abandoning educational principles. Our task is to synchronize speed with stability.

Faculty Development at SUES

Faculty development at SUES is positioned as a strategic lever for transforming the university into an application-oriented, AI-enabled institution. Through pre-service training, workshops on first-class course construction, instructional design seminars, and summer teaching programs, the university seeks to standardize pedagogical quality and align faculty practice with Outcome-Based Education (OBE) principles. Parallel policy frameworks—such as regulations on horizontal research, technology transfer, and science–industry integration—signal a deliberate move to dissolve the boundary between teaching and applied research.
However, beyond the policy architecture lies a deeper governance question: how can faculty roles be simultaneously academic, industrial, entrepreneurial, and pedagogical without generating overload or conflicting incentives? As F3 (Director, Center for Faculty Teaching and Development) observed:
Professional development is no longer just about improving classroom teaching. Faculty are expected to integrate research, industry collaboration, and talent cultivation. The challenge is that these roles demand different competencies and time commitments.

Strengthening the Dual-Qualified Faculty Team

SUES promotes the development of a "dual-qualified" faculty—teachers who combine academic research capacity with substantial industry experience. Promotion policies institutionalize this expectation: younger faculty must accumulate external professional practice (six months to one year), demonstrate innovation achievements such as patents or technology transfer projects, and simultaneously meet publication

and research funding requirements. At the policy level, this framework operationalizes the university's application-oriented mission. It embeds industry engagement into career advancement and ties promotion not only to scholarly output but also to measurable industrial impact.

Yet implementation reveals structural tensions. The dual requirements of academic publication and commercially successful technology transfer can create cumulative pressure, particularly for early-career faculty. As F5 (Full-time Faculty Member) reflected:

We are expected to publish high-quality papers, apply for competitive grants, complete enterprise projects, and guide students' applied innovation—all at the same time. The policy is clear, but the workload is intense.

Furthermore, while the proportion of dual-qualified faculty increased significantly (from 24.15% to 66.08% between 2020 and 2022), questions remain about depth versus formal designation. As F1 (Associate Dean, Electronic and Electrical Engineering) noted:

Industry experience varies greatly. Some colleagues participate in short-term projects, while others are deeply embedded in enterprise R&D. The label 'dual-qualified' does not automatically mean equal levels of engineering competence.

Compared with German universities of applied sciences—where five years of industry experience is a baseline requirement—the SUES model represents an accelerated pathway to professionalization. This difference reflects institutional and labor-market realities in China, but also highlights a structural constraint: rapid scaling of applied faculty may outpace the maturation of industry-embedded academic careers.

Enhancing AI-Related Teaching Capacity

The challenge becomes more acute in AI-related fields. While SUES has recruited new AI faculty, the supply of scholars who combine advanced AI research expertise with substantial industry experience remains limited. High salaries in the technology sector intensify competition. As F7 (Associate Dean, Mechanical and Automotive Engineering) explained:

Good AI researchers are extremely attractive to industry. Even if we recruit them, retention becomes a long-term challenge. Universities cannot always compete financially, so we must rely on academic development opportunities and institutional culture.

This highlights a structural asymmetry between public universities and the private tech sector. Faculty development thus depends not only on training programs but also on retention strategies and organizational identity. To address this, SUES adopts a dual strategy: recruiting industry mentors and upgrading internal faculty AI literacy. Industry professionals participate directly in teaching, while the Faculty Teaching Development Center offers targeted AI training sessions (e.g., AI-empowered teaching reform, intelligent agent platforms, and scenario-based AI application design).

However, the integration of AI into teaching introduces epistemic tensions. As F2 (Full-time Faculty Member) remarked:

Learning how to use AI tools is relatively fast. The harder part is understanding how to redesign courses so that students develop modeling ability and systems thinking, rather than just relying on AI outputs.

Students also perceive the unevenness of AI-related teaching capacity. S1 observed: "In some courses, teachers integrate AI tools very effectively. In others, it feels experimental, as if both teachers and students are still figuring it out together."

Discussion

Artificial intelligence (AI) differs from previous technological waves in several key ways: it evolves extremely quickly, relies on massive datasets and high-performance computing, and is largely mediated through digital platforms that control access to critical resources. Scholars note that such general-purpose technologies transform not only economic activity but also the foundations of knowledge production, favoring actors who control data and computational infrastructure while increasing competition for scarce, specialized talent (Bresnahan & Trajtenberg, 1995; Kenney & Zysman, 2016). In education, these dynamics make traditional, discipline-centered curricula insufficient. Today's graduates need more than foundational knowledge; they must develop adaptive learning abilities, cross-domain problem-solving skills, data literacy, ethical judgment, and a critical understanding of platform-mediated systems.

Shanghai University of Engineering Science's (SUES) "AI + X" strategy provides an example of how higher education can respond. By integrating AI competencies across degree programs, micro-majors, industry colleges, digital learning platforms, and dual-qualified faculty positions, SUES aligns its curriculum with the complex, uneven, and platform-driven landscape of modern knowledge work. Its combination of stable core programs with flexible, industry-responsive modules shows how

universities can adapt governance structures, curricula, and professional roles to prepare students for an AI-intensive labor market.

A key complement to curriculum reform is adaptive governance, which allows institutions to sense change, learn from experience, and adjust programs iteratively rather than relying on static, top-down decisions(Priyadarshini, 2022; Sharma-Wallace, et al., 2018). Research on AI integration in higher education emphasizes flexible, layered governance frameworks that combine technical, pedagogical, and organizational elements while promoting ethical oversight and accountability.SUES demonstrates adaptive governance through its layered curriculum architecture, where experimental modules such as micro-majors coexist alongside established degree programs with longer institutional cycles. These layers act as temporal buffers, allowing innovation at the edges of the curriculum without destabilizing core programs or academic standards. This approach aligns with research emphasizing that higher education institutions must balance stable structures with flexible mechanisms capable of responding to fast-moving technological and ethical challenges.

The Triple Helix model of university–industry–government relations has long helped explain how innovation ecosystems emerge from collaboration among these three actors (Etzkowitz & Leydesdorff, 2000). Traditionally, universities provide research and education, industry contributes market applications, and government supports regulation, with hybrid institutions such as technology transfer offices facilitating partnerships. SUE's industry colleges, enterprise co-designed curricula, and joint research initiatives reflect this model by linking academic knowledge with applied innovation.

However, AI complicates the Triple Helix's assumption of symmetry. AI development often depends on proprietary platforms, large datasets, and high-performance computing concentrated in a few technology firms. These "platform gatekeepers" shape research priorities and curricular content, creating dependencies that challenge the notion of equal collaboration (Kenney & Zysman, 2016). In AI-driven domains, universities must carefully manage their epistemic autonomy—ensuring that partnerships do not compromise academic freedom or priorities. Governance tools such as intellectual property agreements, internal evaluation processes, and diversified partnership portfolios become critical for maintaining agency within these asymmetric collaborations.

SUES's layered curriculum also illustrates a broader pedagogical point: structural interdisciplinarity—simply combining modules from different disciplines—does not automatically produce cognitive integration, or the ability to apply knowledge across domains. Modular programs alone cannot ensure that students develop the skills to model complex domain-specific problems computationally or evaluate the ethical and

societal implications of AI. Faculty concerns that AI integration might become "just adding more programming courses" highlight the gap between structural design and the development of genuinely integrative, reflective competencies.

This tension underscores critiques of rigid, outcome-oriented frameworks like Outcome-Based Education (OBE), which focus on measurable competencies but often neglect processes such as epistemic coordination, reflective judgment, and ethical reasoning. Research on epistemic practices emphasizes the need for translational spaces where different disciplinary languages intersect, allowing students to engage integratively with complex problems (Knorr Cetina, 1999). Rather than treating curriculum as a static structure, institutions must embrace what might be called epistemic choreography—the intentional design of learning experiences that require students to navigate between domain knowledge, algorithmic reasoning, ethical reflection, and real-world contexts.

Finally, SUES's commitment to dual-qualified faculty—academics who combine disciplinary expertise with industry experience—illustrates an institutional strategy to bridge knowledge creation and practical application. This aligns with research on boundary-spanning roles that facilitate knowledge flows between academia and practice. Yet labor-market dynamics in AI fields create challenges: faculty with both advanced AI skills and industry experience are in high demand and command premium compensation, often beyond what universities can offer. Literature on academic capitalism highlights how market forces increasingly shape faculty roles, incentives, and career trajectories (Slaughter & Rhoades, 2004). Addressing these pressures requires more than ad hoc solutions; universities must consider hybrid appointments, promotion criteria that recognize applied innovation, and joint university-industry career pathways. Such structural strategies are essential for stabilizing boundary-spanning roles and sustaining deep, meaningful integration of AI into education without compromising academic values.

Policy Implication

The case of Shanghai University of Engineering Science (SUES) highlights that cultivating AI-integrated interdisciplinary talent is less a matter of adding new content and more a question of institutional alignment. The experience of SUES suggests several practical implications for universities facing similar transitions.

First, interdisciplinary reform must address how knowledge is integrated in practice, not just how programs are structured on paper. At SUES, the challenge was not the absence of AI-related courses, but the difficulty of helping students meaningfully connect AI tools with domain-specific problem solving. This points to the need for

earlier and more sustained cross-disciplinary project experiences, where students work on authentic tasks that require both technical and contextual understanding. Such efforts require more than curricular redesign—they depend on mechanisms that support joint teaching across departments, shared evaluation criteria, and administrative flexibility. Without these supports, interdisciplinary initiatives risk remaining fragmented or symbolic.

Second, the findings underline that university–industry collaboration cannot rely solely on shared intentions. While SUES actively engaged enterprise partners, differences in organizational tempo, performance metrics, and expectations around intellectual property created recurring tensions. This suggests that durable collaboration requires clearer governance arrangements from the outset. Framework agreements, joint coordination bodies, and transparent IP policies can reduce uncertainty and prevent partnerships from reverting to short-term, project-based interactions. In this sense, the depth of collaboration depends less on the number of partnerships formed and more on the institutional mechanisms that sustain them.

Third, the case reveals the structural pressure placed on faculty members expected to act as "dual-qualified" professionals. Faculty were asked to integrate AI into teaching, engage with industry, and maintain academic output—often without differentiated evaluation standards. This imbalance risks burnout and weakens reform efforts over time. Institutions therefore need clearer career pathways that formally recognize applied innovation and industry engagement as legitimate forms of academic contribution. Structured industry placements or funded practice-based leave can further strengthen faculty capacity, but such initiatives must be embedded in promotion and workload systems to be sustainable.

At the policy level, the SUES case suggests that institutional adaptation requires supportive regulatory conditions. Accreditation systems need to recognize competency-based and modular learning pathways if universities are to experiment with flexible program designs. Funding mechanisms should also shift from short-term project grants toward longer-term collaborative platforms that enable shared infrastructure, curriculum co-development, and sustained personnel exchange. Providing incentives for enterprises to participate in extended collaboration—including hosting faculty or offering substantive project opportunities—can further align corporate involvement with educational goals. In addition, ensuring that application-oriented universities are included in AI-related research and innovation funding streams would strengthen their ability to connect teaching reform with regional industrial development.

Overall, the experience of SUES indicates that the core issue in AI-integrated higher education reform is governance capacity. Curriculum innovation, industry

collaboration, and faculty development are interconnected; weaknesses in one area quickly affect the others. Effective policy, therefore, should focus on creating stable institutional conditions that allow universities to manage ongoing tensions—between disciplinary depth and integration, academic standards and industry responsiveness, and individual performance and collective reform. Rather than pursuing isolated initiatives, institutions need coherent governance arrangements that support continuous adjustment as technologies and labor market demands evolve.

Funding

This research was supported by the Youth Project of the National Social Science Fund of China, titled "International Experience and Local Practices of Typological Development in Application-Oriented Universities from the Perspective of Building a Strong Education Nation" (Project No. CIA250310).

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-07

Digital Teaching Competencies in Higher Education and Their Impact on Open Science and Open Education

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The analysis carried out from a dialectical paradigm aims to analyze the implications that the development of digital competencies among university teachers and researchers has for the high-quality advancement of the open science and open education movement, which has set important benchmarks in higher education in recent years. To this end, a review of scientific production from 2019–2023 was conducted using three descriptors, essentially in databases such as Google Scholar, Web of Science (WoS), Scopus, and SciELO. The main results show that, although scientific production on the topic is extensive, there is a greater prevalence of work focused on digital competencies. However, the movement still faces an academic and scientific community that resistant to the democratization of knowledge and its broader societal reach as a whole. This situation has driven the open science movement to gain strength in terms of disseminating research results and promoting international research projects. The main conclusion is that there are a number of challenges that require further research in the short and medium term. Addressing these challenges requires the active participation of researchers and teachers, as well as the support of decision-makers at both international and institutional levels, all in pursuit of educational quality.

Keywords: digital competencies, inclusive education, higher education, open science

Introduction

Social development in recent decades and the most visible changes it has brought about—such as the rapid evolution of technology, the globalization of knowledge, the need to adapt to a constantly changing labor market, and the growing demand for skills that go beyond traditional academic knowledge, have led to the identification

of a set of essential competencies for the twenty-first century (Arias Gómez et al., 2018). This perspective is based on a broad consensus among international organizations and researchers who recognize critical thinking, digital literacy, collaboration, self-directed learning, global citizenship, creativity and innovation, emotional intelligence, and social skills as essential elements for success in an increasingly globalized and digital world.

In this context of transformation, higher education is at a crossroads: it must respond to these global challenges while aligning itself with the Sustainable Development Goals (SDGs) of the 2030 Agenda (CEPAL, 2018). Specifically, SDG 4, which seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (Murillo & Duk, 2017), acts as a beacon guiding educational reforms. To meet this ambitious goal, higher education has become involved in a far-reaching paradigmatic movement: the development of Open Science and Open Education. Although seemingly distinct, these philosophies share fundamental principles such as promoting open access to knowledge, transparency in processes, multidisciplinary collaboration, and the free exchange of educational and scientific resources.

Accordingly, multiple initiatives have emerged from science and academia aimed at fostering the development and adoption of these approaches, all of them increasingly intertwined with the use of digital technologies. This situation demands an analysis of the implications of developing digital competencies among university teachers, students, and researchers for the quality implementation of this movement, which has been shaping trends in higher education in recent years.

The Open Science movement is not an isolated phenomenon but rather the natural evolution of several earlier trends that questioned the traditional ways of producing and communicating science. Its roots can be traced back to the Open Access movement, which emerged in the late 1990s and early 2000s, catalyzed by initiatives such as the Budapest Open Access Initiative (2002) and the Berlin Declaration (2003). These declarations advocated that scientific literature funded with public resources should be freely accessible on the internet to any reader, without economic, legal, or technical barriers.

Open Science goes beyond simple access to articles. It is a comprehensive ecosystem that seeks to make the entire research process more transparent, collaborative, accessible, and efficient. According to Abadal and Anglada (2020), Open Science is a conceptual umbrella that encompasses a set of practices aimed at eliminating barriers that hinder the circulation of knowledge. Its main objectives include:

- Transparency and reproducibility: Allowing any researcher to verify, replicate, and build upon the findings of others by accessing not only the final article but also raw data, protocols, software, and methods used.
- Accelerated collaboration: Enabling cooperation among scientists from different disciplines and institutions and even with non-academic stakeholders (citizen science) to address complex problems more effectively.
- Social impact and democratization of knowledge: Ensuring that the results of publicly funded research benefit society as a whole, not only those who can afford to access scientific journals. This includes professionals, policymakers, entrepreneurs, and citizens in general.

Open Science defends a series of interconnected practices that constitute the pillars of this movement:

- Open Access: Publication of research articles in journals or repositories that are freely accessible.
- Open Data: Sharing research data in public repositories, with appropriate licenses and metadata to enable reuse.
- Open Source Code and Software: Releasing the computer code and algorithms used in research.
- Open Peer Review: Making peer-review reports public and, in some cases, revealing the identities of reviewers and authors.
- Open Educational Resources (OER): Although a pillar of Open Education, their use is essential for teaching and training in Open Science.
- Citizen Science: Involving the general public in scientific research activities.

In parallel, the Open Education movement has gained significant momentum. Its main focus is the elimination of structural, economic, and geographical barriers that limit access to quality education (Morales, 2022; Silva, 2020). Open Education is materialized primarily through Open Educational Resources (OER), defined by UNESCO as teaching, learning, and research materials in any medium, digital or physical, that reside in the public domain or have been released under an open license that permits free access, use, adaptation, and redistribution by others.
Open Education practices include:

- Creation and use of OER: From textbooks and syllabi to videos, simulations, and assessments.

- Design of Open Pedagogies: Teaching and learning approaches that enable students to be co-creators of their learning paths through practices such as renewable assignments (instead of disposable ones) or participation in projects that have an impact beyond the classroom.
- Massive Open Online Courses (MOOCs): Although based on different business models, many MOOCs operate under open access principles, at least in terms of free access to content.
- Open Assessment Practices: Designing authentic assessments that are transparent and allow competencies to be demonstrated in multiple ways.

The intersection between Open Science and Open Education is both natural and powerful. A higher education system that educates in and for Open Science requires teachers who use open educational resources, and research in Open Education in turn benefits from the principles of transparency and collaboration promoted by Open Science. However, implementing these practices in higher education is far from trivial. It requires a specific set of knowledge, skills, and attitudes that go beyond basic technical proficiency.
To implement Open Science and Open Education, a teacher-researcher needs:

To Know (Knowledge):

- Understand the philosophical, ethical, and legal principles underlying both movements.
- Be familiar with open licenses (especially Creative Commons) and copyright.
- Know the thematic and institutional repositories relevant to their discipline.
- Understand business models and open access publishing routes (gold, green, etc.).
- Be aware of institutional, national, and international policies that promote or mandate Open Science and Open Education.

To Know How (Skills/Competencies):

- Information and Data Management**:** Ability to search for, evaluate, manage, and curate research data and OER effectively, including the use of metadata and interoperability standards.
- Creation and Remixing**:** Ability to create, adapt, and combine OER for specific educational contexts while respecting licenses.

- Communication and Collaboration**:** Proficiency in collaborative digital tools such as Overleaf, GitHub, or Hypothesis to work on open projects with colleagues and students.
- Publication and Dissemination**:** Competence to publish in open access journals, deposit preprints in repositories, and share results on open platforms.
- Reflective Practice**:** Ability to critically evaluate the impact of one's own open practices and adjust them accordingly.

At this point, the development of digital competencies becomes an indispensable bridge. These competencies, which have been conceptualized in multiple ways, have recently reached a certain level of consensus in educational contexts, emphasizing the need for training both teachers and students. It is not just about knowing how to use a word processor or video conferencing platform, but about making creative, critical, and safe use of technology in order to fully participate in the open ecosystem.
One of the most comprehensive models in this regard is the Common Framework for Digital Teaching Competence (INTEF, 2017), which identifies five major areas in the development of digital competencies:

- Information and data literacy (the basis for searching for and evaluating OER and scientific data).
- Communication and collaboration (essential for co-creation and open peer review).
- Digital content creation (core to producing and adapting OER).
- Safety (critical for managing digital identity and protecting intellectual property).
- Problem solving (necessary for innovating and implementing new open practices in specific contexts).

These competencies are understood as the creative, critical, and safe use of information and communication technologies to achieve objectives related to work, employability, learning, leisure, inclusion, and participation in society. Therefore, solid training in these competencies provides the foundation that enables the academic community not only to consume but also to produce and contribute significantly to Open Science and Open Education, overcoming the cultural and technical resistance that still persists. This article thus seeks to analyze this symbiotic relationship by examining how the development of specific digital competencies among teachers and

researchers is a fundamental prerequisite for a high-quality implementation of the Open Science and Open Education movement in higher education.
The above leads to the following research question guiding this study:
How do teachers' digital competencies impact the development of the Open Science and Open Education movement in higher education?
This question serves as the basis for exploring the main findings derived from studies conducted in recent years.

Methodology

From a methodological standpoint, this study adopts a systematic literature review approach, focused on analyzing and synthesizing recent scientific production on teachers' digital competencies and their impact on the movements of Open Science and Open Education in higher education. This design enabled to identify trends, areas of consensus, and knowledge gaps by following an explicit, reproducible protocol for the search, selection, and analysis of the literature.

The bibliographic search was conducted during the first quarter of 2024 and was limited to a five-year period (2019–2023), with the aim of capturing the most up-to-date and relevant evidence. Document retrieval was carried out in four well-established and widely used bibliographic sources:

- Web of Science (WoS) and Scopus, as multidisciplinary databases with high citation counts and impact.
- SciELO, to ensure representation of Ibero-American scientific production.
- Google Scholar, to broaden coverage and capture grey literature or publications in institutional repositories.

The search strategy was constructed from three fundamental descriptors in Spanish and English, combined with Boolean operators (AND, OR) in the title, abstract, and keyword fields:

- "Ciencia abierta" OR "Open Science"
- "Educación abierta" OR "Open Education"
- "Competencias digitales" OR "Digital competence"

For the initial identification and management of references, the software Publish or Perish was used, as it is specialized in retrieving and analyzing academic literature metrics.
The article selection process was carried out systematically in several phases, quantifying the results at each stage to ensure transparency. The selection flow is summarized in the following table:

Selection phase	Number of articles	Criteria applied
1. Identification	1,158 articles	Initial search in the four databases using the descriptors.
2. Title and abstract screening	298 articles	Removal of duplicates and preliminary evaluation based on thematic relevance.
3. Full-text assessment	84 articles	Strict application of inclusion criteria (see below). • Empirical or mixed-methods research. • Focused on or representative of Latin American university contexts. • Published between 2019 and 2023. • Available in full text in Spanish, English, or Portuguese.
4. Final included studies	84 articles	Full compliance with inclusion criteria.

Table 1: Phases of quantifying the results.

This process allowed the initial sample of 1,158 records to be refined down to a final corpus of 84 articles used for the definitive analysis.

The analysis of the 84 selected articles was carried out at two levels:

1. Descriptive quantitative analysis: The annual publication frequency was quantified by descriptor to visualize temporal research trends in each area.
2. Qualitative thematic analysis: To deepen the content of the studies, the qualitative analysis software NVivo was used. Through a process of thematic coding, recurring topics, key findings, and challenges reported in the literature on digital competencies, Open Science, and Open Education were identified, categorized, and analyzed. This mixed approach made it possible not only to describe the volume of production but also to synthesize substantial content and conceptual relationships in the documentary corpus, thereby identifying points of convergence and fundamental trends in the field.

Results

The analysis of the reviewed literature confirms that Open Science (Abadal & Anglada, 2020) has gained increasing prominence in recent years. This movement, which has moved beyond being a mere trend to become a paradigm shift in scholarly communication, promotes the idea that research results—including not only scientific

articles but also raw data, protocols, software, and supplementary materials—should be freely accessible to the scientific community and the general public. Its underlying philosophy is to comprehensively foster methodological transparency, the reproducibility of experiments, and interdisciplinary and international collaboration in research. A key pillar of this approach is the promotion of open licenses, such as Creative Commons, which explicitly permit the reuse, redistribution, and, in many cases, adaptation of scientific outputs, thereby breaking down the legal and economic barriers that have traditionally limited the circulation of knowledge.

In parallel and in a complementary way, Open Education (Morales, 2022; Silva, 2020) focuses on openness and free access to educational resources. Its scope is broad and includes teaching materials, online courses (MOOCs), textbooks, educational software, simulations, and more. Its main objective is to eliminate traditional barriers to education, such as the high cost of commercial educational materials and the geographical limitations that affect students in vulnerable contexts or remote regions. Like Open Science, it promotes the use of open licenses that allow not only free access but also contextual adaptation, continuous improvement, and unrestricted distribution of OER, thus fostering a pedagogy based on participation and co-creation.

However, despite the visible benefits of embracing Open Science and Open Education in higher education (García, 2020; Ávila et al., 2021; Morales, 2022)—including accelerating scientific discovery, reducing institutional costs, increasing the social impact of research, and democratizing learning—it is also necessary to acknowledge the structural, cultural, and operational challenges that still hinder their effective implementation. The literature analyzed reveals a consensus around the following obstacles:

- Institutional and teaching resistance: The adoption of open practices in higher education may encounter significant resistance. Placeres et al. (2022) identify that this inertia is largely due to the fact that traditional teaching and publishing approaches, based on closed models deeply rooted in academic culture for centuries, are difficult to transform. The lack of awareness of the tangible benefits of openness, combined with fear of the unknown and the perception of an increased workload, dampens the willingness to innovate. Overcoming this barrier requires sustained awareness-raising efforts and clear demonstrations of added value.
- Lack of recognition in academic evaluation: There is a widespread and well-founded concern that participation in Open Science and Open Education practices is not fairly recognized or valued within current academic evaluation and promotion systems at the international level. Ramírez Montoya (2021) notes

that researchers and teachers may face concrete difficulties in demonstrating the impact and quality of their open work—such as publishing preprints, curating data, or creating OER—compared to traditional metrics, primarily the impact factor of subscription-based journals. This disconnection between open practices and merit criteria acts as a powerful disincentive.

- Dependence on funding and sustainability issues: Open Science and Open Education projects in higher education frequently depend on competitive external funding or, more critically, on the voluntary work and enthusiasm of individual teachers and researchers. Rodés et al. (2022) highlight that ensuring the long-term sustainability of these projects—which includes costs related to repository maintenance, OER updating, and technical support, as well as obtaining stable institutional financial backing—is a major challenge. Without a consolidated funding model, many open initiatives are unsustainable once projects end or volunteer efforts decline.
- Need for greater coordination and collaboration: Effective adoption of open practices necessarily implies greater cross-cutting coordination and collaboration among institutions, departments, and even disciplines. Torre et al. (2021) argue that establishing common policies and practices, sharing technological infrastructure and resources, and fostering a culture of open collaboration constitutes a logistical and cultural challenge in an academic environment that is traditionally diverse, decentralized, and at times competitive.
- Gaps in teacher training: To successfully integrate these paradigms, teachers need specific training not only in the technical use of open resources and tools but also in the effective integration of open practices into their pedagogical design and daily teaching. Ugalde (2021) and González-Pérez et al. (2022) concur that this training ranges from searching for and critically evaluating OER to creating their own resources and implementing assessments that reflect the principles of openness. The lack of this specialized training is a critical barrier identified in multiple studies and is particularly pronounced in certain teacher profiles.
- Quality assurance and rigor: Finally, the literature emphasizes that openness must not, under any circumstances, undermine the quality and rigor that characterize research and higher education. It is essential to ensure quality control mechanisms—such as open or traditional peer review—for open resources and to maintain high standards of academic excellence. Abadal (2021) warns that the sometimes mistaken perception that "open" is synonymous with "lower quality" is a stereotype that must be challenged with evidence and robust procedures ensuring the validity of open knowledge.

In conclusion, the evidence reviewed indicates that overcoming these multifaceted challenges requires coordinated work and alignment of efforts among multiple stakeholders: international organizations that establish reference frameworks and incentive policies; educational institutions that implement them and provide infrastructure and support; teachers and researchers as direct agents of change; and political and governmental decision-makers who can prioritize openness in national education and science agendas (Placeres et al., 2022; Ramírez Montoya, 2021; Rodés et al., 2022). The transition toward a fully open academic ecosystem is, therefore, a complex process that depends on the coordinated action of the entire community.
The systematization carried out, taking the three previously defined keywords as a reference point, revealed extensive coverage of the topic in the scientific literature, which is reflected in the results presented in Table 1.

Descriptor	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
Digital competencies	42	67	89	112	98	**408**
Open Science	18	29	47	63	71	**228**
Open Education	15	24	38	55	60	**192**

Table 2: Number of articles by descriptor and year.

The bibliometric analysis shows that, although scientific production related to the three central descriptors of this research can be characterized as robust and growing, it is essential to temper this assessment by examining the thematic distribution and depth of treatment in the literature. Quantitative data reveal a clear disparity in the volume of publications when digital competencies are compared to Open Science and Open Education. This divergence in academic productivity is driven by historical, conceptual maturation, and adoption factors within the academic community that must be unpacked for a full understanding of the phenomenon.
It is crucial to highlight an inherent methodological limitation of the search approach: the initial analysis was based primarily on the occurrence of descriptors in article titles and abstracts. While this strategy allows for efficient identification of potentially relevant literature, it does not in itself guarantee that these concepts receive substantial and in-depth treatment in the body of the text. An article could mention digital competencies in its abstract as general context but then focus exclusively on a highly specific technical aspect without developing its relationship with Open Education. Therefore, in quantifying the information, it is important to note that the initial interpretation focused on the presence and visibility of these topics in academic

discussions, rather than as an absolute measure of research dedicated exclusively to them.

The marked predominance of scientific production around digital competencies, clearly visible in Figure 1, can be explained by several interconnected reasons. On the one hand, this is a field with a longer trajectory of development and more widespread acceptance within the global academic community. Its relevance is transversal, affecting not only higher education but also the labor market, social inclusion, and citizenship in general. This centrality has led to a large volume of theoretical and empirical production, with multiple consolidated frameworks—such as INTEF (2017)—and a clear integration into educational research agendas for more than two decades. It is a field that has managed to become institutionalized and normalized.

By contrast, Open Science and Open Education, as structured philosophical and practical movements, have a more recent conceptual development and mass uptake, with a significant boost in the last five years. Their disruptive nature—which questions traditional models of publication, academic evaluation, and ownership of knowledge—naturally generates resistance in a scientific community whose reward and recognition systems have historically been linked to closed and exclusive channels. This resistance is not merely anecdotal; it is reflected in the difficulty of changing entrenched practices, in mistrust toward quality control mechanisms in open environments, and in the lack of clear institutional incentives for researchers and teachers to devote time and resources to open practices.

Paradoxically, this resistance and the growing awareness of its limitations have spurred the Open Science and Open Education movements to gain considerable strength in dissemination and international cooperation. The need to demonstrate their value and build viable alternatives has fostered intense activity in organizing collaborative projects, developing shared infrastructure such as repositories and platforms, and publishing manifestos, policies, and case studies that seek to legitimize and normalize these practices. Consequently, although the volume of specific literature has not yet reached the levels observed for digital competencies, its growth rate and presence in high-impact forums are clear indicators of growing dynamism and progressive consolidation in the global academic ecosystem.

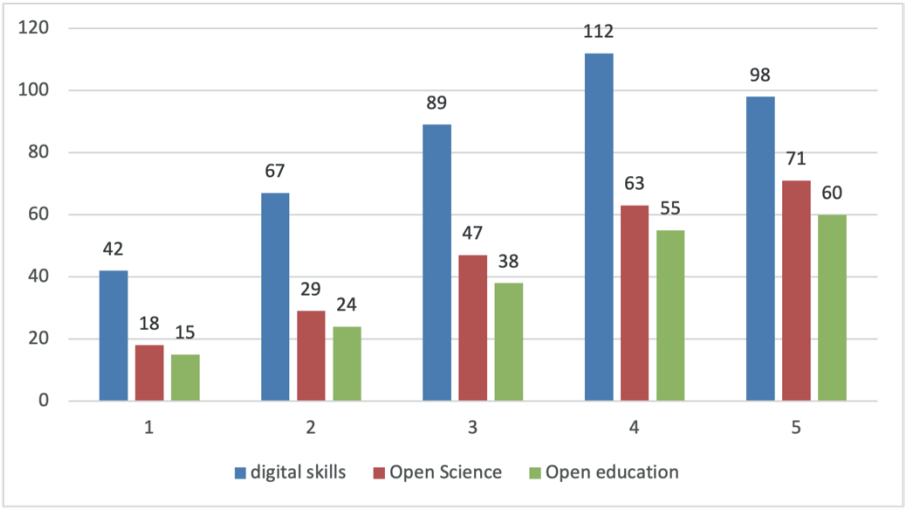

Figure 1: Publication frequency distribution by year and descriptor. Source: Authors' elaboration.

When conducting an in-depth analysis of the identified scientific articles, it becomes clear that, in terms of digital competencies, regardless of the model used to define them, there is a consensus on the need for their development and training, with a strong emphasis on education—and particularly on higher education—including both students and teachers. This emphasis is driven by the increasing use of digital technologies in all areas of life, the urgent need to develop digital competencies among teachers and students, and the support of governments, educational institutions, and international organizations in this regard. Among the main topics addressed in these articles are the different frameworks or models of digital competencies, strategies for their development and training, ways to assess them, and their impact not only on individuals but also on processes.

Similarly, the articles consulted on Open Science highlight the significant increase in open access to scientific publications, driven in part by the indexing of journals on platforms such as the Open Access Scholarly Publishing Association (OASPA) and the Directory of Open Access Journals (DOAJ). Closely linked to this, open peer review practices are also on the rise, allowing reviewers' comments on scientific articles to be made public, which promotes more transparent and collaborative processes in science. Regarding open data, although current levels remain below expectations, a growing trend can still be observed, particularly considering that open

data is essential for Open Science. The articles reviewed also emphasize the establishment of Open Science policies and underscore collaboration among organizations, institutions, and researchers from different regions. They address issues such as technologies and tools for developing open practices, the training of scientists to democratize science, different models for doing so, and the expected impacts.

In line with Open Science, the literature reviewed also reveals a growing development of and attention to Open Education, which has been marked by the increase in the availability of OER, both individually and as part of massive open online courses. The main research in this area focuses on the effectiveness of Open Education, the barriers to its adoption, the infrastructure needed to support it, human resource development, and best practices for its implementation. In this regard, several proposals and alternatives have been made, although some stand out for their more global vision, such as the open courses on the edX platform and OER Commons, a library and space that not only provides access to OER but also makes it possible to create online courses using these resources in a quick and user-friendly manner.

The thematic analysis carried out with NVivo revealed that 73% (n = 28/38) of the articles on Open Education link its success to the development of three digital competencies: searching for, creating, and reusing OER, with the most pronounced training gap among teachers over the age of 45 (González-Pérez et al., 2022). Likewise, while the INTEF (2017) model prioritizes the creation of digital content, our findings show that 68% of Cuban teachers (n = 150) reach only basic levels in this area (Ugalde, 2021). This explains the gap between the theoretical framework and actual practice in Open Science and underscores the need for training programs differentiated by age groups.

The results of the analysis of publications and the main elements highlighted individually in each of the three major groups examined make it possible to identify challenges that require further research in the short and medium term (Ramirez et al., 2022). Addressing these challenges demands the engagement of researchers and teachers, as well as the support of decision-makers at the level of international organizations and institutional leadership (Placeres et al., 2022; Rodés et al., 2022; Torre et al., 2021).

Among the main challenges identified is the digital divide (Acuña Ortigoza & Sánchez Acuña, 2020; Ramírez Montoya, 2021). Although levels of access have increased, there is still a marked difference between those who can and cannot access the most up-to-date information through technology. This may prevent academics or scientists from developing countries from participating fully in the development or dissemination of Open Science and Open Education.

Another challenge concerns the preparation of the actors involved (Abadal, 2021; González-Pérez et al., 2022) to promote and make use of Open Science and Open Education. This is most evident in the current difficulty in finding or accessing open educational resources or scientific data, the lack of skills to analyze this type of open information, and the limited willingness or difficulty in sharing and publishing open educational resources, data, and information.

In this sense, the development of digital competencies cuts across the evolution of Open Science and Open Education (Dias-Trindade & Moreira, 2021; Ugalde, 2021), not only because of the immediacy of information but also because the existence of a digital world is increasingly evident and tangible—a world in which it is necessary to possess competencies that allow not only access, but also communication, safety, data and knowledge sharing, the creation of new resources, and collaborative work. This reality demands, more than ever, the immediate development of digital competencies, with a special emphasis on higher education, where teachers are researchers by definition and where professionals are trained who will transform the society of the future.

Universities thus become spaces where students and teachers use digital technologies to access information—and particularly open learning resources—where research projects are carried out using collaborative tools (De Giusti et al., 2021; Silva, 2020), and where research data are generated that will be reused by other researchers. They are also the context in which open online courses are developed (Ávila et al., 2021; Mera & Mercado, 2019) to keep the international community up to date on specific topics. Universities are therefore the ideal context to foster the development and training of digital competencies in support of Open Science and Open Education (Dias-Trindade & Moreira, 2021), bearing in mind that, as a movement in constant evolution, these initiatives will increasingly demand higher levels of digital competence.

Conclusions

The results confirm a marked asymmetry in the volume of scientific production between digital competencies, on the one hand, and the concepts of Open Science and Open Education, on the other. This disparity is not arbitrary; it reflects the different levels of maturity and adoption of these concepts within the academic community. While digital competencies have become a transversal and institutionalized field of study, Open Science and Open Education, due to their disruptive nature, still face significant cultural and structural resistance. However, the qualitative analysis reveals

an unavoidable interdependence: the advancement of open practices depends on the prior development of a robust ecosystem of digital competencies among university teachers.

A critical gap is identified between the theoretical framework of digital competencies and their concrete application in open contexts. Findings such as the fact that 68% of university teachers reach only basic levels in digital content creation (Ugalde, 2021), despite this area being a priority in the INTEF (2017) model, show that possessing generic digital competencies does not guarantee their transfer to the principles and practices of Open Science and Open Education. This underscores the need to design training programs that go beyond instrumental aspects and explicitly integrate the philosophy, ethics, and working methodologies of these movements, with a differentiated approach that accounts for age profiles and specific disciplinary contexts.

It is also concluded that, although the phenomena of digitalization and open access manifest globally and pose similar challenges across educational settings, the strategies to address them cannot be universal recipes. The effectiveness of any training proposal on digital competencies aimed at Open Science and Open Education will depend on its ability to align with the specific contextual reality of each institution, region, and education system. This implies considering variables such as available technological infrastructure, institutional incentive policies, local academic cultures, and disciplinary particularities. Support from international organizations and the adoption of global reference frameworks are valuable, but their successful implementation requires a critical and adaptive appropriation that responds to the needs and opportunities of the immediate environment.

Therefore, the transition toward a more open and collaborative higher education system is a complex process that rests on a fundamental pillar: the training of a teacher-researcher who is both digitally competent and aware of their role as an agent of change in the democratization of knowledge. This study reveals some of the challenges that must be overcome along this path, emphasizing that the synergy between digital competencies and open practices is not automatic; it must be intentionally cultivated through policies, programs, and ongoing reflection that always start from the concrete reality in which the educational process unfolds.

Recommendations

- Governments should recognize and incorporate, within educational policies, the need to promote the development of digital competencies in close connection with the Open Science and Open Education movement.
- For educational institutions, implement educational policies aimed at developing digital competencies and promoting the Open Science and Open Education movement.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-08

Effects, Competence, Adoption, and Agency as Approaches to Digital Inclusion and Learning at Work: Research Review, Finland

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This scoping review aims to map the research on digitalisation of work in the Finnish workplaces by asking to what extent the inclusive use of digital technology has been recognized as an issue of workplace learning. Four approaches ('effects', 'competence', 'adoption', and 'agency') to the implications of digitalisation are identified, ranging from the requirements put on workers to the development of workers' transformative agency. The concepts of cultural-historical activity theory are employed to discuss the findings focusing on inclusive potential of digitalisation in workers' professional practices and work-related learning in the Finnish workplaces.

Keywords: activity theory, digitalisation, workplace learning

Introduction

Digital transformation and its consequences to learning at work has been analysed as a *conceptual change* for learning processes (Harteis, et al, 2020), learning from errors in terms of *digital ignorance and negative knowledge* (Jensen, et al, 2023), and through *the complexity of perspectives* required for the theoretical and empirical understanding of the ongoing transformation (Ifenthaler, et al, 2021). These are representative examples indicating that novel technologies affect professional practices and learning needs in a manner recognisable across societies and cultures. The development of employees' digital skills is assigned to work-related adult education and training, the role of which is growing as a part of formal vocational education. Given that the education systems vary between countries (Desjardins 2017, Tikkanen et al. 2018) nation-level reviews are in place in internationally networked

studies of work and learning where "agenda-setting is strengthened when it engages at a deep level with educational priorities and development goals conceptualized by people in different parts of the globe" (Evans 2025: 14).
This review asks which professional practices have been addressed in the research of Finland's work life and to what extent the inclusive use of digital technology has been recognized as an issue of workplace learning. The findings of the review will be discussed in the conceptual framework of the cultural-historical activity theory (henceforth, activity theory; Levant et al. 2024). 'Activity theorists' were among the early researchers of the human-computer interaction (HCI) in the late 1980s and early1990s (Nardi 1995). Theoretical focus on mediation, tools, and humans as capable of transforming their activity rather than passively adapting to new technologies were and are the strengths of the activity theory approach.

Background

The dominating discourse of digital transformation at work life emphasises the requirements of digitalisation to workers' competence and capacities. Harteis and Billett (2023) summarise:

> *"So, there will be a need for active engagement by workers to respond to digital transformation, including capacities to be self-directed and regulated in that learning and acceptance of and tolerance toward constant change. Yet, those also require workers to have the opportunity to come to understand the requirements of these forms of knowledge and to have competence in their use. Thus, it is important for workers to be knowledgeable with the operation of digitalized forms of work to the level that they can intervene and manage them successfully." (Harteis & Billett 2023: 175)*

In the face of the requirements Boyadjieva and Ilieva-Trichkova (2023) remind of all peoples' vulnerability amidst global challenges. Taking an empowerment and social justice perspective, they wish to revisit the role of lifelong learning, in which empowerment is "crucial, penetrating all its other roles, and applies to all individuals and societies" (ibid.: 139, 140).
A dimension to observe in the digital inclusion and learning spans between the "opposite ends" of two approaches, one featuring as learning for the adaptation to requirements of digitalisation, another calling for learning that enhances peoples' empowered agency and pursues a clear goal of "gaining control over one's

environment with the aim to improve individuals' and societies' well-being" (Boyadjieva & Ilieva-Trichkova 2023: 144).

Blayone (2019) recognises the discourse of digital-abilities frameworks that describe digital technology as permeating society and requiring human adaptation. The experiences of top-down digital-technology implementations cause anxiety in educators – and at workplaces, I may add. For Blayone, activity theory offers a "less threatening" point of departure by rejecting the Cartesian divide between people and technological artefacts and drawing attention to "agentic humans inquisitively exploring and strategically instrumentalising digital technologies to extend their native capacities for achieving goals" (Blayone 2019: 452).

Rather than seeing digital technologies as imposed on human action they become meaningful as affordances "presenting (culturally shaped and sometimes institutionally bounded) opportunities for action" (Blayone 2019: 451). Digital technologies are not only defining the tools and operational environments for work and learning, but permeate the objects of production making them complex, virtual, and networked (Toiviainen & Vetoshkina 2018), and are "increasingly taking hold of all the aspects of the activity system" (Karanasios 2018: 138).

Empowerment is related but not identical to human agency (Boyadjieva & Ilieva-Trichkova 2023). Activity theoretical research defines agency as transformative in nature reserving the concept to peoples' change efforts through the development of tools and practices (Lund & Vestøl 2020, Sannino 2015). Transformative agency equips workers with the capacity to tackle the problems and lead their learning processes stepwise from the analysis of current problems to the design of new activity through the cycles of expansive learning (Engeström 2015).

Research questions

RQ1. Which lines of work, worker groups, and topics have been covered in the studies of the digitalization of work and workplace learning in Finland?

RQ2. What are the findings regarding the workers' digital inclusion and learning at work?

Method and data

This is a scoping review, a review method applied for exploring the coverage of the literature, mapping the evidence, and informing future research (Peters, et al, 2020). The publication period was framed to years 2019–2025. Year 2019, the start of the pandemic, is a turning point, even though the consequences of pandemic were not the

primary focus of this research design. One reference published in 2018 was purposefully included in the sample to get evidence from the ICT sector work (Hyrynsalmi, et al. 2018).

Literature searches were conducted via Tampere University Library's search service (Andor) where search terms 'Finland + digitalisation + workers' gave 60 hits, out of which 13 were selected to the review. Supplementary searches with 'inclusion' or 'learning' did not produce new relevant references. Further searches were conducted via Google Scholar with 'Finland + digitalisation + workers + learning' (first 100 hits) giving nine new references and via Scopus database (AI not used) with 'Finland + digitalisation + work' giving 82 hits and two new references.

Criteria of exclusion from the review were: impact of digitalization on employees from economic/business or technology perspectives (vs. focus on inclusion, learning); comprehensive European cross-country reviews and comparisons (vs. focus on Finland); sociological macro-level working-life and labour relations (vs. focus on micro/meso level perceptions at work); studies of clients, students, senior citizens, other groups outside active labour (vs. focus on workers).

Selected studies (total 24) addressed a certain work-life context and worker group(s) in Finland and presented results that could be related to inclusion/exclusion and learning aspects of digitalization. Research approaches divided into 15 qualitative (interviews, writings, case studies, ethnography, intervention) and 9 quantitative surveys. The data was extracted and synthesised and mapped in the table format (Table 1).

No.	Research	Context	Target group	Inclusion aspect	Learning aspect
1	Hyrynsalmi, et al. (2018)	Competition of high-skilled professionals in ICT business	software professionals	skill polarisation between software professionals at the war of talents	problems of finding highly skilled professionals to ensure rapid growth and new innovations
2	Rajahonka & Villman (2019)	Perceptions of digital technologies in working and private lives, related to careers and wellbeing	female managers and entrepreneurs in South Savo region	employing digital technologies may improve their wellbeing and equality at work	they need support in finding their digitalized career paths
3	Saari, Käpykangas & Hasu (2019)	Digitalisation of word processing service in medical documentation	typists in backstage service	employees involved in the design and innovation of digital transformation at work	empowering interventions may lead to employees' agency and vision of future job
4	Nikou, et al. (2020)	Workers' intention to use digital technologies in their day-to-day routines	creative workers and designers	factors that influence the intention to use digital technology	digital literacy significantly impacts the intention to use digital technology
5	Silvennoinen (2020)	Digitalisation changes counselling work in the social and health care.	master's students in working-life-orientated adult education	students' perceptions of digitalisation impact on work and professional identities	digitalisation of work practices demands education for blended professionalism (both face-to-face and online work)
6	Wallin, Pylväs & Nokelainen (2020)	Perceptions of professional development in a digitalized work	Finnish government workers	digitalization both supports and hinders professional development and learning	digitalization provides opportunities for job control, flexibility, new ways for

					knowledge development and management
7	Nadav, et al. (2021)	Implementing digital services by integrating them into routine work	health and social case professionals	14 organisational practices to ensure sustainable implementation of digital services and integration into routine work	training should be targeted individually according to skills and work tasks
8	Tiainen, et al. (2021)	Defining the health care and social welfare informatics competences in digital transformation	experts (social, health, business and IT) dealing with the digitalisation of social and health care	inequalities for professionals and citizens; how is equal access to services ensured	to develop the digital skills of educators, degree students and in-service trainees to meet the needs of working life
9	Hyötyläinen 2022	The experiences of people displaced from work by the introduction of labour-saving technology	people displaced from work	sense of growing alienation and social exclusion due to changes in skill-demands and deskilling under automation and robotisation	life-long learning and training policies disregard personal needs of (re)education.
10	Krutova, et al. (2022)	Connection of job insecurity and technology acceptance based on data sample from the nation-wide work and working conditions survey	high-general-skill occupations (e.g. managers) and low-general-skill occupations (e.g. clerical support)	employees' participation and involvement in the development of the organisation play a significant part in the acceptance and implementation of the technological transformations	learning enough about new technologies is a concern both in high- and low-general-skill occupations
11	Mäkiniemi (2022)	Educational use of ICT enhancing work well-being (techno-	professionals of education sector	participants experienced techno-work engagement when educational technology facilitated work,	adopting, learning and using the latest technologies stimulate personal growth,

		work engagement)		when collaborating, when positive climate	professional development; associated with work well-being
12	Niemi & Komp-Leukkunen (2022)	Older employees' experiences of changes in workplaces (mass layoffs, digitalisation and restructuring)	employees of an airline, postal service and social care	simultaneous changes in the workplace and in their health lead older employees to look for ways to exit their jobs	new skills required while experiential knowledge and a long history of learning are devaluated and disrespected
13	Parkatti et al. (2022)	Defining digital competence (DC) in media work	journalists	three frames of DC: the individual attitudes, the team-level support, and the organizational-level enablers and requirements for digital competence	continuing education and study opportunities needed in formal and informal contexts
14	Rantala, et al. (2022)	Digital skills and application use in the eldercare work	home care workers	availability of technology support is crucial facilitator for digital agency at work	technology support increases interest in technology and improves digital skills
15	Einola & Khoreva (2023)	Perceptions of AI and the job role changes that come with it in a media consultancy company	employees of digital media and traditional media	different organizational groups may engage in distinctly different sense-making processes regarding AI; embedded in organizational processes and daily work	people who co-exist with the technologies must take ownership; (AI "taking over" jobs or deskilling humans lacks evidence)
16	Kaihlanen, et al. (2023)	Effects of digitalization in health and social care work	health and social care professionals and managers	negative effects of digitalisation may be overlooked by managers; not supportive of the	continuous discussions between employees and management are required; contributes to

				work of professionals	professionals' well-being, adaptation to changes and to the quality of services
17	Seppänen, Toiviainen & Hasu (2023)	Platform workers' workplace learning under algorithmic management	food couriers and freelancer project specialists	accountability and transparency needed in the design and implementation of digital tools, algorithms and platforms	workers' expansive learning efforts to understand, act in accordance with and influence the mostly algorithmically managed rating systems
18	Surva (2023)	Effects of digitalisation on co-producing restorative services in Estonia, Finland, Ireland and Portugal (COVID-19)	service professionals (mediators)	mediator's facilitative role turned more directive in digital setting putting trust building and feeling connected at risk	the launch of digital services depended more on service providers' readiness to try digital solutions than on service experience before digitalisation
19	Turja (2023)	Equity of opportunities to learn and use modern care technologies (robots) in the workplace	care workers	motivated user-workers lacked opportunity to learn and use robots at work, whereas managers had access to robots irrespective of personal interests	employees' opportunity to learn and work with new technologies should be part of workplace learning
20	Virtanen, et al. (2023)	Associations of digitalization of physicians' work and job strain	physicians	strained by frequent teleconsultations and work that does not meet the goals of digitalization	training specific to the stage of career and system development can be crucial for their well-being
21	Rantanen & Komp-	Adaptation to transformative digitalization	older self-employed	diverse technological requirements of different clients	they pursue diverse strategies to manage

	Leukkunen (2024)	during later working life		increase the digital complexity at work	digitalization-related work demands, ranging from avoidance of technology to technological specialization
22	Saukkonen, et al. (2024)	Effects of digitalization on social work	social welfare professionals	perceptions were predominantly positive; (active clients, supportive decision support systems and faster service processes); complexity	cross-sector and cross-service learning should be improved
23	Karhapää et al. (2025)	Using digital technology in informal workplace learning	learning and development specialists, secretaries and managers of a public sector training organisation	workplace developed practices to manage strains and learning related to the demands of digital technology	sustainable use of digital technology in informal workplace learning (‘sustainable learning’) balances the burdens and benefits of digital technology
24	Ylönen, et al. (2025)	Digital competence profiles perceived by social services and healthcare professionals	social services and healthcare personnel	significant variance related to digital competence profiles: 1) motivated digital experts, 2) burdened digital users, 3) frustrated survivors	training can be developed based on the identified digital competence profiles

Table 1. Review articles arranged by the year of publication

Results

RQ1. Which lines of work, worker groups, and topics have been covered in the studies of the digitalization of work and workplace learning in Finland?

The studies of digitalisation that touch the inclusion and learning aspects at work have been done in (numbers in the following refer to the article numbers in Table 1) health and social care sector (3, 5, 7, 8, 14, 16, 19, 20, 22, 24), self-employed managers and entrepreneurs (2, 21), education sector (11, 23), journalists and media sector (13, 15), online platform work (17), ICT companies (1), creative workers and designers (4), Finnish government workers (6), and justice (18). The context of these studies is mainly the transformation of a given sector, such as the public health and social care, whereas for some the targeted sector is an illustrative case to analyse digital transformation more generally (3, 15). Some studies are on a group level focusing on low-skilled vs. high-skilled occupations (10) and older employees (12). A study of people displaced from work (9) represents a borderline case.

The analysis of the second part of the RQ1 *(which topics have been covered)* applied a data driven content analysis. Four topics were identified based on keywords and key expressions (Table 2): *effects of digitalisation, digital competence, adoption of digitalisation, and digital agency*. The order of presentation is thought to proceed from the reactive reception of the effects of digitalisation at work to the agentive preparedness to work with digitalisation. The 'effects', 'competence', and 'adoption' are typical keywords of each topic area, whereas 'agency' is mainly my own phrasing and interpretation. Digital agency describes the articles that analyse developmental interventions and workers' transformative actions in a way discernible from the three other topics.

Topic	**Keywords (article numbers in Table 1)**
Effects of digitalisation	Skill polarisation, war for talents (1)
	Abstract labour, advanced marginality, displacement, unemployment (9)
	Efficiency, layoffs, health, retirement (12)
	Digital health, changing work (16)
	Occupational stress (20)
	Co-production (18)
	Change management, informal learning, opportunities, participation (19)

	Professional development, professional learning, workplace learning (6) Perceived effects of digitalisation (22)
Digital competence	Digital competence (13) Informatics competencies (8) Digital competence, digital gaps (24) Digital skills (14)
Adoption of digitalisation	Employing digital technologies, technology domestication (2) Digital literacy, digital immigrants, digital natives (4) Acceptance of technologies (10) Co-existence, HR and technology, organizational development (15) Adaptation to transformative digitalization (21)
Digital agency	Agency, transformation (3) Perceptions on changes (5) Sustainability of learning (24) Sustainable implementation, integration into routine work (7) Techno-work engagement (11) Expansive learning efforts (17)

Table 2. The topics of digitalisation of work and workplace learning

RQ2. What are the findings regarding the workers' digital inclusion and learning at work?

Effects of digitalization (ED)

The experiences of unemployed workers who have been displaced by labour-saving technology represent the threatening visions of ED (Hyötyläinen 2022). Rather than blaming technology the informants directed criticism to employers' cost-cutting policy and leaving employees without vital training. Hyötyläinen (2022) calls for workfare policies supportive to an unemployed person's sense of meaningful life.
In the software business the competition of high-skilled experienced workers leads to the polarisation of high-skilled and low-skilled ICT professionals (Hyrynsalmi et al.

2018). The employers see the investment in their training as uncertain, as the most sought-for professionals may easily change work moving after better salary and other benefits. Training on any skills level is an uncertain investment, as today's digital competence is soon outdated. Some workplaces do pay for the training in work hours and access to digital learning environments, but generally this research paints the picture of ED on workers' training as calculating and instrumental rather than the source of enrichment and professional wellbeing in the competed environment (Hyrynsalmi et al. 2018).

To older employees, ED may appear as excluding rather than including, and simultaneous changes at workplaces and in health conditions may strengthen the plans to exit work life (Niemi & Komp-Leukkunen 2022). The master narrative of ED across various workplaces in airline, postal service and social care seemed to converge rather than manifest disintegrating narratives of post-modern societies (Lyotard, cited by Niemi & Komp-Leukkunen 2022). Workers describe the digitalisation and automatization of work, insufficient training and lack of understanding regarding their careers and needs.

Managers of health and social care work seem to emphasise the positive ED more than professionals whose perceptions clearly are divided between the positive and negative effects (Kaihlanen et al. 2023). The risk is that managers overlook the negative effects and are eager to introduce new digital solutions not supportive of professionals' work. This causes distress to workers. Managers' approach to digital training seems to focus on the technical skills of new systems rather than professional learning needs and sufficient time allocation to continuous learning in a hectic work (Kaihlanen et al. 2023). Continuous discussions between management and employees would provide meaningful technologies and training that supports staff and its wellbeing.

Job strain due to the digitalization of work is also evidenced in physicians' work (Virtanen et al. 2023, partly the same authors as in Kaihlanen et al. 2023). The perceived ED are both positive and negative, partly dependent on the length of work experience in clinical work. Technology intensifies teleconsultation, interprofessional collaboration and patient involvement, all of which may be facilitative but also increase workload. Training measures are recommended to focus on time management and work planning together with investment in functional health information systems and physicians' well-being in digital work (Virtanen et al. 2023).

Perceived ED can be divided also in terms of having access to new technologies. One of the articles (Turja, 2023) investigates correlative relations between the organisational position, personal technology orientation, and the opportunity to work with robots in health-care work. Management has a relatively easy access regardless

of individual interest to use robots, whereas employees' access is often lacking, even among those who are willing to work with robots. The equity of technology-use opportunities is an obvious criterion of inclusive use of digitalisation, and, as the author discusses, uneven chances of participation, in general, have been proven to cause inequalities in workplace learning. Research recommends that employees' participation in robot-using pilots and everyday work be written in the organisation's learning goals including both formal and informal learning situations in which new technologies at work are enhanced (Turja, 2023).

The outbreak of the COVID-19 pandemic accelerated the digitalization of work activities bringing to daylight the ED on inclusive ICT use in the service co-production. Restorative justice is based on the victim–offender mediation in counselling meetings (Surva 2023). Restorative justice professionals (mediators) felt that interaction in remote counselling meetings became 'business-like' practically eliminating all informal chatting, which was not likely to nurture trust-building and feeling of connectedness fundamental to co-producing justice (Surva 2023). In a European group of mediators from 15 countries, Finland among them, participants discussed the restorative justice practices during the pandemic sharing their experiences and learning from each other (Surva 2023).

For specialised experts in Finland's government work digitalization provides flexibility and self-control in their work including knowledge development and knowledge management opportunities (Wallin et al. 2020). The positive ED on professional development and learning are seen when the changing work tasks and activities are tailored to support worker's competence; the functioning software and systems are provided; training in the implementation of new technologies is individually targeted and socially supported; and workers are involved in the design and development of digital changes (Wallin et al. 2020).

Finnish social welfare professionals' perceptions of ED on social work were predominantly positive in a nationwide survey. The client information system usage with perceptions of more active client roles, supportive decision support systems and faster service processes signalled inclusive use of digitalisation for the promotion of the clients' agency (Saukkonen et al. 2024). Learning recommendations include allocating dedicated time for managers and professionals to participate in system development and eventually striving for participatory design approach involving all stakeholders. In addition, cross-sector and cross-service learning and dissemination of best practices are recommended (Saukkonen et al. 2024).

Digital competence (DC)

The universities of applied sciences carried out a project aiming at the definition of the health care and social welfare informatics competences for bachelor level education as well as for the use of professional practices (Tiainen, et al, 2021). The process involved specialists of education, health and social care, informatics, and business administration. The DC framework is intended to serve educators, degree students, and in-service trainers and trainees in the planning, implementation and evaluation of health care and social welfare education to meet the needs of working life.

Social services and healthcare personnels' DC profiles have been investigated by statistical analysis of a regional survey data (Ylönen, et al, 2025). Three profiles and percentage distribution were: motivated digital experts with excellent or good digital skills and high motivation to enhance their knowledge (45,1 %), burdened digital users with basic but adequate digital skills, yet working at the edge of their competences (47,4 %), and frustrated survivors struggling with inadequate digital skills, having feelings of burden and stress and low motivation to improve their digital skills (7,5 %) indicating significant differences in the perceptions of the opportunities, challenges and organisational support of digitalisation assessed by employees (ibid.). Practical recommendations include utilising the knowledge of DC profiles in the training of social and health care personnel and addressing the specific needs of burdened digital users and frustrated survivors in carrying out digital reforms (Ylönen, et al, 2025).

Digital transformation challenges home care workers' agency and ability to perform professional and digital skills in eldercare work (Rantala, et al, 2022). A survey investigated the direct and indirect effects of perceived digital skills, interest in technology, and available technology support on the actual use of digital applications at work. Focus on digital skills and application use leaves home care workers' broader professional DC in a background. It is pointed out that technology facilitates work and decreases physical strain, whereas mental strain may increase when balancing between human interaction, digital technologies, reporting tasks, etc. (Rantala, et al, 2022).

Research of media work identified three frames in which the participating journalists perceived DC (Parkatti, et al, 2022). The individual attitude frame describes DC in terms of professional development and mainly positive attitudes towards digitalisation linked with the strong motivation to work as a journalist. The team-level support frame addresses DC through the questions of organisational training and the need for self-directed learning combined with work practices and continuing

competence development in organizations. The organisational-level practice frame put emphasis on DC in the context of organizational development and support to workers' professional and digital skills. The learning implications include the importance of managerial support, not leaving the responsibility to employees, alone. Positive attitudes do not lead to professional competence; continuing education and study practices both in formal and informal contexts of learning are needed in the spirit of lifelong learning (Parkatti, et al, 2022).

Adoption of digitalisation (AD)

Self-employed women managers in their later working life reported both challenges and benefits of employing digital technologies in their working and private lives, but mostly positive experiences of digitalization creating opportunities for advancing their careers and acquiring the equality and prestige at work (Rajahonka & Villman, 2019). AD takes learning by doing and continuous lifelong learning due to the constantly changing technologies. The theory of domestication from the technology implementation research presents how technologies are translated into the language of organizations embedding the digital tool use in the context of work (Rajahonka & Villman, 2019).

Another study of older self-employed entrepreneurs revealed three adaptation strategies to transformative digitalisation: avoidance, facilitation, and specialisation (Rantanen & Komp-Leukkunen, 2024). Avoidance of unfamiliar technology and keeping to existing expertise may work in some sectors where "forced digitalisation" is not strikingly in place, and the years of retirement are getting close. Facilitation strategy means that a professional is ready to invest in new technology and learning in the changing circumstances (COVID-19) to facilitate one's own and the clients' work. Specialisation strategy is concretised in strongly digitalised sectors, such as online marketing, where a professional may employ a technical expert for software maintenance (Rantanen & Komp-Leukkunen, 2024).

Creative workers' intention to use digital technologies in their day-to-day routines divides them to digital natives and digital immigrants (Nikou, et al, 2020). Creative works and fluent digital literacy are often combined, however, limited exposure and access to new technologies positions workers as digital immigrants. Conclusions emphasise assisting creative workers in AD, but, in my interpretation, the special nature of artistic work may not be well captured by general organisational measures (Nikou, et al, 2020).

Acceptance of technologies at work is associated with job insecurity and related to the division between low-skilled and high-skilled occupations with or without technologies at work (Krutova, et al, 2022). The use of new technologies depends not

only on the attitudes, skills or the threat of unemployment, but there are contextual and cultural issues that matter in AD. *"The characteristics of workplaces, such as the employees' participation and involvement in the development of the organisation, play a significant part in both the acceptance and the implementation and outcomes of the technological transformations in the workplace,"* indicate the findings (Krutova, et al, 2022, 110). An open dialogue between the management and the employees about the consequences of new technologies is recommended to enhance workers' integration at workplaces (ibid.).

Co-existence of humans and artificial intelligence (AI) in the workplaces was investigated related to "low-status" automation and "high-status" augmentation (Einola & Khoreva, 2022). Simply put, automation refers to routine tasks that technology takes over from humans, whereas augmentation means AI assistance of human work in complex data processing tasks. In a multinational company, the tasks of automation and augmentation are divided among different personnel groups resulting in distinctly different AD sensemaking processes across the groups, which the managers and HR personnel are not necessarily aware of. AI implementation should be carried out as a local, collective, iterative, and profoundly human project keeping the primary focus on what companies do and why, even when focusing on the use of AI solutions (Einola & Khoreva, 2022).

Digital agency (DA)

In hospitals implementation of speech recognition technology has made the typists' work in medical documentation service unnecessary (Saari, et al, 2019). The researchers carried out an employee-driven change intervention offering the participating typists a safe environment to analyse the change and envision potential future roles, such as innovator, enabler, coordinator, and a quality control editor working with novel technology. Conclusion is that employees' agency can be supported in radical technological changes, in addition, future-oriented training for new capabilities and roles is needed. Research also revealed managements' doubtful attitudes to this kind of employee-driven proactive innovation amidst the change with the outcomes unforeseen (Saari, et al, 2019).

More often than through radical transformation DA is needed to integrate digital services into routine work. Nadav, et al. (2021) suggest 14 practices for enhancing the implementation process in a way that acknowledges health and social care professionals' need to understand and make sense of the new service. The suggestions for the support of DA (my phrasing) include good communication and justification of change, good planning, engagement of employees, providing resources and time for the adoption of the service, and individually targeted training. Employees'

engagement in the change process is called "cognitive participation" whereby workers are given an opportunity to influence. The interviewed participants suggested inviting professionals from different professional groups to work together in the design phase (Nadav, et al, 2021).

Professionals' DA was enhanced in the adult educational master's degree programme by assigning students with a learning task of online counselling (Silvennoinen, 2020). They were asked to study a web-mediated motivational interviewing method combined with a solution-focused counselling approach. The analysis of the students' learning diaries led to the notion of 'blended professionalism,' a combination of the deeply rooted embodiment of care practices and disembodied online interaction based on digitalisation. Blended professionalism should be added to the competence requirements of professional education and training curricula, but the definition of competences and skills must not blur a larger understanding of how digitalisation affects in society (Silvennoinen, 2020).

Education professionals' techno-work engagement describes the positive experiences of using educational technology at work, and links digitalization with improved work well-being (Mäkiniemi, 2022). The main elements of techno-work engagement were categorized into facilitation of work processes, progress in technology use and in new pedagogical solutions and personal growth, collaboration with students and colleagues, and positive emotions and inspiration related to digital work. This excessively positive approach to digitalization of work emphasizes these elements as concrete guidelines when leading digital transformation processes (Mäkiniemi, 2022).

Digital labour platforms change the social and economic circumstances of working and create new challenges for workplace learning (Seppänen, et al, 2023). Workers' accounts of exerting DA (my phrasing) to understand and influence the algorithmically managed (to employees mostly opaque) rating systems were interpreted as *expansive learning efforts* striving for better and fairer interaction, wages and learning opportunities in a platform environment (ibid.). Whether digitalised work environments can be developed towards fairness and inclusive learning opportunities remains to be seen.

One article in this review explicitly recognises digital technology as a means of informal learning at workplaces (Karhapää, et al, 2025). A digital ethnography of the case organisation brought out that digital technology provided means for interaction and frequent communication throughout the workday in a way that promoted informal learning. I interpret that DA is involved in developing management practices to overcome the negative effects of digitalisation at workplaces. Sustainable use of digital technology in informal workplace learning was captured in the term

'sustainable learning', which entails controlling negative effects, promoting learning practices and work wellbeing, and developing the knowledge practices through the collaborative actions by the managers and employees (Karhapää, et al, 2025).

Discussion and conclusions

The scoping review of the research of digitalisation in the Finnish workplaces asked to what extent the inclusive use of digital technology has been recognized as an issue of workplace learning. Firstly, the articles brought evidence from varying sectors and worker groups, from health and social care, other services, and lines of public and private business. Digitalisation challenged humane and craft-like work as well as fully digitalised work, such as media sector, platform work and ICT industry. Secondly, a content analysis resulted in four topic areas related to digital inclusion and learning at work named 'effects', 'competence', 'adoption', and 'agency', with distinctive implications and meanings of digitalisation for workers.

The effects of digitalisation (ED) were analysed in nine articles. Problematic effects and risks include polarisation of skills and deskilling (Hyrynsalmi et al. 2018), marginalisation of displaced workers (Hyötyläinen 2022), and early retirement from work life (Niemi & Komp-Leukkunen 2022). Managers may overlook the negative ED for personnel (Kaihlanen et al. 2023), such as increased digital job strain (Virtanen et al. 2023). The problems of digital tool use appear in virtual consultation meetings where maintaining clients' trust and emotional security is at stake (Surva 2023), and in workers' (in)equality of opportunities for utilising robots at work (Turja 2023). Positive ED can be read in workers' stories of the professional development and learning opportunities (Wallin et al. 2020) and professionals' improved access to client information and clients' active role through digital means (Saukkonen 2024).

It seems that inclusive effects and learning opportunities are polarised. Negative effects fall on low-skilled, displaced, aged, and subordinate workers and vulnerable client groups, whereas benefits are received by autonomous professionals and managers. However, for all groups the digital change is to some extent beyond their control. Identified ED can and should be further interpreted as manifestations of developmental contradictions and sources for a need state (Engeström 2015). Even problematic ED can be identified as "inclusive" triggers for expansive learning rather than indicators of structural work-life changes that workers must cope with while some drop out.

Digital competence (DC) was the main topic in four articles, one study on media work (Parkatti, et al, 2022), three on health and social sector. A network of Finnish universities of applied sciences developed a comprehensive informatics competence

framework for healthcare and social welfare education and in-service training (Tiainen, et al, 2021). Other studies explored DC profiles of the social services and healthcare personnel (Ylönen, et al, 2025), and digital skills and application use among home care workers (Rantala, et al, 2022). The DC literature, more than the remaining three approaches, connects the challenges of digitalisation to basic and continuous professional education. The management of digital inclusion and learning at workplaces can be considered in the planning phase of the programmes.

The question is not just about a capacity to operate with digital technologies, tools and work environments. Activity theoretical research highlights that fundamental for learning is to understand the digitalising object of work (Toiviainen & Vetoshkina 2018). The inclusive use of digitalisation is particularly challenging in care work where even clients' human needs are getting virtually mediated to nursing staff (Juvonen et al. 2022).

The adoption of digitalization (AD) was the focus of five articles. The target groups were self-employed and aged employees (Nikou et al. 2020, Rajahonka & Villman 2019, Rantanen & Komp-Leukkunen 2024), staff of a media consultancy company (Einola & Khoreva 2023), and a sample of a nation-wide work and working conditions survey (Krutova et al. 2022). The adoption studies employ theoretical concepts of technology domestication (Rajahonka & Villman 2019), digital natives and digital immigrants (Nikou, et al, 2020), technology acceptance (Krutova et al. 2022), the co-existence of humans and artificial intelligence in the workplace ecosystem (Einola & Khoreva 2023), and workers' adaptation strategies (Rantanen & Komp-Leukkunen 2024).

The AD research was the most theory-laden of the four approaches drawing on various concepts of the technology implementation studies. In this sample, however, learning-theoretical frameworks are not in the forefront in the investigations of the relationships and interaction between humans and technology. Activity-theoretical studies would enrich the field by making the context of technology use and learning visible in workplaces and educational organisations (Karanasios et al. 2021).

Digital agency was interpreted as the topic of seven studies. In a developmental intervention workers envisioned future digital services for their new work (Saari et al. 2019). In the context of education, students analysed the changes in digitalizing (online) counselling (Silvennoinen 2020). Other studies introduced digital platform workers' expansive learning efforts (Seppänen et al. 2023), practices for integrating digital services into routine work (Nadav et al. 2021), and educational use of ICT in a way that enhances work well-being entitled 'techno-work engagement' (Mäkiniemi 2022). Only one out of 24 reviewed articles observed how the company's practices explicitly harnessed digital technology for informal workplace learning (Karhapää et

al. 2025). Generally, empowering agency in digitalised environments emerged in connection with the opportunity to develop work and gain insight in the new methods of working, learning, and wellbeing.

The inclusive use of digital means sets a learning challenge to professionals, first, for their own capacity building and empowerment and, second, for them being able to enhance various citizen groups' digital inclusion and life-long learning. Inclusive digital practices, cultures and policies receptive to workers' learning were discussed in some of the articles but much more attention should be given to the socio-material solutions of the digital learning culture at workplaces for workers' continuous learning and empowerment.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-09

Empowering Teachers for Inclusive Use of Digital Technologies and Innovation in the School Classroom Workplace Learning

Irina Maslo and Svetlana Surikova

This chapter has connected with an overarching, broad conceptual framework of ASEM RN2 research 2024-2026. The research question from the standpoint of human-centred pedagogy, uses the concepts of inclusive use (ethical approaches and practices that enable equitable access and active participation of the widest possible range of workers) and 'socially embedded capability', developed by Pepka Boyadjieva (2023), to address how working teachers can be empowered through the context of informal combined with non-formal adult learning. Following Boyadjieva's definition of empowerment "in and through (adult) education from a capability approach perspective as an expansion of both agency (process freedom) and capabilities (opportunity freedom)" (Boyadjieva, & Ilieva-Trichkova, 2023, p.175), the social embedded teacher capability will be studied in the Latvian socio-cultural context (Fernández González, 2019).

Introduction

The Latvian country context has particular significance for the research question because the "Competence Approach to Curriculum" (Skola-2030), implemented by the National Centre for Education (NCE) in 2016-2023, aimed to develop, validate, and implement in Latvia a general education curriculum and teaching approach from preschool years to secondary school resulting in pupils knowledge, skills, and attitudes necessary for life today. Since 2016, the reform of educational content integrated virtue education in school cross-curriculum. The moral education programme e-TAP developed in 2021 (Arete.lu.lv, 2019) is unique in that it is thematic. Instead of offering materials on individual virtues, the programme addresses current topics that are discussed in school (such as physical and emotional abuse, social inclusion), seeking possible solutions through the prism of ‘virtues character’ development in moral education (Maslo et al., 2023). There were several reasons why

it was decided to focus the moral education programme e-TAP developing on topics rather than individual virtues. First, this will allow schools to use the resources of the Skola2030 programme (Skola-2030) in the areas of study and subjects included in the programme. This will enable schools to fulfil the content of the state-mandated curriculum while addressing issues from the perspective of character development. In addition, by looking at virtues in the context of problem situations, it is possible to explore in greater depth how different virtues can interact or conflict in real life. Virtues rarely appear in isolation from one another. This will help students develop their judgment and apply virtues appropriate to the situation they are experiencing.

The e-TAP programme has structured into four broad thematic modules (Maslo et al., 2025, p. 3):

- flourishing personalities,
- flourishing relationships,
- flourishing in the digital environment, and
- flourishing society.

This chapter focuses on the scenario of school teachers informal combined with non-formal workplace learning in 2019-2024 in the national-level research projects on piloting the integration of online moral education programme e-Tap in school subject curricula in Latvia. To delve into the inclusive and empowering use of digital technologies and innovations in the chosen scenario, a Loya's model "that explains the mechanism through which college faculty can effectuate deep changes to their teaching views and practices to make them more inclusive" (Loya, 2021a, p. 12) was applied in this chapter.. "The model of inclusive college teaching change aligns with liberator instructional approaches that warn against one-size-fits-most views of teaching," and recognizes that "each classroom as different, [where] strategies must constantly be changed, invented, reconceptualised to address each new teaching experience" (Hooks, 1994, pp. 10-11).

The chapter provides evidence on delve into the inclusive and empowering use of digital technologies and innovations in the chosen scenario:

> (1) Analysis of Google statistics on the usage of provided informal and non-formal learning freedom opportunities
> (2) Secondary analysis of existing data sets of ARETE research (ARETE, 2024) conducted; and
> (2) Two interviews with the e-TAP programme project key staff members who led the implementation of moral education in Latvia conducted.

The research question of the analysis made in this chapter has been “How does a combination of informal and non-formal learning opportunities empower teachers' social embedded capability to gain control over the classroom environment, improving well-being (inclusion)?”

Methodology

To address the issues of inclusion (equitable access and active participation), and empowerment (socially embedded teachers’ capability), the following was done:
1) Analysing the equitable access and participation of a wide range of teachers in the delivery of virtual education in classroom practice and their usage of provided informal and non-formal learning freedom opportunities. This have been considered through the analysis of Google statistics and interviews with experts who led the implementation of moral education in Latvia. The following aspects have been considered:

- Teachers' voluntary participation in the delivery of the virtues character development moral education curriculum in classroom practice over time,
- Teachers' usage of the online platform, supported by a virtual campus (ARETE-school),
- Teachers' voluntary participation in non-formal learning provided by the project team.

2) Studying teachers' capabilities to use the opportunities of freedom provided by the project through secondary analysis of quantitative and qualitative data sets from previous projects (Fernández González et al., 2023):

- Quantitative data of the study on the fit and feasibility of the online virtues character development moral education curriculum;
- Qualitative data of the study on the fit and feasibility of the online virtues character development moral education curriculum (Fernández González, & Surikova, 2024).

3) To understand how to foster and accept different modes for teachers/workers to engage actively, the following questions (Loya, 2021b) have asked in two interviews with project key staff leaders (one female and one male) who led the implementation of virtues character development moral education programme e-Tap in Latvia:

- Are the pedagogies (including the activities, assignments, and assessments) I choose conducive to supporting all my teachers/workers? Which directly?
- Am I empowering my teachers/workers to engage individually, with one another, and with me? How?

- Do I recognise and incorporate my teachers'/workers' experiences and needs? How?
- Do I provide multiple and varied ways for teachers/workers to be able to engage? How?
- How can I gauge if my teachers/workers feel empowered to contribute to our shared creation of knowledge?

Followed the Bowne's (2017) and Loya's (2021a) vision of the teaching philosophy, the interviews were seen as uncovering project staff's beliefs and values about teaching and learning. Concrete examples of the ways in which they "enact those beliefs" (Bowne, 2017, p. 59). "Carefully developed (as suggested by Loya, 2020), it can be a mechanism for instructors to create more inclusive classrooms" (Loya, 2021, p. 1). Inclusiveness is "not necessarily linked to specific pedagogies, but rather, to the epistemological stances of becoming classrooms more inclusive through the authentic granting of epistemic credibility, or the recognition that students are both receivers and producers of knowledge" (Loya, 2020, p. 1). Teaching philosophies of project academic staff have seen here as similar to paradigms by being a "basic set of beliefs that guide action" (Denzin & Lincoln, 2005, p. 5) and are explored, guided by interview questions, in the conclusion of this chapter.

Informal and non-formal learning opportunities provided

Firstly, in framework of the Erasmus+ project "Supporting teachers for developing intra-personal competencies and character education at school, 2017-1-LV01-KA201-035435, the professional development programme for school administrators on values and moral education "Support for school management in promoting values and moral education in schools" was implemented in 2017-2019. This programme offered school-management-teams science-based support in the field of values and moral education, taking into account the guidelines of the education content reform project "School 2030" on values and moral education and international experience in this field. It has been implemented in cooperation with the Pieriga Education Authority and the Riga Education and Information Methodological Centre (Arete Catalyst, 2019).

Next, a well-balanced partnership from Latvia, Estonia, and Spain, comprising three universities, two schools and one teacher-training centre, was established to enable teachers to make inclusive attitudes and values attractive to secondary school students (aged 16 to 19). Within the framework of the Erasmus+ No. 2024-1-LV01-KA220-SCH-000247141 project "Building the Importance of Inclusive Values in Secondary

Education" (INCLUDO) in 2024-2026., 15 highly qualified experts work internationally with 100 teachers on this inclusive project in an environmentally friendly, digitally appropriate and cost-effective way. The project developed a research-based, easy-to-use teacher's guide and a flexible 12-hours teacher-training course to make inclusive values appealing to adolescents in English and the national language. A research report, scientific publication, website, active presence in teacher networks, 15 video stories and multiplier events reaching 1,000 teachers will sustainably promote inclusive attitudes in the education system and the joy of young people in demonstrating inclusive attitudes ((University of Latvia, 2024). Although the methodological material has been prepared for the further education of teachers, its structure is designed so that anyone interested can familiarize themselves with the content and methodological examples of the material and gain an insight into promoting understanding in the areas of character and competency-based education. The bibliography, methodological examples, and description of character education and its constituent aspects will allow each teacher to explore the topic individually and develop the teaching process.

Finally, in framework of the Latvian Science Council founded project, no lzp-2021/1-0385, research on the effectiveness of digital learning programmes for moral education of young people in Latvian educational institutions (grades 1 to 12) was conducted. Teachers from all Latvian regions participated in the delivery of the virtues character development moral education curriculum e-TAP (Arete.lu.lv, n/d) in classroom practice voluntary over time of the project from 2022 to 2024. They involved 122 classes (1,983 students) in 2022, 97 classes (1,451 students) in 2023, and 76 classes (1,056 students) in 2024. Informed consent letter to participate in the study was signed by schools.

The virtual campus ARETE-school supported the teachers' usage of the online platform. The online platform was created within the framework of the postdoctoral project 1.1.1.2/ VIAA /1/16/071 "Modernization of school education in Latvia through an innovative research-based programme on 21st century competences and virtue ethics development supported by a virtual campus (ARETE-school)". The equitable access and participation of a wide range of teachers in the delivery of virtual education in classroom practice and their usage of provided informal and non-formal learning freedom opportunities is evident in Google statistics':

- In 2022, 5,600 users viewed the project web page approximately 20,000 times in total.
- In 2023, from 12,226 project page viewers, 3,321 were first-time visitors and approximately 3,900 of them downloaded the project materials from 01.09.2023 to 31.12.2023.

- In 2024, 55490 project events visited 3686 users. The 3504 from them were fist visitors, All 3686 users started the 7 270 events of the programme sessions. The 2821 users' engagement in 10116 programme events by 15011 downloads from 1757 users was evident.

In total 21 schools were visited to provide informal learning opportunities for teachers. Seven non-formal continuing teachers' courses hold for local teacher training centres.

Secondary analysis results of data from the teachers' feedback

Secondary analysis of quantitative and qualitative data sets from previous projects led to the conclusion that the most teachers demonstrated their social embedded capability to deliver the 1-12 classes-pupils' virtues character development moral education programme in inclusive school-classroom practice.

Boyadjieva's definition of empowerment "in and through (adult) education from a capability approach perspective as an expansion of both agency (process freedom) and capabilities (opportunity freedom)" (Boyadjieva, & Ilieva-Trichkova, 2023, p.175) was applied. "The capability to participate as an act of freedom and the achieved functioning involved analysing" both constraining (challenges) and enabling (solutions for benefits) factors that have affect the freedom of teachers to attend the project activities as the provided opportunities of informal and non-formal adult education (Ilieva-Trichkova, &Boyadjieva, 2024, p. 128). Twelve correlations between the codes "Challenges" and "Solutions"; 25 correlations between the codes "Solutions" and "Benefits"; and five correlations between the codes "Challenges", "Solutions" and "Benefits" were identified in the focus group discussions with teachers:

An Example: A correlation between the codes "Challenges" and "Solutions"

When talking about the online learning process, it must be understood that the first thought is that there will be inconveniences, and the stereotype that it is impossible and the question of how to do it will come into play. When we tried to think as a group about what to do, it seemed that nothing could done. Thanks to my group members for their positivity and goodwill, we concluded that, even when it seems that nothing can done, a lot could done. In case of online learning, we must always try to find out the needs and knowledge of pupils'. We must always look for ways to involve them in various activities, whether it be during class time, even if it means learning new tools

and skills, or encouraging them to take a break from studying, go out into the yard, and do some activity there. Then we realised that we can achieve this presence effect through feelings and various associations. One message from our group, whose theme is maple leaves. The task for those present now, on their way home, is to walk through the park and find some more colourful maple leaves, turn them over in their hands, look at the veins, look at the colours, and try to think of someone they could give them to. Because every maple leaf is different, and every person who comes to us is different. The next thing we do is, when we receive this maple leaf, we naturally reach out our hand. Then, we try to play with this idea using our hand. This is your hand, and these are your fingers. The little ones can write their good qualities opposite each finger, and it is not always that easy. It is easier to name your negative qualities than to think about what is good in you. Moving on, we can use the same hand in the older classes and think about what values your fingers represent as a diagram. Finally, finally yet importantly, it is currently Patriotism Week, a month of celebrations, and we will think about what kind of handprint we will leave in Latvia.

An Example: A correlation between the codes "Solutions" and "Benefits"

Our group decided that the methods we use are varied. We adapted them to the pupils. We adapted them to the circumstances. We adapted them to the topic we are discussing. What we would like to share came to mind during a class on tolerance. I encouraged students to discuss this topic through things they understand. First, before we get to tolerance, I ask them to express their thoughts on what diversity is. How they understand it. Then, once they have talked about it and discussed it, I invited them to look at diversity in nature through animals, because this is the closest topic to young children, and to describe how they see it. How they see it in nature. The goal was to conclude that diversity is beautiful. There is nothing superfluous in nature; we all belong in nature, regardless of what we look like, how big we are, how smart we are, how powerful we are, etc. In the next discussion I invited them to look at this diversity in society, and not only to look at it in society, but also to think about social groups that are usually targeting of intolerant in comments and intolerant stereotypical thinking. I invited them to think about whether this diversity is also beautiful in this case. I invited them to think about how we would like them to be treated and how society treats and relates to each of these social groups. This gave pupils an opportunity to think about how this applies to real life if we made a completely random comment, a completely random statement that we have heard in our family, in society, or among friends. The question is – how do these people feel?

If we have already concluded that, there is nothing superfluous in nature, that everything in nature is beautiful, and then humans are part of nature. Therefore, there is something beautiful in these people too; we can try to see this beauty, this goodness in every person, and again we concluded that diversity is still beautiful, no matter what. Thus, through discussion and debate, we arrive at the conclusion that tolerance is acceptance of what is different, what is other. Here, we could continue to discuss respect; the ability to accept people; the ability not to offend each other; to admit our mistakes; and to develop a positive attitude towards others, because we as people want to receive a positive attitude towards ourselves, regardless of the fact that we may not be the most beautiful, the smartest, the best, etc. At the end of the lesson, we came to one beautiful conclusion: that we are like coloured pencils in your pencil case – each one is different, but all are equally important. This is one of my lessons, which my colleagues asked me to share. There are various methods. Thank you for listening.

An Example: A correlation between the codes "Challenges", "Solutions", and "Benefits"

This period was quite difficult. At the very beginning, when all this online learning started, we organised an online meeting with parents, teachers, and both of us. This meeting was very fun and enjoyable, and the students and parents liked it. We talked about the things we needed to prepare for and were not ready for yet, and these things were very new and difficult for everyone to understand. We talked together and realised that we were at the beginning of a new journey. Moreover, this online meeting gave us great peace of mind. This was a very valuable experience for me. Of course, during the process, we were used to working in our WhatsApp group and learnt how the children were feeling. Parents shared their observations about their children with us, gave us some recommendations, and asked some questions. Therefore, this is an ongoing process with parents and students about what we can do better and what we can do differently. This whole process was very instructive, as I pointed out [in the initial survey], because we do not usually see each other, we do not see what parents see, and we were very happy to learn all these things from the parents.

Different modes to empower teachers' social embedded capability

In the e-TAP+ project (2022-2024), two project key staff researchers were interviewed. One of the interviewees led the effectiveness research work package, maintained contact with control-group-class teachers at all age levels (grades 2-4, 5-7, and 7-9), and was also a mentor to four primary school teachers who implemented the e-TAP moral education programme in their classes. The other interviewee was a leader of all projects mentioned in this chapter, an owner of the mentoring process and results at whole, and a mentor of teachers involved. Both two interviewed researchers maintained contact with the control-group-class and experimental-class teachers by e-mail, sending to them letters in the spring with questionnaire documents and instructions, as well as letters at the end of the summer with the results of the questionnaire for their classes in PowerPoint format, along with some explanations on how to interpret the results.

The pedagogies (including the activities, assignments, and assessments) conducive to *supporting teachers/mentees*

The pedagogical strategies used by the project key staff researchers/ mentors in the e-TAP+ project were well aligned to support a wide range of teachers/mentees. This was evident in the both interviewees' expressions. Direct support included (Table 1).

Interviewee 1	***Interviewee 2***
The mentoring model with personalised communication channels email, WhatsApp, phone, MS Teams, Zoom) ensured accessibility and responsiveness has been applied. *Structured seminars* (introductory and refresher) provided a clear orientation and ongoing support. *Detailed guidance and materials* (PowerPoint slides, videos, and methodical materials) aided implementation and consistency. *Feedback mechanisms* (e.g., reflective reports and planning documents) helped track progress and adapt approaches as needed	We included *a wide range of activities* in the programme so that teachers could choose those methods they like best. We included: - Class discussion, - Video discussion, - Pictograms, - Quotations, - Individual and classroom reflection tools, - Others We also provided activities - For working in pairs, - Group working activities, - Activities have to be implemented with parents. *Another method* we used was "class conference", where groups of students presented to the others their individual research on given moral education topics.

Table 1: Interviews' quotations, which demonstrate the pedagogical strategies, used to support teachers

Empowering teachers/mentees to engage individually, with one another, and with academic staff

The approach applied respects professional autonomy while providing structured opportunities for dialogue and collaboration. To encourage teachers/mentees.to engage in the project, the researchers/mentors ensured the communication with teachers through Table 2).

Interviewee 1	***Interviewee 2***
Individual engagement: Offering choices in communication methods and languages, respecting personal and professional preferences. *Peer engagement:* Group seminars enable peer learning and sharing of experiences. *Engagement with mentee:* Personalised mentorship and regular feedback loops ensure that mentees feel supported and heard.	*Joint seminars:* We organised joint seminars at the very beginning of the piloting of the project, so that teachers can meet each other. These seminars were organised by class group so that teachers with common interests can meet. *Emails and phone messages:* We also wrote individual emails to each teacher to create a sense of mutual trust and personalised attention. With some of teachers we also used and phone messages to keep in touch, especially if they missed the join meetings. *Feedback seminars:* We also organised feedback seminars at different times and days so that all teachers can participate in the interpretation of the results of the research.

Table 2: Interviews' quotations, which demonstrate approaches, used to engage teachers

Recognising and incorporating teachers'/mentees' experiences and needs

The following interviews' quotations, which demonstrate a responsive and inclusive mentoring philosophy applied (Table 3).

Interviewee 1	***Interviewee 2***
I requested and analysed classroom-planning documents to understand how the e-TAP curriculum is integrated into each teacher's context. The use of reflection reports allowed teachers to voice their experiences, challenges, and successes. My feedback and support were tailored to the developmental stage of each class, acknowledging variation in readiness and contextual needs .	I tried to recognise and incorporate my workers experience and needs during the project. I tried to find an appropriate work for each worker; for some workers specialised in elementary school or preschool education and then they were working on the materials of that education level and mentoring teachers who work in elementary education or preschool. For capturing my workers needs, we had weekly meetings where we discuss how they were doing with their mentoring work and with their follow up of the implementation of the lesson plans. During the meetings, we agreed jointly our communication plan with teachers to find the right balance, so that we are present enough but not making too much pressure on teachers. Teachers' needs were also talking into account. For example: During the piloting of the project, teachers could choose the topics that are more important for them. Some of them took into account the needs of their classroom, asking their pupils which topics they need or they want to discuss.

Table 3: A responsive and inclusive mentoring philosophy applied

Providing multiple and varied ways for teachers/mentees to be able to engage

There were multiple ways for teachers to engage teachers provided (Table 4).

Interviewee 1	***Interviewee 2***
Communication: Email, WhatsApp, phone, SMS, and video calls offer flexibility. *Materials:* Presentations, printed/digital questionnaires, YouTube videos, and written guides cater to different learning styles. *Feedback:* Opportunities for written reflection, verbal updates, and planning exchanges offer varied feedback modalities	We included *teachers' feedback comments* into the final version of the programme. In addition, in some cases *we modified the programme itself, removing concrete materials or adding new things.* For example, some teachers pointed to the necessity of including more materials coming from Latvian culture, and so we changed several of the activities of the programme to include more materials from Latvia. Furthermore**,** *we transcribed and translated the videos that were in English into Latvian so that teachers can use them easily in the classroom.* Another way teachers could engage was *by sending their suggestions to the e-mail that was in the platform of the project encouraging them to do so.*

Table 4: Interviews' quotations about the ways to engage teachers

Gauging the teachers/mentees feel empowered to contribute to the shared creation of knowledge.

Qualitative evidence of empowerment through thoughtful teacher reflections (oral and written), formalising this with structured self-evaluation tools, deepen interviewees insight (Table 5).

Interviewee 1	*Interviewee 2*
We have evaluated this empowerment by: *Monitoring reflection reports* for initiative-taking, critical thinking, and suggestions (as shown in the detailed teacher feedback). *Conducting follow-up interviews* focused on perceived value, voice, and agency in the programme. • *Tracking implementation fidelity and creativity,* such as teachers modifying or adapting lessons to better fit their class needs.	Teachers felt empowered to contribute to our shared created of knowledge. A good number of teachers participated in the final conference of the project, which indicates that they were interested in the knowledge we have jointly created. Many of them invited the project staff to their school to lead seminars for teachers, parents and pupils, spreading the project results. Some of teachers were suggesting new topics to include in future editions of the programme.

Table 5: Evaluation tools of teachers/mentees empowerment

Together both interviewees with other colleagues organised and conducted two support seminars for the classroom teachers of the control and experimental group's 2nd-4th grades:

- An introductory seminar at the end of the summer (with the aim of introducing the programme, its guidelines, structure, methodology, and implementation requirements), and
- A "refresher" seminar at the beginning of autumn (with the aim of jointly reflecting on what has been achieved and refreshing the memory of the program's guidelines, methodology, etc.). At the beginning of the school year, we agreed with each mentee teacher on the most suitable communication channel (e-mail, WhatsApp chat, phone call, text message, video call, etc.), type of communication, and language (Latvian or Russian). The language issue was raised because most of the teachers I mentored were not native Latvian speakers, so in order to facilitate communication.

At the beginning of the school year, the mentees sent to the interviewee 1 their class teaching plans, which helped them, understand how teachers integrated e-TAP lessons into their teaching plans and allowed them to follow the implementation of the e-TAP programme throughout the school year. Once every three months (before each holiday period – autumn, winter, spring, summer), mentees provided feedback on their progress. Every spring, mentors sent letters with survey documents and instructions to both the control- group-class teachers and the experimental-group-class teachers and at the end of the summer, the interviewee 1 sent letters with the survey results for

the class in PowerPoint format, along with some explanations to make it easier to interpret the results.[1]

Empowering teachers' social embedded capability to gain control over the classroom environment, improving well-being (inclusion)

A Google statistics on the usage of informal and non-formal learning choice opportunities, as a secondary analysis of existing data sets of ARETE research and two interviews with experts, who led the implementation of the virtues character development moral education programme in Latvia, provides evidence on delving into the inclusive and empowering using the digital technologies and innovations.
The adopted dialogical approach respects each participant, promotes equality in discussions, and fosters an informal and friendly atmosphere that encourages openness to new ideas, striking a balance between broadening horizons, building trust by encouraging pupils to think more deeply through discussions and reasoned debates. Cultural and ethical knowledge provided teachers with new perspectives on which to base pupils' discussions. The diversity of the support tools offer provided in-depth activities for pupils and materials for teachers, which was used depending on the class's prior knowledge and level.
The large number of teachers who participated in the final conference of the project indicated their interest in the knowledge that was jointly created. Many of these teachers have invited the project staff to their schools to lead seminars for teachers, parents and pupils, thus spreading the project results. Some teachers also suggested new topics for future editions of the programme (IZPF, 2024).

Conclusions

The chosen scenario helps explain how working teachers can be empowered through an integration of informal and non-formal adult learning opportunities from a capability approach perspective as an expansion of both, agency (process freedom) and capabilities (opportunity freedom)" (Boyadjieva, 2023, p.175).
The empowering teachers' social embedded capability to gain control over the classroom environment, improving well-being (inclusion) can be ensured through:

- The well aligned to support a wide range of teachers/mentees pedagogical strategies on mentoring throughout the personalised communication channels

[1] All materials as communication letters or teaching plans can be ordered directly at the authors of this chapter.

via email, WhatsApp, phone, MS Teams, Zoom ensure accessibility and responsiveness of teachers.

- Structures seminars for a clear orientation and ongoing support with detailed guidance and multi-visualised materials aid implementation and consistency. Including a wide range of activities so that teachers can choose those methods they like best and the feedback mechanism help track progress and adapt approaches as needed to promote teacher empowerment and pedagogical alignment with the programme's goals.
- Recognising and incorporating teachers'/mentees' experiences and needs, and the needs of their classroom pupils, as well parents' shared observations about their children, demonstrate a responsive and *inclusive mentoring philosophy*.
- The multimodal approach ensures inclusivity and responsiveness to diverse preferences and technological capacities, providing multiple and varied ways for teachers/mentees socially embedded capability to engage.

Teachers feel empowered to contribute and to share created knowledge that is evident in monitoring reflection reports and conducting follow-up interviews focused on perceived value, voice, and agency in the programme, tracking implementation fidelity and creativity, such as teachers modifying or adapting lessons to better fit their class needs. Qualitative evidence of empowerment through thoughtful teacher reflections (oral and written) formalises this with structured self-evaluation tools that deepen insights in inclusive mentoring philosophy applied. The inclusive and empowering use of digital technologies and innovations in the chosen scenario, explains the mechanism through which academic staff can effectuate deep changes to teachers' views and practices, making the non-formal and informal learning inclusive (Loya, 2021a, p. 12).

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Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-10

Empowering Performance of Musicians in the Context of Digital Transformation: the Case of a Symphony Orchestra

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This article examines the process of empowering musicians and introducing digital technologies in a symphony orchestra. Based on the analysis of scientific literature and quantitative research, it analyzes on how technologies change the organization of work, learning and mutual communication of musicians. The results of this research show that the empowerment of musicians by digital means increases their autonomy, motivation and creativity, but the integration of digital technologies in the orchestra is still fragmented and often depends on individual initiative. While most musicians appreciate the benefits of technology, some feel neutral or stressful about change, which highlights the need for systematic organizational support. The article emphasizes that empowerment and the use of technologies are interconnected processes that require not only technical measures, but also cultural and organizational adaptations in order to effectively empower musicians and strengthen the quality of the orchestra's activities.

Keywords: empowerment of musicians, symphony orchestra, digital transformation, integration of technologies, motivation of musicians

Introduction

The music performance sector, like other spheres of activity today, is undergoing a change due to the rapid development of technology and its integration in the different activities. Symphony orchestras representing classical music culture also apply various technologies in their activities, not only to increase the efficiency of activities, but also in seeking to enhance the involvement of audiences . For example, there can be used digital audio workstations in the are of composing and arranging of music, or using software for notation, score prepration. Digital metronomes can help the orchestra musicians in maintaining tempo, while virtual reality tools can help

musicians to visualize their parts in the orchestra. Digital tools also enhance and improve the audio quality, help to reach wider audiences, assist in admninistrating the actriuvities of orchestra, as well as support development of skills of the musicians.

The application and use of digital technologies allows musicians to develop competences that meet today's requirements for handling these technologies in the performance of music. Cheng (2018) points out that traditional music performance must be complemented by the ability to use digital platforms for music production and communication. An interesting point is made by Mukt et al. (2023), who pointed out that the various music platforms not only make it possible to reach a wider audience, but also ensure greater control over their artistic expression.

Weener, Noorloos (2022) draws attention to the need to recognise that while digital tools offer great opportunities for empowerment of the performers, they also pose challenges such as increased competition and the need to constantly adapt to new technologies. Therefore, in order to foster a supportive and motivating environment for the musicians of symphony orchestras, it is essential to understand the dynamics of empowerment and the digitalisation of the activities of orchestra.

In a broad sense, empowerment of the performer of any activity by the digital technologies also concerns decision-making, motivation, giving responsibility and taking responsibility for one's own work. A study conducted by Ortega-Orozco et al (2020) showed that music performers who feel empowered are more involved in their work, leading to better performance and satisfaction. The aforementioned authors have proved that the inclusion of digital technologies in the daily practice of musicians improves their cognitive functions - memory and attention.

Quite a few research studies deal with the empowerment of musicians and the application of technology in the symphony orchestra. Salvaggio (2024) studied the use of digital technologies in five different orchestras and pointed to their importance for sustainability, audience reach and competitiveness. Ford and Mandviwalla (2020) drew attention to the technological shift in viewers' attitudes towards the performing arts and the need to review existing communication strategies. Kammerhoff et al. (2019) explored how the existing hierarchy of the structure of symphony orchestras determines the participation of musicians in decision-making processes. Sellman (2025) noted that recent examples show how orchestras integrate virtual reality technologies to enrich the audience's experience and provide new perspectives for musicians. For example, the Orchestre de la Suisse Romande in Geneva developed the Virtual Hall app, which allows listeners to experience concerts from the perspective of musicians on stage. This app offers six different locations on stage with 360-degree view and interactive digital score. This allows listeners to better

understand the work of musicians and strengthens the connection between performers and the audience.

Problem of investigation.

The digital transformation of the symphony orchestra is a continuous process, depending on the evolution of musical technologies and their adaptation to the needs of the orchestra, the financial possibilities of the orchestra to acquire them, the competences and enthusiasm of the members of the orchestra to use information technologies, specific projects in which technologies are necessary or, on the contrary, not used at all. Digital transformation, on the one hand, promises many advantages: greater efficiency of music performance, better cooperation, the ability to reach a wider audience. On the other hand, it also raises a number of questions about how to preserve the human element, creativity and uniqueness, which are extremely important in the work of the symphony orchestra. There is also the need for performer empowerment. The symphony orchestra is associated with tradition, so the introduction of digital technologies must meet the needs of today and the preservation of tradition.

Research questions:
How does the integration of the digital technologies into the activities of the symphony orchestra empower the performance of the musicians of the symphonic orchestra in the different areas of activities?
How does the integration of the digital technologies into the activities of the symphony orchestra empower development of the competences of the musicians of the symphonic orchestra?

The subject of the research is the empowerment of musicians in the context of the digital transformation of the symphony orchestra.
The aim of research is to identify how the empowerment of musicians in the orchestra is related to the use of digital technologies.
The research is based on the theory of creativity (Amabile, 2012), which states that creativity is determined not only by personal qualities, but also by social and organizational environments, and internal motivation, positive emotions, openness to experience and supportive environment are the main principles of this theory. Creativity is fostered by the domain-specific skills, the processes which lead to the novel thinking, as well as by the intrinsic and extrinsic motivation to engage in the

creative activity. Social environment of the creative activity can also support of hinder creative performance of an actor (Amabile, 2012).
Methods of scientific literature analysis, meta-analysis and questionnaire survey were applied.

Benefits of Empowering Employees in the Workplace

Research on empowerment of the performers of activities began in the 1960s with increased attention to the individual in the workplace. Leadership power increases by sharing it with others – empowering workers(Ford G. et al., 2019; Peek, 2024). This requires the following conditions: opportunities for improvement, dissemination of information, support, resources, clear authority and motivation.
Abdul et al.(2024) found that strengthening workers' technological skills improves performance. Amor and others (2021) distinguish structural (resources) and psychological (motivation) empowerment, emphasising the importance of their interaction. Li et al. (2022) associates the use of technology with the reduction of discrimination and sees empowerment as a combination of competence and control.
Risgiyanti (2023) supports these statements by stating that an inclusive environment reduces social exclusion of workers and has a positive impact on workers' psychological well-being. Channarika (2024) revealed the link between workplace empowerment and organisational commitment. The study was conducted in Cambodian universities by interviewing a female lecturer. The author found that empowerment significantly improves employee productivity and promotes mutual understanding between managers and employees and is a key factor in organisational commitment. The results of this study showed that lecturers feel very little empowerment, they are accustomed to taking an interest in their personal well-being, and not in the university as an organization.
Shamsuddin and Others (2023) sought to establish that the organisation's culture and structure relate to the empowerment of employees and reasoned on the need to take into account the broader context of the organisation, the empowerment of employees in order to achieve the organisation's cultural development and depth. The author noted a significant gap in this type of research. Employees need to feel that they are an important part of the organization and it is their activities, involvement and responsibilities that contribute to the development of the organization's culture.
In South-East Asia, employee empowerment studies were carried out by Hassand et al. (2022) and found that both the psychological and the power (and hence the responsibility) of the assigned tasks contribute to the overall well-being of employees, job satisfaction, and a healthy working atmosphere.

There is no doubt that research on performer empowerment has also been carried out in the arts and music sector. It may seem that there is no need to further empower performers in this sector, as they seem to be motivated by a desire for creativity, self-expression or a desire to be on stage. However, economic, social and technological changes do not overtake this sector either, and it is likely that it works well for the artists who work there.

Empowering performers in the arts and music sector is also important. A study conducted in the Philippines by Almanden et al. (2024) highlighted the lack of representation of artists, the influence of family dynamics and factors such as professional tension, economic instability and the role of technology influencing the creative process.

Gamble et al. (2018) conducted 52 interviews with representatives of the music sector and found that marketing companies rarely acknowledge their shortcomings, and the main beneficiaries are not the listener or the performer, but different other stakeholders. The authors propose to develop relationship-based marketing, which is necessary in the arts sector in order to increase performer empowerment.

There is no doubt that, when performing their own or others' music at all times, performers can also convey a message that is relevant to them or listeners - the text of the song, the detail of the outfit, the inscription can be a subtle sign of resistance or support, and this is one of the easiest to understand examples of empowerment or maybe empowerment.

Brattico and Varankaitė (2019) introduced the concept of ‘aesthetic empowerment through music’, where music is not only an art, but also a source of psychological strength that determines emotional response and self-reflection. They singled out biological factors for the enjoyment of music: dopamine release, physiological reactions, effects of expectations and surprises, cultural experiences all contribute to emotional regulation, creativity and social engagement.

Liao (2023) explored pop music as a tool for empowering women in China, emphasizing the liberation of women, the creation of identity, and the dissemination of feminist ideas through creation. Female musicians, using music, texts and image, actively break down stereotypes and strengthen women's self-awareness.

McCarry et al. (2023) analysed the problems of violence and sexual harassment in the music industry. The study revealed a culture of silence, accompanied by fear and long-term psychological consequences. Projects such as the MeToo or Safe Space initiatives are becoming important steps towards women's empowerment, achieving lasting change through community support and systemic awareness.

To sum up, greater performer autonomy and decision-making power leads to an improvement in performance, reduces gender discrimination, promotes a supportive

organisational culture, strengthens motivation, sense of equivalence and community, accelerates the development of innovations and integration of digital platforms, allows to express themselves aesthetically, politically and financially, and also increases self-confidence and understanding of the activities of the sector.

Integration of digital technologies into the activities of the symphony orchestra

Scientific literature provides examples of the integration of various digital technologies into the activities of the symphony orchestra. Some of them we think are role models, others are worthy of short-term attention, but it is clear that today a rare orchestra operates completely without technology. Technology applications range from routine sheet picking applications, remote rehearsals to artificial intelligence solutions. At the same time, there are challenges: well-established audience expectations, performance standards, accessibility of the digital technologies, availability of it‘s usage skills or maintaining authenticity.

Digital technological solutions (platforms, mobile applications, multimedia) inevitably change the nature of the orchestra's activities. Gibeng (2023) explored how listeners perceive classical concerts using tablets and mobile apps. Data from the study (141 listeners, 13 performers) showed that technology influences pleasure, a sense of authenticity and motivation to attend concerts.

Barros et al. (2023) linked the use of technology to audience engagement, especially in the context of the COVID-19 pandemic, when the virtual format of orchestras became a necessity. They analysed the broadcasts of the São Paulo State Symphony Orchestra on YouTube and noted that the comments had become a new form of mediation between the performer and the listener. Such platforms enhance interaction, encourage greater engagement of listeners, but at the same time pose challenges to artistic expression. It has been noted that it is important for the orchestra to select works suitable for the digital space – less ritualistic, more adapted to the virtual experience.

During the pandemic, Bergman (2021) studied performance of the Gothenburg symphony orchestra in London by looking into how digital technologies are changing the musical experience of listeners and raising questions about the aesthetics of music. Frequent broadcasts of concerts allow listeners to choose a more comfortable form of listening and relationship with music. Participants of this research study noted that the ability to listen to recordings not only for educational but also for relaxation purposes is particularly important, especially for lonely people under stress. While listening is often related to a specific space and time, recordings help maintain

concentration and the idea of listening. In this way, the listener becomes a more active member of the community by sharing experiences.

Spronck et al. (2021) sees the integration of technology into performance not only as a means for the survival of the orchestra, but also as a challenge to tradition. The 'Empty Minds' project (2018, the Netherlands) aimed to activate listeners by empowering them and engaging them in interactive activities through concerts. However, the idea that viewers could directly influence artistic performance was rejected. While some viewers were reluctant to attend, the authors stress that successful engagement requires a rethink of concert traditions, as technology alone is not enough.

Olaniyi et al. (2024) studied the influence of digital means of communication (Asana, Trello, Slack) on the teamwork of the symphony orchestra. A survey of 557 experts found that these tools improve communication, lower hierarchical barriers and increase collaboration, but their misuse can lead to stress or disengagement. A positive effect is achieved when digital tools are used consistently and all employees receive training. In addition, Chye et al (2021) stressed that digital technologies contribute to the sustainability of the orchestra by increasing its visibility and the longevity of its works.

Salvagio (2024) explored whether orchestras can influence social change beyond the traditional role. He highlights the potential of orchestras as "agents of social change" that influence civil society, promote personal development and solve social problems. Impacts include:

- Social and educational impact: musical collectives develop empathy, communication skills, improve academic achievement and self-esteem, and educational activities promote the education of listeners;
- Cultural and Emotional Influence: music influences emotions, promotes communication and is used in therapy;
- Institutional strategy and challenges: changes in finance, audiences and digitalisation that need to be adapted;
- Policy and financial support: art communication and state, as well as the support from audience.

The author notes that orchestras will become real agents of change if they themselves successfully implement changes and participate in social and political processes. He raises questions about the activity of orchestras in the social sphere, long-term financial stability and their inclusion in the wider society. Salvagio (2024) stresses that orchestras need active engagement in community, education and innovation to become not only a source of entertainment, but also promoters of social justice, cultural diversity and emotional well-being.

Chyja and Others (2021) point out that symphony orchestras are dependent on listeners and must ‘discover’ themselves again in response to changes in the pandemic. It stresses that the digitisation of concerts, the costs and revenues, and the attitude of listeners towards the transformation of orchestras are important for all orchestras. Similarly, Szedmak (2021), who in interviews with 10 orchestra executives highlighted the need to apply new digitalised management models, integrate digitalisation in the performance, audience engagement, game elements, visualisation and virtual reality to adapt to a changing world. According to him, correct leadership and insights allow the orchestras to maintain their positions.

Chen and Others (2023) examined the sound quality of a symphony orchestra from the perspective of its listeners. They note that the acoustics of concert halls are judged by beauty and sound, but the quality of sound can vary greatly depending on the place of the listener in the hall. A study in virtual space has shown that sound is mostly influenced by distance from the stage, and quality sound is a subjective parameter. These studies are constantly being repeated due to changing technologies.

Gibbs (2019) drew attention to the development of Broadway musicals, for which orchestras need to adapt by introducing digital technologies needed to imitate new genres, such as hip-hop or electronics. Although technology allows us to reduce the number of members and budget of the orchestra, it poses a threat to jobs of musicians. The musicians' union aims to control the use of technology and ensure the importance of live musicians. Gibbs looks at three technologies – synthesizer, virtual orchestra and Ableton Live – and highlights that trade union interests and outdated regulations are hindering the uptake of technology, even though musicians would like to apply them (Gibbs, 2019).

Vaag et al. (2015) addressed the psychosocial risks of musicians. A study of 1607 Norwegian musicians showed higher levels of anxiety, depression and stress, especially among vocalists, keyboardists and soloists. The untimely deployment and pressure of technology further exacerbates these problems. Kammerhoff et al. (2019) notes that successful technology integration depends on the resolution of interpersonal conflicts, collaboration, artistic vision and hierarchy, and that technology can facilitate these changes. Russel (2012) has previously pointed out that digital engagement requirements can lead to dissonance between musicians' self-perception and professional experience, so empowerment strategies are vital to the orchestra's modernity and musicians' satisfaction.

In conclusion, the integration of digital technologies into the activities of the symphony orchestra is a two-way process: it helps to improve the quality of performance, communication and marketing, and to adapt to the needs of listeners, whether aesthetic, emotional, educational or health-related. The most commonly used

technology is the production and dissemination of music on digital platforms. Success depends on timely application and consideration of real needs. The role of orchestras is expanding, and not only concerts, but also closer contact with audiences and educational initiatives are expected. Virtual concerts must create meaningful experiences and interactivity. While digitalisation raises concerns about potential job losses for musicians, it allows them to reach a wider audience, encourage audience engagement and contribute to the professional development of musicians. In this regard, there is suggested the following research question for the empirical study: How does the integration of the digital technologies into the activities of the symphony orchestra empower the performannce of the musicians of the symphonic orchestra in the different areas of activities by developing their competences?

Methodology and organisation of the survey

The methodology has been finally decided after the literature review. The analysis of the scientific literature and the formulation of the survey questions disclosed that the most appropriate methodological appraoch is a quantitative survey using a survey questionnaire. The questionnaire was created in stages, in parallel with the writing of the theoretical part, in order to quickly incorporate relevant ideas and ensure the formulation of questions suitable for the research.
Prior to the publication of the questionnaire, a pilot study was carried out in which 8 respondents participated. This procedure made it possible to assess the clarity of the questions without the need for corrections. The survey was subsequently published on the platform 'Apklausa.lt' and its link was active until 1 April 2025, after which data analysis and interpretation of the results started.

Methods of data collecting and analysis

There was chosen an online questionnaire with 30 questions. Thi s choice is based on the following arguments:
• the ability to collect data from several orchestras quickly and efficiently;
• anonymity, which can promote openness in more sensitive topics;
• simple analysis of data and comparison of results between groups;
• the possibility of including open-ended questions complementing quantitative data with qualitative information.
The link to the online questionnaire was actively shared within the musicians' community through rehearsals and messaging on the Messenger platform. Responses were received consistently and participants were eager to fill in the questionnaire.

Data processing and analysis

Data was exported from the system of Apklausa.lt to Excel, where graphs, tables and percentage analysis were created. The results are given in absolute numbers and percentages.

Survey instrument

A specially prepared questionnaire based on the analysis of scientific literature and responding to the purpose and questions of the research was used for the research. The questions are grouped into six thematic blocks, which cover demographic data, attitudes towards digital technologies, practices in their use, the impact on the professional performance and well-being of musicians, and professional development.

Such structure of the questionnaire helps toassess the attitude of musicians towards the integration of digital technologies into the activities of the orchestr. It is also helpful for determining the influence of technology on professional autonomy, motivation, decision-making. The questions also target identifying the competences needed to succeed in the digital transformation and reveal the emotional and practical relationship of musicians with technological changes.

The questionnaire was designed to cover both quantitative (closed-ended) and qualitative (open-ended) questions, allowing to receive not only statistical information, but also insights from opinions and experiences. The qualitative data were analysed by applying thematic analysis approach.

The research was conducted in accordance with all ethical requirements for social science research. Participation was voluntary and participants were guaranteed anonymity and confidentiality. The identity of the study participants shall not be disclosed in order to protect the interests of the study participants and to ensure data protection. The researchers sought to maintain objectivity and avoid conclusions that could negatively affect the institutions or individuals involved in the investigation.

Sample of the study

The research was conducted by interviewing musicians of Lithuanian orchestras. 144 respondents replied to the questionnaire. 66% belong to the 26-35 age group, , 34% are 36-45 years old. More than half of the participants in the orchestra have been working for more than 11 years: 27% said they had more than 21 years of service, while another 27% indicated they had 11-20 years of performance experience, and around 20% – 6-10 years' performance experience.

Limitations of investigation.

The study has been conducted with a limited sample, so its results can be interpreted as first steps in the wider context of musicians' use of technology. Future research could focus on qualitative aspects and wider groups of musicians. Nevertheless, this work provides valuable insights into the attitude of orchestra musicians towards digital transformation and professional development.

Results of the study

Approach to digital technologies.

Participants in the study showed varying levels of interest in digital technologies. Around 27% of respondents are actively following technological developments, while another 36% are interested but not very involved. 32% show only limited interest, while 4% admit not to be interested at all. This shows that while most musicians are to some extent interested in technology, their activity and attitudes in this field vary significantly.
In terms of their technological competence, 56% of musicians consider themselves to be medium-level consumers and 26% have identified themselves as skilled consumers. Meanwhile, 12% admitted to using technology rarely, and 6% identified themselves as beginners.
Such results reveal that the musicians of the orchestra are distinguished by various levels of digital skills, from advanced to beginners.

Use of digital technologies in the workplace.

Musicians do not yet use digital technologies very actively: 51% say they use them regularly, 31% only occasionally and 18% do not use them at all). This shows that the integration of technology in the daily life of orchestras is not yet common and is slow.

The most commonly used devices are a smartphone (26%), a tablet (22%) and a computer (12%). Less common are digital scores (10%), online platforms (8%), chat apps (5%) or even artificial intelligence (4%). Only one musician participated in the virtual rehearsal. This shows that everyday practice is dominated by simple, familiar tools, and advanced technologies are not yet widely applied.

While the use of technology is slow, access to it is quite satisfactory: 47% of respondents always have access to the tools they need, with a further 14% having access most often. Only a few cases indicate limited access. Interestingly, most

musicians feel comfortable using digital technology in their activities related to the musical performance: 35% very comfortable, 38% comfortable. Only 3% feel very uncomfortable. This means that while not everyone is actively using digital tools, most feel confident and stress-free with them.

The impact of digital technologies.

Musicians recognize that digital technologies make work easier: 24% of respondents indicate that they save time, 17% help them learn more quickly, 13% improve the organisation of rehearsals and 11% appreciate better communication and music analysis. Technology also gives more control (10%) and autonomy (9%).
However, some musicians believe that this has not changed their work. We asked the participants about the influence of technology on decision-making. While more positive responses were expected, 42% were neutral and 26% agreed that technology contributes to better decision-making. This shows that while technology helps in practical work, its role in decisions is not yet fully clear.
Answers disclose that digital technology contributes most to:

- acceleration of work and communication with colleagues,
- the sharing of notes and the use of chambertone,
- self-monitoring and access to the library,
- error analysis,
- optimisation of rehearsals,
- reducing additional work (e.g. sheet printing),
- convenient use of digital scores on stage,
- work planning and stress reduction,
- reduction of errors.

Thus, although musicians do not always directly feel the influence of technology on decisions, practice shows their importance in everyday activities.

The impact of digital technologies on communication and learning.

Most musicians value the impact of digital technologies on communication in a neutral way (39%), but 22% feel a clear improvement and 11% feel no influence. This shows that technology has not yet fully established itself as the main communication tool in the orchestra or that its potential in this field has not yet been exploited.
In practice, technology accelerates the sharing of information and notes, allows you to solve issues remotely, share ideas and organize rehearsals more efficiently. Digital devices and solutions help to plan time and encourage interest in innovation. However, some note that while communication is getting easier, it can lead to a loss of social connection.

When it comes to learning, most musicians agree that technology helps to improve skills: 34 % strongly agree, 43 % agree. Only a few believe that their learning does not depend on technology. However, the impact of technology on learning motivation is limited, with the majority (19%) considering it neutral, while only a minority feels more encouraged to learn.
When asked whether digital teaching methods are more effective than traditional ones, almost half of the musicians supported them, but most remain cautious or neutral. This shows that traditional methods are still important, and the use of technology in teaching has potential, but has not yet been fully exploited.
Technological and organisational formats of learning and the impact of technology in the orchestra. Musicians of the orchestra are most fond of learning through videos (38%), mobile apps (24%) and online courses (23%). Interactive simulations are not yet popular (9%) and 6% have no experience with digital learning. This shows that visual and convenient forms of independent learning receive the most attention, but the use of technology is not the same in all areas.
Digital technologies mainly affect individual practice (41%), preparation for concerts (28%) and organisation of rehearsals (16%). Digital tools improved communication with colleagues by only 5% and administrative work by 8%. This means that technology is more likely to facilitate personal or preparation processes than collective or organizational ones.
When it comes to decision-making at work, 37% of musicians feel that technology gives them more autonomy, but 33% feel that working principles have not changed. One even mentioned that the freedom of decision had diminished. Thus, the impact of technology on freedom and change in the orchestra is mixed.

Upskilling.

Musicians would be most interested in learning through remote courses (32%), individual consultations (26%) and orchestra seminars (24%). For some, training seems unnecessary, showing different levels of preparation or motivation.
While not everyone is very active in learning digital skills, as many as 77% want the orchestra to invest more in digital technology training, and 20% responded ‘don’t know’. This demonstrates a shared desire for improvement and the need for better organised learning opportunities.
84% of musicians are interested in how technology can help them develop better, be more creative or communicate better. Most also want to know how digital technologies are changing the way the orchestra is organised – 84% agree, but 8% do not.

A further 89% are interested in how technology could be integrated into their professional learning, while only a few (4%) are not interested. This shows that musicians are striving for modern and innovative ways of learning.
Most (70%) believe that technology increases their autonomy and decision-making capacity, but there are also doubts and uncertainties. However, 85% agree that digital technologies contribute to professional development, although 9% do not see this connection.

Views of musicians to digitalisation in musical performance.

Digital transformation is inevitable and musicians view it in many different ways. As many as 42% feel positive and think that it is mostly useful, and 29% even believe that digital innovation makes work much easier. However, 7% are negatively affected by technology, which poses additional challenges and burdens. A further 22% take a neutral position as they have not yet experienced significant changes.
This shows that while most musicians are optimistic, there are still a number of doubts or difficulties. It is therefore important to further explain, support and showcase successful examples.
As for emotions, the participants of the study revealed a rather colorful spectrum: 38% feel curiosity and interest, 28% are happy because technology helps work and 26% are simply neutral because they accept the situation as it is because they do not see the potential to change it. However, 8% feel stress and frustration because they do not feel relief from work or other positive changes.This is a good illustration of how different musicians are going through the digital transformation inside.

When it comes to attitude changes over the past year, 41% of musicians feel more confident and comfortable using technology, and 32% are still learning but looking at it positively. 18% say that their attitude has not changed, 4% express negative attitudes and 5% feel challenges and inconveniences.
Thus, most orchestra musicians feel more comfortable with digital technologies, some are still learning, and a small group faces difficulties or negative emotions.
Summary of the results of the study
The attitudes of musicians towards the digital transformation are mostly positive, but there is often a certain degree of neutrality – indifference, but rather caution and uncertainty about how things will develop further. Most musicians are interested in innovation, but more often they learn, observe and wait for impulses from the outside, rather than boldly moving forward. Those who are challenged by technology or uncomfortable are rarely openly opposed – they recognise that digitalisation is inevitable.

The practical use of technology in the life of the orchestra has so far been rather limited, mostly by phone or tablet, while innovations such as artificial intelligence or digital scores are still used infrequently. Musicians feel comfortable with technology, but their application is often superficial and fragmented, which may indicate a lack of systematic solutions or proper training.
However, musicians make it clear that technology makes work easier by improving organisation, making rehearsals more effective, helping to better plan and collaborate, and making the flow of information faster. However, in the field of social communications, the impact of technology is often not felt, and neutral provisions indicate that practical usefulness is still lacking or that changes are not yet unusual.
When it comes to learning, musicians appreciate the potential of technology – they particularly like videos, apps and online courses. However, while these tools are useful support, they do not always inspire greater motivation to learn. However, most would like the orchestra to invest more in training in digital technologies, as there is a feeling that the potential has not yet been exploited and there is a desire to improve.
The range of emotions is varied, with many feeling curiosity and joy, but many being neutral, as if they were ready for change, but still do not dare to go deeper. Stress and frustration remain a minority issue, but their importance is significant. Over time, more and more musicians feel confident, but still not everyone has overcome the emerging challenges. Thus, while positive emotions dominate, they are often accompanied by fragmented behaviour, acknowledging the benefits, but lacking internal motivation and structural support to make the benefits of digital technologies a reality in everyday life.

Discussion

The results of the scientific literature analysis and quantitative research provide a better understanding of the dynamics of the empowerment of musicians of the symphony orchestra through digital technologies and their attitude towards this process. Empowering musicians, as illustrated by literature, is not only about recognising competences, but also about empowering them to act – to decide, plan, learn, create and collaborate. The research confirms that the use of digital technologies in the orchestra can significantly contribute to increasing autonomy: 70% of musicians agree that technology gives them more autonomy and 37% say it helps them make decisions. These figures represent a great potential that orchestras could use more efficiently.
However, while technology is seen as a means of organising performance and improving it‘s efficiency – for example, helping to plan rehearsals or share notes –

their integration in the orchestra's activities remains fragmented and mostly takes place 'from the ground up', i.e. on the initiative of musicians, rather than as part of the orchestra's systematic strategy. Frequent use of technology is limited to smartphones, tablets and simple apps, while more innovative solutions such as artificial intelligence or digital scores are still rare. This reveals a lack of systemic solutions, appropriate training and incentives that prevent empowerment from being fully established.

Interestingly, while musicians often feel comfortable with technology, their practical use is fragmented and superficial. This discrepancy between a positive attitude and a limited practical engagement reflects a degree of caution or uncertainty, which may be linked to a lack of systematic support and a lack of internal motivation. This conclusion is also supported by the fact that, while 77% of musicians want more training, technology does not always increase their motivation to improve – it is seen as a useful tool, but not as an inspiration.

Another important aspect of the study is the conflicting attitudes of musicians towards the impact of technology on decision-making and peer-to-peer communication. While the majority agree that digital tools increase autonomy, almost half of respondents (42%) remain neutral, with only a minority feeling that technology significantly improves their decision-making. This shows that the formal possibilities to act more independently have not yet been fully realized in everyday practice. There is also a paradox in the impact of technology on communication: while they speed up the flow of information and facilitate organisation, almost 40% of musicians do not see a clear improvement in the quality of communication. This may be a sign that technology is not yet a substitute for the human connection that is crucial in the orchestra's work.

In conclusion, the empowerment of the musicians of the symphony orchestra through digital technologies is at an early stage of development. The results of the research reveal a strong desire for improvement, interest and openness to innovation, but there is a lack of systematic and targeted integration of technologies, structured support and motivation. This situation creates quite a clear tension between opportunities and reality, between the freedom provided by technology and internal doubts or fears. Therefore, in order for digital technologies to become not only tools, but also a factor of cultural change in the orchestra, it is necessary not only to introduce technological solutions and devices, but also to develop an organizational culture in which musicians feel confident, valued and empowered to exploit the full potential of technology.

Conclusions

Empowering of musicians to perform in a symphony orchestra adds value at several levels: individual, organisational and social. Greater autonomy and freedom of decision improve work performance, speed up learning (85% of respondents), and increase creativity and motivation (84%). Technology contributes to more efficient planning, communication and time-saving, and 37% of musicians have experienced greater autonomy. While technology strengthens the sense of community from a social point of view, some musicians remain neutral due to their impact on relationships (39%). However, not only technology implementation, but also organizational support and internal preparation are important for empowerment. Artistic music in itself also acts as an enabler, enhancing identity and a sense of belonging even in the context of digital change.

Integrating digital technologies into the activities of orchestra is a complex and multifaceted process. It covers both internal organisational processes – dissemination of information, organisation of rehearsals, learning, and external communication with the audience – digitisation of concerts, education, emotional communication. The most commonly used technologies are for creation and sharing of records (38%), scheduling and communication in groups (28%), and individual practice (41%). Virtual concerts form a new audience experience, but some musicians (33%) feel that technology does not change their working principles, and 8% are stressed by change. These circumstances reveal the new role of the orchestra, not only as a concerting collective, but also as a community, educational and social centre. However, it is important to ensure that technology complements live performance rather than replacing it, which is one of the concerns of musicians.

The empowerment of musicians and the use of digital technologies are closely linked and mutually reinforcing. Technology acts as an enabler, providing more autonomy, opportunities for improvement and self-expression. At the same time, empowered musicians are more likely to experiment and adopt new technologies, which accelerates the digital transformation of the orchestra. This interaction is bidirectional and depends on the support of the organization, the emotional environment and personal readiness. Technology does not reveal its potential without conscious cultural and organizational adaptation, so it is not an end in itself.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-11

Empowering Learning in the Age of AI: Towards Inclusive and Human-Centered Workplaces

Wan-Ying Tay and Zan Chen

As artificial intelligence (AI) transforms the workplace, its role in reshaping how professionals learn, grow, and adapt has moved to the forefront of lifelong learning debates. This chapter explores how AI can be harnessed to foster inclusive workplace learning and empower workers. Focusing on cases from the finance, insurance, and hospitality sectors in Singapore, the chapter builds on the concept of socially embedded capability (Boyadjieva & Ilieva-Trichkova, 2021). It proposes that meaningful empowerment emerges when AI is embedded in work that expands both individual agency and workplace affordances.

Using secondary qualitative research method (Cheong et al., 2023), we examine how AI tools (e.g., adaptive learning platforms, analytics dashboards, AI robots, AI mentors) are being deployed to scaffold learning, drive performance, and reconfigure work roles and practices. Through these cases, the chapter reveals both the empowering possibilities of AI and the risks of deepening inequality when AI is deployed without attention to access, equity, and workers' active participation.

Integrating three theoretical perspectives: socially embedded capability (Boyadjieva & Ilieva-Trichkova, 2021), personal and relational agency at the workplace (Littlejohn, 2023; Edwards, 2010), and cognitive-behavioural research on deep learning (Bjork et al., 2013; Ryan & Deci, 2017), the chapter shows that effective AI design must support both individual reflection and collective sense-making. The three organisations examined, namely, Prudential (insurance), OCBC Bank (finance), and Hilton Singapore (hospitality), operate in sectors where trust, judgment, and human interaction are central to professional practice. Insurance relies on careful assessment and ethical decision-making; banking emphasises advisory relationships and long-term customer confidence; and hospitality depends on emotional intelligence and frontline empathy. These sectors, therefore, provide rich contexts for examining how AI interacts with socially embedded capabilities, personal and relational agency, and deep learning processes, illustrating how intelligent systems can both enhance and constrain reflection, collaboration, and human development in high-touch, safety-critical environments.

The chapter concludes that AI should be perceived not merely as an instrument of efficiency but as a medium for expanding human potential. It calls for organisational and policy frameworks that ensure inclusive access, participatory design, and a human-centred approach to AI adoption in the workplace.

Keywords: Workplace learning, Artificial Intelligence (AI), socially embedded capability, personal agency, relational agency, cognitive-behavioural research

Introduction

The interaction between humans and machines is becoming commonplace. It unfolds every morning when office workers boot up their computers, every afternoon when hotel staff coordinate with service robots, and every evening when call centre agents conclude conversations guided by Artificial Intelligence (AI) insights.

Such interactions extend far beyond the straightforward, familiar narrative of efficiency and productivity. It addresses the core of what it means to grow, to develop expertise, and to become more capable human beings in an interconnected world. The question is no longer whether machines can perform our tasks; it is whether they can become thoughtful companions in our journey towards mastery.

Against this backdrop of evolving human-machine collaboration, Singapore offers a uniquely illuminating vantage point. The nation has long positioned lifelong learning as the bedrock of economic competitiveness, investing heavily in initiatives like SkillsFuture that encourage continuous skill development (SkillsFuture, n. d.). This commitment provides a strong foundation for exploring how AI can enhance, rather than replace, human learning.

While the city-state's economy rests on a diversified base, the finance, insurance, and hospitality sectors provide affluent contexts for studying AI adoption. These sectors are not only critical drivers of Singapore's competitiveness but also domains where service quality, trust, and human interaction remain indispensable. They therefore offer valuable settings for examining how learning, judgment, and professional identity are reshaped alongside intelligent systems.

In this chapter, we explore how artificial intelligence is reshaping the conditions under which people learn, act, and develop in their workplaces. Guided by this context, the chapter is organised around three interconnected research questions. First, how does AI shape socially embedded capability in the workplace, particularly workers' opportunities to participate meaningfully in learning, to feel included, and to sustain confidence and professional identity? Second, how does AI influence workplace learning agency, at both personal and relational levels, as employees learn to reflect,

collaborate, and exercise judgment alongside intelligent systems? Third, how do AI-enabled tools and environments support or hinder deep learning processes, such as metacognition, retrieval, and the development of adaptive expertise in real-world work settings?

To explore these questions, the chapter uses analytic case narratives drawn from publicly available organisational documents, media reports, and industry publications. The cases are written as composite and fictionalised accounts, not to represent specific individuals, but to synthesise recurring patterns observed across documented practices within each sector. This approach is well established in organisational and social research, where narrative inquiry treats stories as analytic devices for interpreting action, meaning, and sense-making rather than as literal accounts of events (Czarniawska, 2004). Recent methodological work further demonstrates how composite character narratives grounded in empirical data can be used to surface social mechanisms and relational dynamics while maintaining analytic rigour and ethical clarity (Arjomand, 2022). The case narratives, therefore, function as interpretive lenses through which broader processes of capability, agency, and learning with AI can be examined.

Taken together, this chapter frames AI not simply as a technical intervention, but as a social and cognitive phenomenon that interacts with capability, agency, and learning at multiple levels. It is organised in three sections. It begins by introducing the theoretical lenses that guide our discussion: socially embedded capability, workplace learning agency, and perspectives from cognitive and behavioural sciences. It then examines sectoral cases drawn from publicly available sources, each illustrating how AI can act as a learning companion while also exposing risks of exclusion and inequity. The final section compares insights across these cases, draws out implications for organisational and policy design, and concludes with a call for human-centred and inclusive approaches to AI adoption.

Literature Review: AI, Capabilities, and Agency in Nested Systems of Learning

Artificial intelligence in workplaces is too often described in practical terms: streamlining workflows, improving efficiency, or boosting productivity. While these outcomes matter, such views miss the deeper question: how does AI reshape the conditions under which people learn, exercise judgment, and grow as professionals? Addressing this question requires moving beyond descriptions of tools and applications to frameworks that consider learning as part of a wider organisational and social system.

This section draws on three interconnected strands of thinking to examine both the promise and the risk of AI as a learning companion: socially embedded capability, workplace learning agency, and cognitive and behavioural insights. Together, these perspectives help resist what Selwyn (2011) calls technological determinism, defined as the assumption that technology produces progress. As scholars such as Crawford (2021) and Regmi (2024) remind us, technologies are never neutral; their effects depend on the social, organisational, and policy contexts in which they are created and used, and on the power relations that determine who benefits from them. Thinking about AI in this way situates it within a nested system of learning, where individual actions, workplace practices, and institutional structures continuously shape one another (Engeström, 2001; Bronfenbrenner, 1979). Within such systems, AI can either extend human capability and inclusion or deepen existing divides in workplaces.

Socially Embedded Capability: Learning as a Collective Achievement

The capabilities approach, initially developed by Amartya Sen (1999) and later extended to educational contexts by Martha Nussbaum (2011), underscores that what people can do and become depends not only on their own abilities but also on the social and institutional conditions in which they live. Building on this perspective, Boyadjieva & Ilieva-Trichkova (2021) describe learning as socially constructed rather than personally achieved. This suggests that access to learning technologies is insufficient unless learners are meaningfully empowered to engage with them (Pan, 2023). These enabling conditions include social support, cultural understanding, and institutional recognition. Studies show that the impact of technology depends less on the tools themselves and more on the social and organisational environments in which they are used. Tawfik et al. (2016) highlight how learning technologies often reproduce existing inequalities when organisational structures remain unchanged, while Mishra et al. (2020) demonstrate that social networks and peer support are stronger predictors of learning success than mere access to devices or software.

This socially embedded capability perspective is particularly relevant for understanding how AI could potentially shape opportunities for learning at work. What matters is not how advanced the technology is, but whether it supports or limits people's ability to learn and collaborate. As Flores-Crespo (2007) notes, capability expansion "requires friendly conditions" (p. 60), not simply the presence of resources or tools. Just as schools need supportive pedagogical and institutional arrangements, workplaces must provide enabling cultures, structures, and affordances if AI is to enhance learning and participation genuinely. Afterall, beyond access and structure, participation also depends on how included and valued people feel. Social support

does more than enable learning; it sustains motivation and belonging, the psychological conditions that turn opportunity into engagement (Deci & Ryan, 2000). When thoughtfully designed, AI can strengthen these relationships by connecting people with similar goals, surfacing shared challenges, and supporting reflective dialogue.

Recent studies show that AI-enabled tools and analytics can foster collaboration and reflective dialogue among professionals, helping learners situate their work and development within a shared, collective process. For example, Wang et al. (2025) demonstrate how intelligent teaching analytics support collaborative reflection and shared regulation, while Arefian, Esfandiari, and Zarei (2025) show that AI-based reflective tools can function as collaborative partners that deepen joint sense-making. Complementing this, Wei et al. (2025) find that generative AI can enhance collaborative problem-solving and team performance, suggesting that well-designed AI systems can contribute meaningfully to collective learning and professional growth.

While social participation is central to professional learning (Wenger, 1998; Billett, 2004), recent studies of AI-mediated feedback warn that automation can weaken learning relationships by displacing dialogue and shared interpretation (Kukulska-Hulme & Ilic, 2025). Notably, Shibani and Buckingham Shum (2024) highlight ecosystem-level risks in AI-assisted writing, cautioning that design must foreground interpretability, human judgment, and equitable practices rather than merely boosting efficiency.

Additionally, Boyadjieva and Ilieva-Trichkova (2021) emphasise that lifelong learning depends on social structures that either enable or constrain individual action, such as workplace cultures, organisational norms, and institutional recognition. In Singapore, Chen and Tan (2024) found that adult educators' willingness to engage with digital learning tools depends on factors such as organisational support, workplace affordances, and innovative culture.

These insights above shift the conversation from access to capability, underscoring that AI's promise lies not in technological sophistication but in the social and institutional scaffolds that enable people to learn, reflect, and act together. The impact of AI on workplace learning, therefore, hinges less on the power of algorithms and more on whether organisations preserve and strengthen the human conditions, dialogue, trust, and collective sense-making, through which real empowerment and professional growth emerge.

Workplace Learning Agency: Personal and Relational Dimensions of Learning

While the previous section focused on how learning opportunities are socially created and sustained through organisational and institutional conditions, this section turns to how people exercise agency within those environments. In other words, it shifts attention from the availability of learning affordances to the ways workers interpret, take up, or resist learning opportunities in practice.

To examine this, we draw on Littlejohn's (2023) conceptualisation of workplace learning agency, which offers a robust lens for understanding how both personal and relational agency are enacted within organisational settings. Building on Edward's (2010) distinction, Littlejohn posits that agency is not solely an individual attribute but could be perceived as something that is exercised through ongoing interaction between individuals, others, and the conditions of work. From this viewpoint, effective workplace learning depends not only on individual initiative, self-direction, and reflection, but also on collective sense-making, collaboration, and the capacity to work with others.

This framing is particularly relevant for understanding how AI reshapes learning at work. As intelligent systems increasingly mediate access to information, feedback, and opportunities for action, they become part of the environment through which agency is exercised. AI can therefore either strengthen workplace learning agency by supporting reflection, dialogue, and coordination, or constrain it by narrowing discretion and displacing relational interaction. Littlejohn's (2023) account helps make this tension visible, highlighting why the design and embedding of AI systems matter for how workers learn, adapt, and participate meaningfully in organisational life.

Within this framework, workplace learning agency can be understood through two closely related but analytically distinct dimensions: personal agency and relational agency. Distinguishing between these dimensions clarifies how learning is enacted in practice and why AI systems may support or disrupt learning in different ways. Personal agency foregrounds individuals' responsibility for directing and regulating their own learning. In contrast, relational agency draws attention to how learning unfolds through interaction, collaboration, and shared sense-making with others. Together, these dimensions provide a valuable lens for examining how AI-mediated environments shape not only what workers learn but also how and with whom they learn.

Personal agency involves workers' ability to set learning goals, select appropriate resources, monitor their progress, and adapt their approaches in response to feedback and reflection. This metacognitive dimension of learning agency aligns closely with

research on self-regulated learning (Zimmerman, 2002) and expert performance (Ericsson & Pool, 2016), which emphasise learners' active role in orchestrating their own development.

Relational agency, as conceptualised by Edwards (2010), extends beyond individual self-direction to encompass collaborative capacity, that is, the ability to work with others to expand possibilities for action and learning. This involves recognising and mobilising the resources that others bring to shared challenges, negotiating different perspectives and expertise, and co-constructing solutions that individual learners could not achieve independently. Such collaboration depends on psychological safety and mutual trust. Workers are more willing to share, question, and co-create when they believe their contributions are recognised and not displaced by algorithmic systems (Mirbabaie et al., 2022).

The distinction between personal and relational agency is crucial for evaluating implementations of AI learning companions. AI systems can enhance personal agency by providing timely feedback, adaptive challenges, and reflective prompts that support self-regulated learning. However, they risk undermining relational agency if they substitute algorithmic interaction for human collaboration or create competitive dynamics that discourage knowledge sharing and shared sense-making.

While social participation has long been recognised as central to professional learning, recent research on AI and digitally mediated learning highlights how design choices critically shape the quality of learning relationships. Knight, Shibani, and Buckingham Shum (2023) demonstrate that ethical and interpretive design in learning analytics can preserve learner agency by supporting dialogue and reflection rather than delivering automated judgments. Complementing this, Holmes et al. (2022) argue that human-centred AI must be grounded in shared values and collective responsibility, cautioning that efficiency-driven automation risks eroding trust and participation when relational dimensions are neglected.

Research on feedback and dialogue further reinforces this concern. Ajjawi et al. (2025) and Dai et al. (2025) emphasise that effective feedback is inherently relational and dialogic, requiring opportunities for interpretation, response, and shared meaning-making. When feedback becomes overly automated or one-directional, learning relationships may be weakened. At the same time, recent empirical studies show that AI can support collective learning when designed to scaffold collaboration rather than replace it. Wang et al. (2025) illustrate how intelligent analytics can foster collaborative reflection and shared regulation, whereas Wei et al. (2025) demonstrate that generative AI can enhance collaborative problem-solving and team performance.

Synthesising across these findings, the impact of AI on workplace learning depends less on the degree of automation or technical sophistication than on whether systems

are designed to sustain dialogue, interpretability, and collective sense making within supportive organisational contexts. Rather than optimising efficiency alone, these studies point to a clear design principle: AI systems should not think for people, but think with them. When AI preserves human discretion, invites interpretation, and supports reflective engagement, it can function as a learning companion, extending professional capability while safeguarding agency, accountability, and responsibility.

Cognitive and Behavioural Science: Building Deep Learning

Research in cognitive psychology and the learning sciences offers important insights into how AI can be designed to strengthen, rather than weaken, learning. A key contribution of this body of work is the recognition that effective learning is not simply a matter of exposure or efficiency, but depends on how learners actively engage with information, regulate their thinking, and work through challenge. Three strands of research are especially relevant to understanding AI-enabled workplace learning: retrieval practice, metacognitive awareness, and the productive role of challenge.

The first concerns retrieval practice, often referred to as the testing effect. A substantial body of evidence indicates that active recall leads to stronger retention and transfer than passive review. Carpenter, Pan, and Butler (2022) demonstrate that long-term understanding improves when learners retrieve and apply knowledge. From this perspective, AI systems can support deep learning by prompting learners to explain ideas, generate examples, or apply knowledge across varied contexts, thereby encouraging active engagement rather than passive consumption.

The second strand focuses on metacognition, understood as the ability to monitor, regulate, and reflect on one's own learning and thinking processes. Research by Fleming and Dolan (2012) and Dunlosky et al. (2013) shows that skilled learners continually assess their understanding, adapt strategies in response to feedback, and reflect on progress over time. Emerging research suggests that AI can support these metacognitive processes when it is designed to scaffold reflection rather than replace it. For example, Tomisu, Ueda, and Yamanaka (2025) describe a Cognitive Mirror framework in which AI externalises aspects of learners' thinking, enabling them to reflect on their reasoning and identify misconceptions. Similarly, Li et al. (2025) provide empirical evidence on how analytics can capture self-regulated learning strategies and how scaffolding relates to learning performance. What emerges from these studies is that AI systems can make thinking processes more visible and foster reflective habits, provided they enhance rather than automate human judgment.

The third insight concerns the concept of desirable difficulty, which challenges the assumption that learning should always feel smooth or effortless. Research in learning

science shows that effortful engagement plays a critical role in durable learning. Bjork, Dunlosky, and Kornell (2013) argue that learning is strengthened when tasks are challenging yet achievable, as such conditions prompt deeper cognitive processing and support long-term retention. Forms of productive struggle, such as varied practice, spaced review, or the need to generate responses rather than recognise them, encourage learners to integrate knowledge more robustly when paired with timely feedback and support. Difficulty, when carefully calibrated, is therefore not an obstacle to learning but a key mechanism through which learning becomes durable and transferable (Kapur, 2024).

These cognitive and behavioural insights align closely with Vygotsky's (1978) notion of the Zone of Proximal Development, defined as the space between what learners can accomplish independently and what they can achieve with guidance. In workplace settings, AI companions can function as responsive supports within this zone by adjusting the level of challenge, prompting reflection, and offering real-time feedback. Importantly, such systems do not replace human mentors or social learning. Instead, they extend moments of coaching and feedback that may otherwise be scarce. However, the potential of AI to act as a developmental scaffold depends critically on the quality of learner engagement and the surrounding motivational conditions. Deep learning requires sustained effort, reflection, and appropriately calibrated challenge. For designers of AI-enabled learning systems, the goal is therefore not to eliminate effort but to make it meaningful. This involves supporting learners in thinking more deeply, acting with greater awareness, and developing capabilities that endure. Challenge becomes productive only when learners feel competent and supported, echoing Self Determination Theory's emphasis on autonomy, competence, and relatedness as foundations for sustained motivation and learning (Ryan & Deci, 2017).

Case Analyses Based on Composite Narratives

To examine how AI reshapes workplace learning, this chapter uses secondary qualitative analysis of publicly available organisational documents, press releases, industry reports, and media coverage of company initiatives in Singapore between 2024 and 2025. These sources form the empirical basis for understanding how AI systems are framed, coordinated, and experienced across organisational contexts. Rather than presenting descriptive summaries alone, the chapter employs analytic case narratives constructed from composite and fictionalised characters. These characters are not intended to depict specific individuals but to synthesise recurring

patterns, learning situations, and relational dynamics observed across the documentary data.

Using composite narratives as analytic devices is well established in qualitative research. In his foundational work on narrative methods, Czarniawska (2004) argues that organisational storytelling offers insight into interpretive processes and meaning-making. Similarly, composite narratives are used to present complex situated accounts in ways that maintain contextual richness while protecting anonymity (Willis, 2018). Thompson et al. (2025) demonstrate how composite stories derived from synthesised research findings can humanise data and make findings accessible to broad audiences, illustrating thoughtful procedures for constructing such narratives. Johnston, Wildy, and Shand (2023) illustrate how composite narratives can faithfully reflect multiple participants' experiences in qualitative research by drawing on thematically coded data to represent shared phenomena. Together, these sources show that the composite narrative is not an ad hoc device but a recognised qualitative strategy for making sense of multiple data sources and for emphasising patterns, processes, and typicality.

The specific character construction process in this chapter followed three key analytic steps. First, documentary sources were collected and coded thematically to identify recurrent roles, practices, tensions, and learning dynamics associated with AI adoption. Second, these themes were clustered into typical configurations of work and learning (e.g., career reflection, judgment calibration, empathy training) that cut across multiple sources. Third, composite characters were developed to embody these configurations and to illustrate how individuals might experience and respond to AI in everyday work. To maintain traceability, we preserved an explicit mapping between coded data clusters and narrative elements, consistent with best practice in composite narrative construction (Willis, 2018; Johnston et al., 2023; Thompson et al., 2025). This approach allows the cases to function as interpretive lenses through which broader processes of capability, agency, and learning with AI can be examined across different workplace contexts.

Case Study 1: OCBC Bank – When the Career Conversation Turns Inward

Sarah sits in a quiet OCBC branch during the mid-afternoon lull, the kind of interlude that rarely exists in the constant rhythm of client meetings and portfolio reviews. As a relationship manager in Global Consumer Financial Services, her role requires not only financial expertise but also the ability to anticipate clients' needs and build trust over the long term. These moments of pause, though brief, are precious. She opens MOBI, OCBC's artificial intelligence-powered career growth companion, unveiled in 2024, as part of her personal commitment to staying ahead in a shifting financial landscape.

The application, introduced during OCBC's "Grow Your Way with MOBI" festival and prominently profiled in the bank's 2024 Sustainability Report, is described not as a traditional learning management tool but as a 24/7 career companion. Its design is simple but ambitious: to help every employee, from frontline branch staff to senior executives, understand their current strengths, identify emerging skills, and chart pathways across the organization. Unlike static course catalogues, MOBI maps employees' competencies against OCBC's evolving opportunity landscape, nudging them toward roles, projects, and learning resources aligned with their aspirations.

Sarah scrolls through her dashboard. It includes a short online course on Environmental, Social, and Governance (ESG) communication and a reminder about a mentoring session with a senior specialist in sustainable finance. They are activities that may be of interest to the employee, assembled into the application that allows her to see options she might not otherwise have considered.

She logs in to the ESG course, which provides structured resources and reflective exercises on integrating sustainability into wealth management conversations. Reading the material, Sarah is struck by a realisation: in her own practice, she often frames ESG around compliance and returns, a perfectly rational approach, but one that misses the deeper client motivations about legacy and values. MOBI has not told her this outright; the reflection arises from engaging with the resources it recommended. The system provides the mirror; the insight is her own.

Building an AI-enabled ecosystem

OCBC's evolving learning architecture shows how artificial intelligence (AI) can be integrated into a broader system of human capability rather than serve as a substitute for it. Beginning in 2023, the bank introduced OCBC GPT, a generative AI tool made available to all 30,000 employees worldwide to support writing, research, and idea generation. Pilot tests involving about 1,000 staff found that tasks were completed around 50 percent faster, including time spent reviewing the AI's output (OCBC Bank, 2023). However, the intent was not simply to improve efficiency but to create space for deeper thinking, reflection, and learning.

In 2024, OCBC extended this philosophy through a S$30 million workforce development initiative focused on building resilience and future skills (People Matters Global, 2025). The initiative included an internal career marketplace supported by AI analytics and a large-scale coaching transformation, with more than 100 senior leaders working toward professional coaching certification (OCBC Bank, 2024a). This combination of technology and coaching reflects the bank's belief that human development must remain at the centre of technological adoption. While AI provides

data-driven insights and scalability, human mentoring and reflection sustain meaning and motivation.

At the heart of this learning system is MOBI, an AI-powered career growth companion launched in 2024 to help employees map their learning and career pathways. Employees can upload their résumés, identify skills, and receive personalised recommendations for learning, coaching, and internal assignments (OCBC Bank, 2024b). These short-term internal gigs, typically lasting between three and eighteen weeks, enable employees to work across functions, build new capabilities, and contribute to cross-departmental projects. Such practices strengthen networks of shared understanding and nurture what learning researchers describe as communities of practice – spaces where knowledge is developed and shared collectively (Wenger, 1998).

MOBI operates alongside MentorMe, a mentoring initiative that pairs employees with experienced leaders to guide professional growth. Together, these programs demonstrate OCBC's effort to build a learning culture that values both technological and human connections. Although OCBC has not disclosed details of MOBI's analytics, aggregated data from such systems likely support leadership in identifying emerging skills, workforce trends, and priority areas for development. In this way, MOBI functions not only as a personal learning companion but also as a strategic tool that links individual learning journeys with organisational foresight.

As illustrated above, OCBC's various initiatives illustrate a layered model of capability development. At one level, AI tools enhance efficiency and insight; at another, analytics support opportunity mapping and mobility; and at a deeper level, human coaching and mentoring anchor reflection, ethical judgment, and belonging. This approach reflects what capability theorists describe as the social embeddedness of learning: progress depends not on technology alone but on the quality of relationships, culture, and institutional support that enable it. In doing so, OCBC offers a compelling example of how AI can serve as a learning companion that enhances, rather than diminishes, human potential within complex organisational systems.

Case Study 2: Prudential – Trusting the Algorithm, Questioning the Claim

Marcus sits in his office at Prudential, a leading insurance company, reviewing a medical claim for a construction worker who injured his knee on-site. The documentation appears complete, the medical reports are consistent, and the claim amount falls within the usual range.

Before he begins, the company's AI tool, powered by Google's MedLM model and developed through Prudential Singapore's AI Lab, has already processed the case. It

summarises the documents, extracts key information, and recommends approval with an 87 percent confidence score. On paper, the reasoning looks sound.

Still, Marcus reviews the documents carefully. After thirty years of assessing claims, he has learned to recognise details that automated systems may overlook, such as the timing of medical visits, the sequence of treatments, or subtle inconsistencies in a doctor's notes. The AI's recommendation prompts him to pause and consider which aspects may require closer examination.

This moment reflects a broader shift in professional work. AI is not only accelerating routine tasks but also changing how people reason and learn. The system provides structure and speed while the human contributes judgment and context. Together, they create a more reflective and deliberate decision-making process.

For Marcus, the AI's high confidence score becomes a cue to examine his own assumptions. For the organisation, this shows how human experience and machine intelligence can complement each other when they are designed and used with care. The interaction is not about deferring to technology but about developing professional awareness, the capacity to sense when to trust, when to question, and how to explain one's reasoning clearly.

Prudential's Responsible AI Journey

Prudential's adoption of artificial intelligence in Singapore exemplifies how efficiency and reflection can coexist within responsible innovation. In 2024, the insurer launched its AI Lab, a regional hub supported by Google Cloud, to develop AI applications that enhance decision quality while maintaining human oversight (Prudential plc, 2024a, 2024b). The Lab operates as a controlled environment where new tools are tested through a secure stage-gate process before being scaled into business operations.

This measured approach reflects Prudential's commitment to governance and trust rather than automation for its own sake. Furthermore, this commitment aligns closely with Singapore's emphasis on ethical and transparent AI use, as articulated in the Monetary Authority of Singapore's FEAT principles, namely, Fairness, Ethics, Accountability, and Transparency (Monetary Authority of Singapore, 2018). In its 2024 Sustainability and Governance Report, Prudential Singapore outlined its internal framework, PruSafeAI, which ensures that all AI and machine learning projects are reviewed for responsible use and subject to multi-level oversight (Prudential Singapore, 2024). Among the first innovations approved through this framework was MedLM, a generative AI model developed in collaboration with Google Cloud to

support claims officers in analysing complex medical documentation with greater accuracy and efficiency (Prudential plc, 2024c).

The introduction of MedLM marked a turning point in how AI was framed within the organisation. Instead of positioning the system as a replacement for human expertise, Prudential described it as a cognitive scaffold – an aid that helps professionals think, verify, and learn more effectively. Officers are encouraged to review and question the AI's recommendations, transforming routine claims work into a process of reflection and retrieval. Research in the learning sciences shows that such active engagement strengthens long-term understanding and metacognitive awareness (Carpenter, Pan, & Butler, 2022).

These practices have also reshaped team learning. As officers compared their interpretations and decisions during regular discussions, the system became a shared reference point for professional dialogue and calibration. The AI not only facilitated individual decision-making but also fostered collective learning and shared standards of judgment. As Prudential's Head of Innovation, Magdalene Loh, explained in an interview with the DesignSingapore Council, the company's innovation ethos is rooted in design thinking and structured experimentation, which focuses on helping people "think differently about problems" rather than automate them (DesignSingapore Council, 2023).

Prudential's broader strategy demonstrates that meaningful AI adoption depends as much on organisational learning as on technical sophistication. By embedding governance, cultivating reflective practice, and encouraging collaboration, the company positions AI as a learning companion that augments rather than displaces human judgment. Its recognition in 2025, through global innovation awards and the Million Dollar Round Table (MDRT) Culture of Excellence distinction, further reflects how a culture of trust, experimentation, and ethical leadership can turn technological adoption into a catalyst for deeper learning and capability development (European Business Magazine, 2025).

Ultimately, Prudential's experience suggests that the actual value of AI in the workplace lies not in the speed of automation but in the quality of thought it enables. By making reasoning more transparent and reflective, Prudential's AI journey illustrates how technology can strengthen, rather than erode, the human capacities of discernment, accountability, and learning.

Case Study 3: Hilton Singapore – AI as Soft Skills Coach in Hospitality

In a quiet training room at Hilton Singapore, front desk associate Mei Lin puts on a virtual reality headset for her weekly practice session. Within seconds, the space

transforms into a digital replica of a hotel lobby. A guest approaches the reception counter, visibly tired and frustrated after a sleepless night due to a malfunctioning air-conditioning unit.

Drawing on Hilton's HEART (Hear, Empathize, Acknowledge, Respond, Thank) service model, Mei Lin begins: "I can hear how frustrating this has been for you." Her words are correct, but as she speaks, the system is already listening back. Using voice-analysis technology developed through Hilton's collaboration with SweetRush and Google Cloud (Hilton, 2024; SweetRush, 2022), the system detects formality in her tone, rapid pacing, and the absence of emotional resonance. A coaching prompt appears on screen:

> *"Notice how the guest's posture changes when you acknowledge her frustration. Try slowing your pace slightly, match her concern with warmth, and sustain eye contact."*

Mei Lin pauses, adjusts, and tries again. This time her tone softens, her posture conveys attentiveness, and the virtual guest's expression relaxes. Her competency dashboard updates in real time, reflecting improvements in empathy, pacing, and service recovery response time. More than a performance scorecard, the dashboard functions as a learning platform, helping trainers and staff identify areas for growth, tailor development plans, and accelerate mastery across teams.

Hilton's Learning Imperative: Training Emotion at Scale

For Hilton, the challenge is one of scale. With more than 400,000 team members worldwide, how can a service brand consistently nurture emotional intelligence, the skill that defines hospitality? A clean room or prompt check-in may please guests, but it is empathy in moments of stress that earns loyalty. Traditional methods, such as classroom sessions or on-the-job shadowing, are limited in developing the subtle emotional awareness that genuine service requires. They also cannot scale easily or deliver consistent quality across properties.

To address this gap, Hilton began experimenting with immersive learning nearly a decade ago. Partnering with SweetRush, a learning design firm based in San Francisco, the company piloted early virtual reality modules in 2015. What began with small-scale trials in safety and diversity training has evolved into an integrated AI-VR learning ecosystem by 2024 (Hilton, 2023; SweetRush, 2022). Singapore now serves as a strategic hub for these initiatives, reflecting the nation's focus on human-centred technology and service excellence.

The system integrates multiple technologies into a single framework. Built on WebXR, it is accessible via headsets, laptops, or mobile devices, ensuring inclusivity

across locations. Generative AI models analyse speech, tone, and pacing to provide real-time coaching and dynamically adapt to guest reactions. The content is organised around three key modules: Delivering on Our Customer Promise, which focuses on service recovery through Hilton's HEART model; Hotel Immersion, which allows corporate staff to experience frontline work; and Exceed with Empathy, which encourages perspective-taking through simulated guest experiences. Together, these modules train both precision and perception, helping staff understand not only what to do but also how to do it with care.

From a learning science perspective, Hilton's approach reflects established research on experiential learning (Kolb, 1984). Each scenario guides employees through a cycle of experience, reflection, and adjustment, creating what psychologists call desirable difficulties, which can be viewed as a challenging practice that strengthens retention and adaptability (Bjork, Dunlosky, & Kornell, 2013). Immediate feedback fosters metacognitive awareness, encouraging staff to observe their own actions and refine them, consistent with principles of deliberate practice (Ericsson & Pool, 2016). The virtual environment provides a safe space for experimentation, reframing mistakes as opportunities for learning rather than as performance failures.

While training begins with individuals, its benefits extend across teams. Staff routinely debrief after sessions, comparing which phrasing, tone, or gestures were most effective in resolving guest tensions. These reflections turn AI feedback into social learning, forming what Wenger (1998) calls "communities of practice." Internal surveys conducted in 2024 found that 87 percent of participants in the "Hotel Immersion" module reported greater empathy for frontline roles, thereby strengthening cohesion and respect across hierarchies (Hilton, 2024).

The results are tangible. Immersive training reduced classroom time from four hours to twenty minutes while maintaining or improving learning outcomes (SweetRush, 2022). Employees trained under the AI-VR system learned up to four times faster and demonstrated greater confidence in managing challenging interactions. Properties adopting the program reported improvements in guest satisfaction and employee engagement. Hilton's initiatives also earned multiple Brandon Hall Awards in 2022 and were cited in Skift's (2024) Future of Hospitality Education report for advancing "technology-enabled empathy."

Hilton's experience illustrates that AI's real value lies not in automation but in amplification. By framing AI as a coach rather than a controller, the company enables employees to practise empathy, reflect on feedback, and strengthen emotional awareness. The system preserves autonomy and judgment, positioning technology as an enabler of deeper learning rather than a replacement for human skill. In doing so,

Hilton redefines efficiency, not as doing more in less time, but as learning faster and caring better.

Discussion: AI, Learning, and Agency in Practice

This discussion interprets findings from the three sectoral cases of OCBC, Prudential, and Hilton through the lenses of socially embedded capability, workplace learning agency, and cognitive and behavioural learning sciences. Rather than treating artificial intelligence as a uniform or purely technical intervention, the cross-case analysis shows how AI reshapes workplace learning by mediating participation, judgment, and learning practices in context. Collectively, the cases reveal that AI's educational effects depend on how learning, agency, and care are organised within workplaces, rather than on the technology's sophistication alone.

Socially embedded capability and inclusive participation

The first research question examined how AI shapes socially embedded capability, particularly workers' opportunities to participate meaningfully in learning while sustaining confidence and professional identity. Across the three cases, AI expanded capability most effectively when it lowered barriers to participation and made learning opportunities visible, without positioning workers as passive recipients of algorithmic guidance.

At OCBC, the MOBI platform broadened access to career development by making learning pathways, internal opportunities, and mentoring relationships transparent to a wide range of employees, rather than relying on informal networks or managerial discretion alone. At Prudential, MedLM supported claims officers by externalising complex reasoning processes, enabling both experienced and less experienced staff to engage more confidently with judgment-intensive work. At Hilton, AI-supported simulations created psychologically safe environments in which frontline staff could practise emotional and relational skills without fear of reputational or performance consequences. In each case, AI-supported inclusion did not replace human learning but reshaped the conditions under which participation became possible.

Interpreted through the capability literature, these findings reinforce the argument that empowerment depends on institutional support, recognition, and enabling environments rather than access to tools alone. AI-enhanced socially embedded capability was achieved only when embedded within organisational cultures that valued learning, care, and participation. Where such conditions were present, AI widened participation and supported professional identity. Where they were fragile or

absent, AI risked reinforcing existing inequalities. This highlights the importance of organisational and policy contexts in shaping inclusive learning outcomes.

Learning Agency in AI-Mediated Work: Personal and Relational Dimensions

The second research question focused on how AI influences workplace learning agency at both personal and relational levels, as employees learn to reflect, collaborate, and exercise judgment alongside intelligent systems. The cases show that AI strengthened agency when it supported interpretation, reflection, and dialogue, but constrained agency when its outputs were treated as authoritative rather than provisional.

At the level of personal agency, AI functioned as a learning companion by prompting individuals to question, compare, and reflect on their own thinking. At Prudential, MedLM transformed routine claims processing into opportunities for metacognitive engagement, as officers weighed algorithmic recommendations against professional intuition. At OCBC, personalised analytics enabled employees to reexamine possibilities and reflect on their aspirations.

At the level of relational agency, learning emerged through dialogue, coordination, and shared sense making. Hilton's immersive simulations foregrounded empathy, collaboration, and emotional attunement, reinforcing learning as a relational process rather than an individual transaction. Across the cases, the agency depended not only on what AI enabled individuals to do, but on how it shaped conversations, relationships, and shared interpretations at work.

Analytically, these patterns align with theoretical accounts of workplace learning agency, which emphasise that agency is exercised through interaction with others and with tools. AI preserved agency when it remained interpretive and dialogic, but risked undermining it when organisational practices encouraged deference to algorithmic outputs.

Deep Learning with AI: Reflection, Effort, and Adaptive Expertise

The third research question examined how AI-enabled tools and environments support or constrain deep learning processes, including metacognition, retrieval, and the development of adaptive expertise. Across the cases, AI contributed most meaningfully to deep learning when it structured experience to include effort, reflection, and appropriately calibrated challenge.

At Prudential, repeated decision-making supported effortful retrieval and reflective comparison, strengthening professional reasoning over time. At Hilton, immersive simulations operationalised experiential learning and deliberate practice, allowing employees to rehearse complex emotional responses under supportive conditions. At

OCBC, reflective prompts and coaching connections helped employees integrate learning with evolving professional identities.
These findings align closely with learning science research showing that deep, sustained learning depends on challenge, feedback, and reflection rather than frictionless efficiency. AI-supported learning not by removing effort, but by making effort visible and meaningful. Where effort was bypassed, or judgment was automated, learning risked becoming shallow or performative.

Synthesis: From Learning Practices to Organisational Meaning

Viewed across the three research questions, the discussion suggests that AI's influence on workplace learning cannot be reduced to individual features, tools, or outcomes. Instead, its effects emerge through how learning opportunities are organised, how agency is exercised in everyday practice, and how organisational values shape what counts as learning and development. Learning with AI, in this sense, is not only about acquiring new skills. It reflects how workplaces configure participation, responsibility, and growth over time.
At the same time, the cases show that AI can support reflection and participation in ways that make organisational priorities more visible. Where learning was framed as developmental and inclusive, AI tended to reinforce opportunities for reflection, dialogue, and professional growth. It did so by making reasoning, pathways, and expectations more explicit. Where efficiency and standardisation were prioritised, however, AI was more likely to narrow learning into compliance-oriented routines. In these settings, opportunities for discretion and sense-making were more limited, particularly when algorithmic outputs were treated as authoritative rather than interpretive. Following this line of thought, AI did not determine organisational culture. Instead, it brought into view how learning was valued, whose judgment was recognised, and how responsibility was shared between humans and systems.

Conclusion: Learning in the Age of Intelligent Companions

This chapter has examined how artificial intelligence can be harnessed to foster inclusive workplace learning and learner empowerment, rather than merely to automate tasks or optimise performance. Drawing on sectoral cases from OCBC, Prudential, and Hilton, and informed by the literature on socially embedded capability, workplace learning agency, and learning sciences, the chapter shows that AI's educational value lies in how it expands participation, supports agency, and enables deeper forms of learning when thoughtfully designed and embedded.

A central finding is that AI supports inclusion by lowering barriers to learning participation and making opportunities for development visible to a broader range of workers. Across the cases, AI enabled more employees to access learning pathways, practise complex skills, and engage in reflective work that might otherwise remain concentrated among those with privileged access to informal networks or mentoring. In this way, AI contributed to learner empowerment not by replacing human learning, but by reshaping organisational conditions so that more people could participate with confidence and sustain a sense of professional identity.

The chapter also demonstrates that learner empowerment depends critically on how AI shapes learning agency. AI empowered learners when it supported reflection, interpretation, and collaboration, allowing workers to exercise judgment alongside intelligent systems. Where AI systems invited dialogue and sense making, both personal and relational agency were strengthened. Where AI risked narrowing discretion or encouraging compliance, empowerment was more fragile. This highlights that AI does not empower learners by default; empowerment emerges when organisations design AI systems and practices that preserve learner voice, discretion, and shared responsibility.

From a learning perspective, the findings further suggest that AI can support deep learning by scaffolding effort, reflection, and care. For example, learning became more meaningful when AI helped learners make their thinking visible, engage in productive challenge, and practise skills in psychologically safe environments. Empowerment, in this sense, involved not the removal of difficulty, but the creation of conditions under which learners could engage with challenge and grow through it.

In summary, the chapter advances the argument that AI can function as a learning companion that supports inclusion and empowerment when it is aligned with organisational cultures that value learning as developmental, relational, and ongoing. At the same time, AI acts as a cultural mirror, revealing whether organisations are prepared to support these values or whether learning is treated instrumentally. These dual roles help explain why similar AI technologies can produce very different learning outcomes across workplaces.

The implication is clear. The future of workplace learning will not be determined by how much AI can automate, but by how intentionally organisations harness AI to expand participation, preserve agency, and support meaningful learning for all workers. For leaders, this requires investing not only in technology, but also in inclusive cultures, reflective practices, and governance arrangements that place learner empowerment at the centre of AI adoption. In the age of intelligent companions, AI's promise lies in its capacity to support people as active participants in their own learning, rather than as passive subjects of technological change.

Disclosure Statement: Generative AI tool ChatGPT was used for language editing and improving the clarity of the manuscript. All intellectual content, research design, and data analysis were conducted solely by the authors.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-12

The Impact of Digital Technologies and Innovations in Korean Universities on the Development of Teaching Competencies of University Professors

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This study explores how digital and AI technologies have transformed teaching competence in Korean universities, with a focus on the role of Centers for Teaching and Learning (CTLs). Case analyses of J University and N University revealed that most professors demonstrated mid-level digital competence, while a small number acted as pioneers of innovation. At N University, faculty showed strong abilities in learner communication and instructional improvement but weaker competence in professional development and strategic facilitation. Findings indicate that digital competence has become an essential component of teaching competence, shaping both instructional quality and student learning outcomes. CTL programs were found to be widely utilized and effective in supporting faculty growth. The study concludes that CTLs should expand tailored and ethically grounded programs integrating AI pedagogy and reflective practice to enhance professors' competence and strengthen the competitiveness of Korean higher education.

Keywords: digital competence, AI competence, teaching competence, CTL, Korean higher education

Introduction

The necessity of research

According to the World Competitiveness Report 2023 published by the International Institute for Management Development (IMD), Korea's higher education competitiveness ranked 49th among 64 countries (Ministry of Economy and Finance, 2023, June 20). This relatively low ranking highlights the urgent need for qualitative improvement in Korean higher education. In response, universities have sought to clarify core competencies aligned with their educational goals and institutional

visions, while designing curricula and support systems aimed at enhancing educational quality and competitiveness.

Among the components of these educational support systems, faculty teaching competence constitutes the most critical factor. Teaching competence not only determines the quality and outcomes of university education but also serves as a decisive element of institutional competitiveness (Jun, 2020). Whereas research competence was traditionally regarded as the primary dimension of faculty competence, recent discourse has increasingly emphasized teaching competence as essential for addressing the needs of twenty-first-century learners and responding effectively to rapid social and technological change.

Korean universities employ several institutional mechanisms to enhance faculty teaching competence, most notably lecture evaluation systems and Centers for Teaching and Learning (CTLs) (Lim, 2021). Lecture evaluation results are systematically communicated to faculty and, in some cases, used for identifying outstanding instructors, reappointing part-time lecturers, or requiring participation in professional development programs. Complementing these evaluation mechanisms, CTLs design and operate faculty development initiatives such as workshops, special lectures, and instructional consulting to support continuous improvement in teaching practice.

In recent years, CTLs—functioning as the primary administrative units for faculty development—have increasingly focused on strengthening faculty members' digital and AI competencies. This shift has been driven by the expansion of ICT integration, the diffusion of competency-based education, and the rapid growth of online courses and cyber-lectures, leading CTLs to develop new digital competence programs for faculty (Lee & Kim, 2024; Woo, 2025). The COVID-19 pandemic further accelerated this transformation by compelling universities and faculty members to adopt online teaching systems and to acquire digital competencies necessary for instructional design and delivery. Consequently, digital competence has emerged as an indispensable dimension of contemporary teaching competence in Korean higher education (Lee & Kim, 2024; Woo, 2025).

As digital technology and innovation increasingly shape teaching and learning environments, faculty digital competence has become closely intertwined with overall teaching competence. Within this context, CTLs play a pivotal mediating role by guiding, supporting, and sustaining the enhancement of faculty teaching competence in the digital and AI era.

Accordingly, this study examines how digital and AI technologies have transformed teaching competence in Korean universities, with particular attention to the role of Centers for Teaching and Learning (CTLs). The research addresses the following

questions: First, how has the concept of teaching competence in Korean higher education expanded to incorporate digital and AI competence in the context of digital innovation? Second, what are the levels and characteristics of university professors' digital and AI competence, and how do these competencies differ by individual and professional characteristics? Third, what roles do Centers for Teaching and Learning (CTLs) play in strengthening university professors' digital and AI teaching competence in Korean universities?

Methodology

This study employed a mixed-methods research design that integrated document analysis, secondary data review, and survey-based empirical analysis to examine the expansion of teaching competence in the digital and AI era and the role of Centers for Teaching and Learning (CTLs) in Korean higher education. First, a literature and document analysis was conducted to establish the conceptual and policy context of digital and AI competence, drawing on prior academic studies, national policy reports, and institutional documents related to digital transformation, faculty development, and teaching competence, particularly those published by Korean educational authorities and research institutes.

Second, the case of J University was examined through a secondary analysis of existing empirical research. Specifically, this study drew on the findings of Kim and Roh (2024), who investigated the effects of college instructors' digital competence on learners' digital competence using survey data from J College. Their findings provided an empirical basis for understanding the relationship between faculty and student digital competence and informed the comparative interpretation of faculty digital competence in the present study.

Third, an original survey was conducted for the case of N University. Data were collected from March 1 to March 15, 2025, from 146 full-time and part-time faculty members across disciplines. The survey measured professors' digital and AI-related teaching competencies and their engagement with CTL programs using structured questionnaire items developed based on prior research and institutional contexts. Quantitative data were analyzed using descriptive statistics and comparative analyses to examine overall competency levels and differences by demographic and professional characteristics. Together, these methods enabled a comprehensive examination of faculty digital and AI competence and the institutional mechanisms supporting its development.

Professors and the Digital Society, Digital Competence

The Digital Society

The application of digital technologies across all sectors of society, fundamentally reshaping traditional social structures, is referred to as digital transformation. In its early stages, digital transformation was largely driven by private-sector technology companies, which disrupted industrial structures and business models while shifting communication patterns and lifestyles toward digitally mediated, non-face-to-face modes. More recently, governments have actively promoted digital transformation in the public sector by utilizing big data analytics to enhance governance systems and mediate public opinion (Kim et al., 2025).

In higher education, digital transformation has been emphasized as a major policy agenda. The Ministry of Education (2020), in its *Support Plan for Digital-Based Innovation in Higher Education*, underscored the importance of curriculum exchange among universities, the formation of regional higher education ecosystems, and the strengthening of students' digital competence. In addition, universities have been granted autonomy to establish standards for online courses, including the operation of fully online degree programs, which has further accelerated the digitalization of university curricula.

This process of digital transformation presupposes that universities possess an adequate level of digital competence. In higher education, unlike in primary and secondary education, faculty members bear primary responsibility for curriculum development, instructional materials, and teaching–learning activities. Accordingly, professors' digital competence is indispensable for the development of digital curricula. Moreover, because faculty digital competence directly influences students' digital competence in instructional settings, it constitutes a crucial factor in advancing the overall digital competence of universities (Kim & Roh, 2024; MoE, 2020).

In general, digital competence refers to the ability of individuals to use digital devices, technologies, and content both skillfully and safely, reflecting the universal level of competence expected of the general population (Media Smarts, 2016). In educational contexts, however, digital competence has been conceptualized in a more differentiated manner.

The Joint Information Systems Committee (JISC) in the United Kingdom defines digital competence as the set of capabilities required to live, learn, and work effectively in a digital society. JISC identifies six core elements—ICT proficiency and productivity; information, data, and media literacies; digital creation, problem solving, and innovation; digital communication, collaboration, and participation; digital learning and development; and digital identity and wellbeing—highlighting

that digital competence extends beyond technical proficiency to include cognitive, creative, and ethical practices.

In Korea, educational institutions have similarly emphasized the educational dimensions of digital competence. The Korea Education and Research Information Service (2023) defines digital literacy as the knowledge and competence required to use digital media and technologies, locate information sources, and critically evaluate information for communication and problem solving. Likewise, the Korea Educational Development Institute (2021) conceptualizes digital competence as encompassing the understanding and application of digital technologies, ethical and safe practices, problem solving, and the management of information and data in teaching–learning contexts.

However, within teaching–learning environments characterized by dynamic interactions between instructors and learners, faculty digital competence must be defined from an instructional design perspective. In this regard, the Joint Research Centre of the European Commission proposed the *European Framework for the Digital Competence of Educators (DigCompEdu)*, which identifies six sub-dimensions of educators' digital competence: professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence (Redecker, 2017).

Digital Competence

Digital competence refers to the digital knowledge, attitudes, and skills required to live and participate effectively in a digital society. In the early 2000s, it was largely defined as the ability to use digital technologies and tools. As digital transformation has accelerated across social domains, however, the concept has expanded beyond technical proficiency to include problem solving through digital technologies, digital communication and collaboration, as well as civic responsibility and ethical dispositions. A related concept, digital literacy, emphasizes the interpretive and critical dimensions of digital engagement, and despite conceptual distinctions, the two terms are often used interchangeably in contemporary discourse (Jang, 2023).

The European Commission defines digital competence as "the set of knowledge, skills, attitudes, abilities, strategies, and awareness required to use ICT and digital media to perform tasks, solve problems, communicate, manage information, act ethically and responsibly, collaborate, and create and share content and knowledge for work, learning, participation, and self-development" (Ferrari, Punie, & Redecker, 2012, p. 84). This definition underscores that digital competence encompasses not only operational skills but also ethical, cognitive, and participatory dimensions.

Similarly, Choi (2018, p. 32) conceptualizes digital competence as a comprehensive construct that includes the ability to use and critically evaluate digital technologies, active participation in digital culture, ethical and responsible conduct, and the application of problem-solving strategies. From this perspective, digital competence is broader than digital literacy, as it facilitates effective social communication in digitally mediated environments, supports problem solving, and enables the creation of new knowledge.

Moreover, digital competence has been identified as a core competency for the future, encompassing critical thinking about digitally acquired information, creative content production, and the capacity for social and emotional communication in digital contexts (Gil, Lee, & Hwang, 2022).

Professors' Digital Competence

Digital competence is widely recognized as a core competency for the future and is particularly critical for university professors responsible for preparing students for participation in a digitally transformed society. At the micro level, professors' digital competence directly shapes students' learning within teaching–learning contexts by enabling effective instructional design, supporting interactive and learner-centered instruction, and providing data-informed feedback. At the same time, it facilitates the development of students' own digital competence, thereby contributing to the overall digital competence of universities as institutions (Kim & Roh, 2024).

Among the theoretical frameworks explaining professors' digital competence, the TPACK (Technological Pedagogical Content Knowledge) model is especially influential. TPACK conceptualizes digital competence as the dynamic integration of content knowledge, pedagogical knowledge, and technological knowledge, emphasizing that these domains must be continuously balanced and aligned in instructional practice rather than treated in isolation (Koehler & Mishra, 2009).

Professors' digital competence can also be understood as a hierarchical and developmental construct. Lee (2015) described digital competence as a sequential and continuous concept that varies in level, while Martin and Grudziecki (2006) proposed a progression from digital competence to digital usage and ultimately digital transformation. Similarly, Davies (2011) identified a developmental trajectory from awareness to praxis and phronesis, highlighting a shift from basic familiarity with technologies to practical wisdom in their educational use.

Empirical evidence from Korea supports this developmental perspective. Kim and Roh (2024) assessed professors' digital competence at J University using an adapted version of the scale developed by Lucas et al. (2021), consisting of six sub-factors and 22 items. Based on total scores, professors were classified into six levels—

Newcomer, Explorer, Integrator, Expert, Leader, and Pioneer—representing increasing degrees of digital engagement and instructional sophistication.
The distribution of digital competence levels among the 210 professors surveyed approximated a normal distribution (see Table 6). Most professors were positioned at intermediate levels, with 35.7% classified as Experts and 31.0% as Integrators, together accounting for 66.7% of the sample. Smaller proportions were identified as Explorers (12.4%) and Leaders (12.9%), while relatively few were categorized as Newcomers (4.8%) or Pioneers (3.3%).

Level of Digital Competence	Number Range	Frequency	Per Cent
Stage1: Newcomer	0–22	10	4.8
Stage2: Explorer	23–43	26	12.4
Stage3: Integrator	44–65	66	31
Stage4: Expert	66–87	75	35.7
Stage5: Leader	88–108	27	12.9
Stage6: Pioneer	109 over	7	3.3
Total		210	100

Table 1. Levels of Digital Competence among Professors at J University. Source: Kim and Roh (2024)

Digital Innovation and the Expansion of the Concept of Teaching Competence

Changes in the Concept of Teaching Competence Before and After COVID-19

Enhancing faculty competence is a key factor in improving the quality of university education, and numerous studies have developed competency models to diagnose and evaluate teaching competence. In general, teaching competence refers to professors' ability to design effective instruction, apply diverse teaching methods, manage classes, deliver learner-centered instruction, and utilize instructional media appropriately. Korean studies have proposed various multidimensional models reflecting these elements. For example, Yang and Chung (2010) identified core competencies for excellent faculty, while Song and Noh (2016) and Lee and Choi (2016) categorized teaching competence into domains related to instruction, management, evaluation, and instructional disposition. Subsequent studies further expanded these frameworks by distinguishing teaching competence from research competence and proposing models composed of basic, practical, and innovative

domains, often developed through Delphi methods and empirical validation (Park, 2017; Seo et al., 2010; Lee & Choi, 2021, 2022; Kang, 2022). Collectively, this body of research demonstrates broad consensus that teaching competence is a multidimensional and developmental construct.

During the COVID-19 pandemic, digital competence emerged as a particularly salient dimension of teaching competence, and more recently it has expanded to include artificial intelligence (AI). At N-University, a traditional four-year institution that also operates cyber courses and MOOCs, the abrupt transition to online instruction in early 2020 led faculty to adopt diverse instructional formats, including recorded lectures, real-time streaming, and external digital platforms. Surveys indicated substantial variation in instructional practices, with recorded lectures being the most commonly used format. The public release of ChatGPT in November 2022 marked another turning point, accelerating the diffusion of generative AI and prompting universities to move beyond basic digital transformation toward the active integration of AI into teaching and learning.

Recent studies consistently emphasize that digital and AI competence extends beyond technical skills to include instructional design, digital content development, ethical awareness, and reflective practice. AI–digital competence has been conceptualized as a multidimensional construct encompassing digital literacy, pedagogical application of AI tools, content creation, and awareness of ethics and information security, all of which require systematic professional development and institutional support (Seo et al., 2023; Heo & Kang, 2023). Complementary research on online and future-oriented teaching competence highlights the integration of technological, pedagogical, and relational dimensions of instruction, identifying core domains such as instructional design and implementation, learner understanding and communication, self-reflection, and professional development. Although faculty and students may prioritize different aspects, both groups consistently recognize self-development and instructional material development as critical. Taken together, these findings indicate that teaching competence in the digital and AI era is an integrative construct combining technological capability, pedagogical expertise, ethical responsibility, and continuous professional growth, positioning digital and AI competence as a central driver of innovation in higher education (Kang & Lee, 2021; Kim, Park, & Lim, 2021; Lee, Kim, & Lee, 2020).

The Concept and Measurement of Teaching Competence with an Emphasis on Digital and AI: The Case of N-University

At N-University, the teaching competence framework revised in 2024 was organized into two domains: basic competence and innovative competence. Within the innovative competence domain, particular emphasis was placed on professors' ability to design instruction responsive to the demands of the AI era, develop customized teaching and learning materials, and implement educational innovation through the integration of digital technologies and AI.

With the advancement of the Fourth Industrial Revolution and digital transformation, the educational environment has undergone rapid change, increasing the importance of faculty competence in adapting to and leading these shifts. Since the COVID-19 pandemic, the normalization of non-face-to-face and hybrid instruction has further highlighted the need for pedagogical approaches that incorporate AI, big data, and digital technologies. In response, N-University revised its teaching competence diagnostic items to more clearly identify faculty competence levels and areas for improvement. Although the Center for Teaching and Learning operates various faculty support programs, systematic evaluation of their effectiveness remains necessary to determine how well these programs contribute to strengthening faculty competence and promoting learner-centered education.

Teaching competence diagnostic results provide empirical data that identify faculty members' strengths and areas for development, serving as a basis for improving faculty development programs. By restructuring existing programs to reflect contemporary educational demands and professors' practical needs, universities can more effectively enhance teaching competence and student learning outcomes. In addition, these diagnostics offer foundational evidence for program improvement, feedback systems, and institutional policy-making, enabling the Center for Teaching and Learning to operate support programs in a more systematic and effective manner.

Regarding specific competencies, Learner Empathy and Communication Competence recorded the highest mean score ($M = 4.49$, $SD = .460$), indicating that faculty members are particularly strong in understanding and communicating with students. In contrast, Professional Development Competence showed a comparatively lower mean ($M = 3.99$, $SD = .621$), suggesting the need for more systematic support for continuous self-development and professional growth.

Among innovation-related competencies, Customized Teaching and Learning Material Development Competence ($M = 4.07$, $SD = .571$) and Instructional Diagnosis, Evaluation, and Improvement Competence ($M = 4.11$, $SD = .608$) ranked relatively high, reflecting efforts to adapt instructional resources and improve

teaching practices through reflective evaluation. By comparison, Strategic Learning Facilitation Competence recorded the lowest mean (M = 3.92, SD = .616), indicating challenges in promoting active and innovative learning. Adaptive Instructional Design Competence (M = 4.14, SD = .565) and Learner-Centered Instructional Management Competence (M = 4.01, SD = .631) fell within the mid-range, suggesting moderate proficiency in flexible lesson design and interactive class management.

Overall, the findings indicate that faculty members demonstrate relatively strong competence in empathy, communication, and instructional evaluation, while lower scores in professional development and strategic facilitation highlight the need for targeted institutional support. These results underscore the importance of strengthening CTL programs to enhance innovation-oriented competencies in alignment with digital and AI-driven educational transformation.

Analysis of Faculty AI–Digital Competence: The Case of N-University

Based on prior studies on AI–digital competence (Lee, Dong-Guk et al., 2020; Heo & Kang, 2023), this study defined the concept of AI–Digital Competence and developed a measurement instrument consisting of 13 items derived from this definition. The items were designed to comprehensively assess professors' ability to utilize AI and digital technologies in teaching and learning contexts. Reliability analysis yielded a Cronbach's α of .953, indicating a very high level of internal consistency for the instrument.

In this study, AI–Digital Competence is defined as the integrated ability of educators to effectively and creatively employ artificial intelligence and digital technologies in teaching and learning processes. This competence encompasses designing and implementing instruction using AI and digital tools, engaging in collaboration and problem solving through interactive platforms, searching for and transforming relevant data and resources, conducting data-driven assessment and feedback, and exercising critical and creative thinking for self-directed learning and instructional innovation.

The survey was conducted between March 1 and March 15, 2025, with a total of 146 university faculty members. Of the respondents, 82 (56.2%) were male and 64 (43.8%) were female. In terms of academic rank, non-tenure-track faculty represented the largest group (50 respondents, 34.2%), followed by assistant professors (40, 27.4%), professors (31, 21.2%), and associate professors (25, 17.1%).

No.	Items
1	I can use digital media and digital technologies to collect, store, and retrieve teaching resources, and apply them in my classes.
2	I can utilize AI-digital technologies to effectively gather the resources needed for my teaching.
3	I can use AI-digital tools to collaborate and communicate with colleagues and students in problem-solving tasks.
4	I can use AI-digital technologies to design and operate professor–student learning activities.
5	I can recognize and utilize AI-digital technologies that replace or supplement the role of textbooks and professors.
6	I can develop the ability to analyze and transform data using AI-digital technologies, and apply the transformed data for teaching and research.
7	I can use AI-digital technologies to search for and reorganize specific teaching resources at the required level (Digital curation).
8	I can use AI-based evaluation technologies to monitor and provide feedback on students' learning progress.
9	I can use AI-digital technologies to actively engage students in class and facilitate interactions with peers and learners.
10	I can use AI-digital technologies to provide effective feedback on students' learning outcomes and performance.
11	I can foster learning communities, share information smoothly, and apply digital tools such as SNS and smart devices in teaching.
12	I can use AI-digital technologies to cultivate students' learning skills needed for creative problem-solving.
13	I can use big data and AI-digital technologies to analyze students' learning patterns and plan new instructional strategies.

Table 2. Questionnaire of AI-Digital Competence for N-University

The results revealed statistically significant gender differences in AI–Digital Competence. Male professors reported a higher mean score ($M = 3.74$) than female professors ($M = 3.43$), and this difference was statistically significant ($p < .05$). This finding suggests that male professors tend to perceive or utilize AI–Digital Competence more actively than their female counterparts. Consistent with prior research, such gender differences may be associated with higher engagement in technology-based learning and digital tool use among men (Cooper, 2006; Li & Kirkup, 2007). Possible explanations include differences in technology use frequency, disciplinary opportunities for technology integration, and levels of self-efficacy related to digital technologies (Vekiri & Chronaki, 2008).

Classification			N	M	SD	F/t
AI-Digital Competence	Gender	Male	82	3.74	.689	2.543**
		Female	64	3.43	.773	
	Major	Engineering	21	3.77	.598	1.567
		Social Science	44	3.75	.722	
		Humanity	27	3.41	.757	
		Arts	15	3.66	.739	
		Health Science	39	3.46	.795	

**p<.05, **p<.01, ***p<.001*

Table 3. AI-Digital Competence Differences by Gender and Major in N-University

In contrast, no statistically significant differences were found across academic majors. Engineering (M = 3.77) and Social Science (M = 3.75) showed relatively higher mean scores, while Humanities (M = 3.41), Arts (M = 3.66), and Health Science (M = 3.46) reported slightly lower averages. However, these differences were not statistically meaningful. This outcome suggests that AI and digital technologies have become widely integrated across disciplines, minimizing major-based disparities in AI-Digital Competence. In other words, as digital tools and AI applications are increasingly embedded in diverse curricula and learning environments, the gap between disciplines appears to be narrowing (Tømte & Hatlevik, 2011).

Independent variable	*B*	*SE B*	β	t	p
(Constant)	2.625	.269		9.754	.000***
Passion for CTL Participation	.254	.068	.298	3.752	.000***

**p<.05, **p<.01, ***p<.001*

Table 4. Impact of Passion for CTL Partiipation on AI-Digital Competence

The Role of University CTLs in Strengthening Faculty AI–Digital Teaching Competence

CTL Programs for Faculty Competence Enhancement

As of 2024, Korea has a total of 327 universities and colleges, including 194 four-year universities and 133 junior colleges. Nearly all higher education institutions operate a Center for Teaching and Learning (CTL), largely because national university evaluation and accreditation criteria require the establishment and operation of teaching and learning support organizations. As a result, CTLs have become universal institutional units within Korean higher education.

CTLs generally function as hubs for educational development and support for both faculty and students. For faculty development, they provide workshops, seminars, and training programs aimed at improving teaching competence, diversifying instructional strategies, and responding to emerging educational trends. For students, CTLs offer academic support services such as tutoring, learning skills workshops, and guidance on study strategies and time management. With the rapid expansion of e-learning, generative AI, and digital technologies—particularly following the COVID-19 pandemic—faculty members have been required to adopt new digitally mediated teaching approaches, further reinforcing the importance of CTL-led professional development.

The establishment and expansion of CTLs in Korea were strongly influenced by the University Comprehensive Evaluation and Accreditation System administered by the Korean Council for University Education. While the first evaluation cycle (1994–2000) focused on creating favorable conditions for university education and enhancing accountability, the second cycle (2001–2006) placed greater emphasis on improving educational quality. In particular, evaluation criteria began to stress universities' efforts to develop teaching methods, professors' diversification of instructional approaches, and the quality of course syllabi, which directly motivated universities to establish CTLs (Yeom & Kim, 2008; Kim, 2004; Min & Lee, 2005).

Early CTL initiatives primarily emphasized lecture support and instructional media production (Min & Lee, 2005). Empirical studies also showed that professors at four-year universities regarded effective teaching support as the highest priority of CTLs (Kim, Song, & Lee, 2004). Similarly, in the United States, where CTLs have operated since the 1960s, faculty development has been recognized as a central institutional function. Over time, CTLs have established their identity as organizations that promote instructional expertise, deepen understanding of learners, and support reflective teaching practices through consultation and professional evaluation.

At N University, AI-integrated teaching programs were actively implemented in 2023 and 2024. In 2023, seven programs were offered, including Educational Use and Ethics of ChatGPT (186 participants), Designing Instruction with ChatGPT (219 participants), and Conducting Research with ChatGPT (206 participants), attracting a total of 902 participants. In 2024, three programs were implemented, such as Instructional Design and Implementation Based on the ADDIE Model Applying Generative AI (176 participants) and Designing Education with EdTech (185 participants), with a total of 383 participants. Although the number of programs and participants decreased in 2024, this change reflects a transition from an initial expansion phase of AI-integrated education toward a stage of consolidation and specialization.

Digital Innovation and the Role of University CTL Education and Training

In April 2025, in-depth interviews were conducted with eight university professors to examine the impact of digital innovation on their professional lives and the role of CTL programs in strengthening teaching competence. The participants included four men and seven women, all holding the rank of assistant professor or above. Three were in their forties and eight in their fifties, and all had begun their academic careers prior to the COVID-19 pandemic, with an average of seven to eight years of teaching experience. Their professional trajectories enabled them to provide reflective insights into changes brought about by digital innovation. To ensure confidentiality, participants were anonymized using alphabetic identifiers.

Overall, the findings indicate that AI and digital technologies have generated both opportunities and challenges in academic work. In teaching, digital tools improved efficiency and expanded learning experiences, while concerns were raised regarding potential negative effects on creativity and independent thinking. In student interaction, digital platforms increased opportunities for participation but also contributed to weakened interpersonal relationships and learner passivity. These results suggest that higher education must balance the efficiency gains of AI with pedagogical strategies that preserve creativity, meaningful interaction, and human relational depth.

(1) The Impact of Digital Innovation on Teaching

Digital innovation and AI have significantly transformed teaching practices. Following the COVID-19 pandemic, synchronous online lectures and recorded classes enhanced instructional efficiency by reducing temporal and spatial constraints and enabling supplementary teaching and research supervision (A, D). Some instructors integrated AI tools such as ChatGPT into group activities, allowing

students to directly experience AI-mediated learning processes (B). Generative AI was also widely used for lesson design and instructional material development, particularly in producing visual resources, thereby improving preparation efficiency and diversifying learning experiences (E).
At the same time, faculty members expressed concerns that excessive reliance on AI could reduce opportunities for students to engage in independent thinking and creativity. This highlights the need for pedagogical approaches that coexist with AI while safeguarding learners' cognitive and creative development (C).

(2) The Impact of Digital Innovation on Interaction with Students

With regard to student interaction, digital innovation produced mixed effects. During the pandemic, platforms such as Zoom enabled sustained communication with students and continue to be used for special lectures in the post-pandemic period. Interactive tools such as Quizlet, Kahoot, and Padlet facilitated real-time questioning, discussion, and collaboration, thereby enhancing engagement (E). AI-based platforms supporting synchronous and asynchronous communication were also perceived as useful instructional aids (F, H), and in some fields, digital resources were combined with play-based learning to create new pedagogical possibilities (F).
Conversely, faculty noted that the rapid pace of digital platform development made effective integration challenging (G). Others observed that students' preference for non-face-to-face formats weakened interpersonal relationships and led to more superficial interactions (A, C). Despite increased online meetings, the affective bonds characteristic of face-to-face instruction were perceived to have diminished, and students were reported to display more passive attitudes toward learning after the pandemic (D, G).

3) Faculty Efforts to Respond to Digital Innovation

Faculty members reported diverse efforts to strengthen their AI and digital competencies. All respondents (100%) participated in CTL programs such as workshops and special lectures, indicating that CTLs have become a central channel for professional development. In addition, many engaged in self-directed learning through YouTube (70%) and books (60%), while others attended external lectures or utilized online courses such as MOOCs.
Qualitative responses revealed that faculty efforts extended beyond participation to include hands-on practice with generative AI, engagement in specialized training programs, and collaboration within scholarly communities. Some compared AI-generated outputs with their own expertise to refine instructional content, while others emphasized continuous learning, practical application in teaching, and the integration

of new insights into course design. These efforts reflect a combination of institutional participation, self-directed learning, collaborative engagement, and practice-oriented application.

4) The Impact of CTL Programs on Strengthening Faculty Competence

All ten interview participants reported having participated in N-University CTL programs, underscoring the CTL's role as a core faculty development platform. Regarding effectiveness, six respondents rated the programs as "very helpful," while four rated them as "helpful," with no neutral or negative evaluations reported. This indicates a consistently positive perception of CTL program effectiveness.

Qualitative feedback highlighted the value of practice-oriented and case-based instruction, discipline-specific approaches, and opportunities for sharing instructional outcomes. Faculty emphasized the importance of hands-on learning, the integration of AI with existing educational tools, the dissemination of innovative teaching models, and attention to humanistic perspectives in the AI era. Overall, these findings suggest that CTL programs exert a multidimensional influence on faculty development by supporting practical teaching competence, discipline-sensitive expertise, and reflective engagement with digital and AI-driven educational change.

5. Conclusion

This study examined how the integration of digital technologies and innovations in Korean universities has reshaped faculty teaching competence. The findings indicate that digital competence, once considered a supplementary skill, has become a core dimension of teaching in higher education. Faculty members' ability to integrate digital and AI tools now directly influences instructional quality, students' learning experiences, and institutional competitiveness. Case analyses of J University and N University further demonstrate that faculty digital competence follows a hierarchical developmental structure, with most professors positioned at intermediate levels and a smaller group leading innovative practices. While digital competence is widely diffused, notable disparities in proficiency and application remain.

The COVID-19 pandemic functioned as a critical turning point that accelerated the digital transformation of university teaching. Subsequent advances in artificial intelligence, particularly the rapid diffusion of generative AI such as ChatGPT, have further expanded the scope of faculty competence. Digital competence is now closely linked to meaningful student engagement, innovative curriculum design, and the cultivation of ethical and critical awareness in digital environments. At the same time, challenges persist, including the risk of reduced creativity and weakened interpersonal

relationships due to over-reliance on AI, as well as uneven access to training opportunities among faculty.

Within this context, Centers for Teaching and Learning (CTLs) play a pivotal role as mediating institutions for faculty development. Rather than merely transmitting technical knowledge, CTLs support reflective, ethical, and innovative teaching practices. Evidence from N University shows that CTL participation is nearly universal among faculty and that programs are consistently perceived as helpful in strengthening AI–digital competence. These findings suggest that the future development of Korean higher education depends substantially on how effectively CTLs function as hubs for faculty development in the digital and AI era.

To further strengthen faculty AI–digital teaching competence, Korean CTLs should adopt more systematic and future-oriented strategies. Faculty development programs should be differentiated according to professors' current competence levels, offering tailored pathways for newcomers, intermediate users, and innovators. Beyond basic digital literacy, CTL initiatives should incorporate AI-enhanced pedagogy, including instructional design with generative AI, data-driven assessment, and ethical decision-making in technology use. Discipline-specific modules are also essential to ensure that AI and digital tools are meaningfully applied across diverse academic fields.

Equally important is sustained attention to the reflective and ethical dimensions of faculty development. CTLs should promote awareness of academic integrity, algorithmic bias, and the preservation of creativity and critical thinking. These efforts can be strengthened through communities of practice that facilitate collaboration, sharing of best practices, and joint innovation among faculty. Finally, systematic evaluation of CTL programs through longitudinal assessment, along with expanded national and international collaboration, will be crucial for advancing AI–digital faculty development and positioning Korean CTLs at the forefront of educational innovation.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-13

Enriching Learning at Work: How the Inclusive Use of Digital Technologies and Innovation Empowers Thai LGBTQ+ Workers in the IT Sector

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This study examines the professional landscape for LGBTQ+ individuals in Thailand's IT sector. It investigates the gap between the nation's reputation for social tolerance and its lack of formal legal protections. Using a multi-method approach, the research combines quantitative data from an online survey of 291 employees at 90 companies with qualitative insights from interviews with 38 LGBTQ+ professionals and senior executives.
The findings show that the IT industry offers a generally supportive work environment. However, LGBTQ+ employees still face ongoing challenges related to gender expression and identity. Our analysis shows that using digital platforms and inclusive policies can reduce occupational segregation and increase job satisfaction. The urgent need remains to include sexual orientation and gender identity in diversity analytics to understand the impacts on different groups across sectors.
Ultimately, this study offers actionable, evidence-based insights for corporate leaders and policymakers to develop targeted interventions, such as structured mentorship programs and equitable hiring protocols. It highlights the imperative of leveraging digital technology to foster genuinely inclusive workplaces, thereby empowering the LGBTQ+ workforce and contributing to Thailand's national socio-economic development strategy.

Keywords: LGBTQ+, digital technology, IT sector, workplace inclusion, Thailand

Introduction

The discussion about diversity, equity, and inclusion is spreading through global job markets. Digital transformation is reshaping industries. As a result, organizations are emphasizing workplace learning, human capital, and innovation to meet competitive

and technological challenges. LGBTQ+ professionals and other marginalized groups play a key role in organizational performance, influencing retention, creativity, and knowledge sharing. This article examines these dynamics in Thailand's IT sector, where digital technologies are driving economic change and reshaping the environment for LGBTQ+ employees to learn, collaborate, and advance.

In line with many developing nations, Thailand is actively pursuing its "Thailand 4.0" initiative, which aims to use technology and innovation to boost economic growth and global competitiveness. The information technology (IT) sector, known for its high-productivity roles and attractive salaries, is central to this national strategy. However, beneath its progressive and modern exterior, this male-dominated field remains influenced by deep-rooted social norms that impede gender equality and inclusivity.
In Thailand, the rapid growth of services and IT-related sectors coincides with a younger, more digitally literate workforce that increasingly expects workplaces to respect diverse identities. This generational shift amplifies the stakes of inclusive workplace learning, as organizations that fail to align digital innovation with equity may struggle to attract and retain high-potential LGBTQ+ talent. Globally, the expansion of digital HR systems, e-learning platforms, and data-driven performance management has transformed how organizations recruit, train, and evaluate employees. For LGBTQ+ workers, these tools can either reproduce existing inequalities—for instance, through biased data and opaque algorithms—or open up new avenues for visibility, voice, and tailored support.
Although Thailand is widely seen as a tolerant country, especially concerning the LGBTQ+ community, this apparent acceptance often conceals ongoing systemic discrimination and social stigma within professional environments. This issue is particularly pronounced for LGBTQ+ individuals working in the IT sector, where there is a significant scarcity of research on the specific obstacles they encounter. The lack of detailed data on their experiences makes it challenging to grasp the full spectrum of their workplace difficulties, which include occupational segregation, pay inequality, and varying levels of job satisfaction.
Many Thai organizations maintain policies that are insufficient to support LGBTQ+ employees according to their actual workplace needs. While these organizations may display external commitments to inclusivity, they often fail to establish the necessary internal systems, such as gender-sensitive HR platforms, comprehensive anti-discrimination policies, and protected reporting channels. The IT sector faces high competition and rapid, skills-based career advancement, so LGBTQ+ workers need supportive structures to maintain their well-being and access digital learning opportunities and innovative work participation.

This study fills this crucial research void by positing that the inclusive application of digital technologies and innovative workplace practices is essential for empowering LGBTQ+ employees and cultivating a more equitable and supportive work environment. Organizations are increasingly utilizing digital platforms to enhance workplace operations through e-learning systems, performance dashboards, communication tools, and anonymous feedback channels. These tools can also support cultural transformation when they are designed and governed with an inclusive mindset. Organizations can eliminate discriminatory practices by implementing inclusive digital technology, which creates equal learning opportunities and supports daily work-based learning for IT professionals to advance their careers. Drawing on mixed-method evidence from LGBTQ+ professionals in Thailand's IT sector, this study argues that the country's reputation for social tolerance and the industry's progressive image coexist with persistent, systemic barriers that constrain LGBTQ+ workers' careers and well-being. By integrating the Individual Differences Theory of Gender and IT with a labor economics framework, the article demonstrates how inclusive uses of digital technologies and workplace innovations can both reveal and mitigate discrimination in recruitment, everyday interactions, and advancement. It contends that the strategic, data-driven deployment of digital platforms and inclusive HR practices is not merely optional, but essential for transforming superficial tolerance into substantive inclusion and for realizing the full socio-economic potential of Thailand's digital economy.

Literature Review and Theoretical Approach

Academic analysis has long highlighted a fundamental contradiction in Thailand's relationship with its LGBTQ+ community: a culture of social tolerance exists alongside a significant lack of legal and institutional safeguards. The prevailing societal view, often associated with the nation's Buddhist traditions, fosters a degree of acceptance, yet this has not historically led to the granting of formal rights (Badgett, 2014). This has resulted in a complicated social environment where LGBTQ+ people are often visible but lack legal and professional equality.

Early academic studies on gender and sexual diversity in Thailand, as reviewed by Jackson and Dunagwises (2020), were frequently shaped by Western perspectives that treated non-normative identities as pathological. Beginning in the 2000s, however, a new wave of academics has adopted a more sophisticated, culturally attuned, and sociological approach. This evolution in academic thought has coincided with significant legislative progress, including the 2015 Gender Equality Act and the landmark approval of the marriage equality bill. These laws represent a shift from

informal tolerance to formal recognition of the rights of these individuals. This legislative momentum is further reflected in national policy, such as Thailand's Fifth National Human Rights Plan (2023-2027), which formally designates LGBTQ+ individuals as a priority group for efforts aimed at eliminating discrimination and raising public awareness (Office of the National Human Rights Commission of Thailand, 2023). Nevertheless, challenges persist in effectively implementing and enforcing these statutes, and subtle forms of bias, such as microaggressions and promotional disparities, remain common in professional workplaces. This body of work highlights a gap at the intersection of LGBTQ+ employment, digital transformation, and high-growth sectors, including information technology. Responding to this gap, the present study brings together scholarship on gender and sexual diversity in Thailand with theories of gender and IT and labor economics to examine how digital tools and organizational practices shape LGBTQ+ workers' opportunities and constraints in the IT industry. This combined perspective informs the dual theoretical framework outlined below.

International research on LGBTQ+ labor market outcomes consistently documents wage gaps, occupational sorting, and differential access to stable employment, even in jurisdictions with legal protections. Studies in diverse contexts suggest that sexual and gender minorities may cluster in particular industries or roles perceived as more accepting, while still encountering barriers in advancement and pay parity. Bringing this literature into conversation with the Thai IT sector allows the present study to ask not only whether discrimination exists, but also how it is patterned across occupations and career stages.

A growing body of scholarship examines how digital platforms, remote work technologies, and algorithmic decision systems reshape workplace inclusion. Some studies highlight the risks of reproducing bias through automated screening, performance metrics, or opaque decision rules, particularly when training data reflect historical discrimination. Other research points to the potential of digital tools to expand access to training, enable anonymous reporting, and support communities of practice among marginalized employees. This article contributes to this emerging field by examining how such technologies are deployed in Thai IT organizations and how LGBTQ+ workers themselves perceive their impact.

Existing Thai scholarship has begun to document the stigma and discrimination experienced by LGBTQ+ workers in specific sectors such as services, education, and manufacturing. These studies underscore the role of entrenched gender norms, client expectations, and organizational hierarchies in shaping everyday treatment at work. However, comparatively little is known about how these dynamics manifest in the IT industry, which is often portrayed as meritocratic and globally oriented. By focusing

on this sector, the present study tests whether Thailand's broader patterns of gendered and sexual inequality are replicated, transformed, or partially mitigated in a digitally intensive environment.

This societal background is especially pertinent to Thailand's fast-growing IT sector. As a critical component of the "Thailand 4.0" economic strategy, the IT field is a high-wage, high-productivity industry essential for the nation's future. Yet, despite its modern, tech-focused image, the sector retains a traditionally male-centric culture. The current body of academic work on gender and employment in this area largely fails to address the specific experiences of individuals with diverse gender identities and sexual orientations, leaving a major research gap. Jackson and Dunagwises (2020) underscore this gap, advocating for more focused studies on gender and sexual diversity, particularly within high-growth fields like technology and business.

The empirical evidence from this research points to a clear pattern of job-based segregation within the IT industry. LGBTQ+ professionals are disproportionately found in roles like software development and IT consulting and are significantly underrepresented in senior management positions. This indicates that even if initial hiring barriers are low, a "glass ceiling" presents a formidable obstacle to career progression. Moreover, the study's findings reveal ongoing pressures concerning gender expression and identity that negatively impact job satisfaction and well-being. This suggests that for the digital economy to achieve its full potential, it must deliberately and proactively cultivate inclusivity for everyone, moving from passive tolerance to an active pursuit of equality.

To analyze these complex issues, this study employs a dual theoretical framework:

(1) The Individual Differences Theory of Gender and IT

Proposed by Trauth et al. (2004), this theory suggests that the underrepresentation of women in IT is not due to a single cause but results from a complex interaction of personal, social, and cultural factors. It rejects a simple male-female binary, asserting that an individual's unique traits and social environment—including their cultural upbringing, personal ethics, and life experiences—collectively shape their career path. This study expands upon this theory by incorporating sexual orientation and gender identity as crucial individual difference variables. By doing so, the research aims to uncover how the distinct identities of LGBTQ+ professionals in the Thai IT sector shape their career decisions, work experiences, and overall quality of life. This approach enables an analysis of how factors beyond traditional gender roles, such as the process of "coming out" at work or managing one's gender expression, have a direct bearing on professional success.

(2) Labor Economics Framework

This study merges the Individual Differences Theory with a labor economics framework to examine the measurable economic and career repercussions of the challenges the LGBTQ+ community encounters in the workplace. This framework, frequently used to investigate the effects of discrimination on the labor market, provides a systematic method for measuring how individual differences influence professional outcomes. Through this lens, the research analyzes how social biases and identity-related pressures translate into quantifiable results, including:

(2.1) Occupational Segregation: The clustering of LGBTQ+ workers in certain IT specializations and their scarcity in leadership positions.

(2.2) Wage Disparities: Gaps in pay between LGBTQ+ and non-LGBTQ+ employees who possess comparable qualifications.

(2.3) Job Satisfaction: The degree to which a hostile or non-inclusive work atmosphere adversely affects the job satisfaction and career endurance of LGBTQ+ professionals.

Methodology

This study was conducted using a comprehensive, multi-method research design. A sequential mixed-methods approach was chosen to gain a thorough understanding of the issue by integrating both quantitative and qualitative data.

The research process was organized into three distinct stages:

(1) Quantitative Survey: The initial phase utilized an online survey instrument designed to gather comprehensive data on the professional experiences of IT workers. This instrument comprised three main components:

(1.1) demographic questions to establish a baseline profile of respondents.

(1.2) Likert-scale items to quantitatively measure variables such as job satisfaction and perceptions of workplace inclusivity, adapted from established scales (e.g., Smith, 2020); and

(1.3) specific questions designed to document experiences with corporate diversity policies and instances of unfair treatment. The analysis of this data focused on identifying overarching trends, such as the general level of support in the workplace and potential inequalities in job satisfaction and career roles.

The survey employed a combination of purposive and snowball sampling strategies. Initial recruitment targeted employees in medium and large IT firms based in Bangkok and major regional hubs, using professional networks, LGBTQ+ community organizations, and online forums. Respondents were encouraged to share the survey link with colleagues, allowing the sample to expand across different company sizes and sub-sectors, including software development, IT consulting, fintech, and digital marketing.

(2) Qualitative Interviews: For the qualitative phase, in-depth, semi-structured interviews were conducted to provide a nuanced, contextual understanding of the quantitative findings. The interview protocol was developed to probe several key themes, including participants' career progression and any barriers encountered; their lived experiences with workplace culture, including microaggressions; the impact of gender identity and expression on their professional lives; and the perceived role of digital tools in either fostering or hindering an inclusive environment. A purposive sample of 38 individuals, comprising both LGBTQ+ professionals and company executives, was interviewed. This dual-perspective approach provided insight into both the employee experience and management's initiatives toward creating an inclusive culture. The interview data were analyzed using thematic analysis to identify recurring themes, narratives, and specific examples of challenges, such as microaggressions, as well as successes related to gender identity and expression at work.

The instrument included validated scales to measure job satisfaction, perceived organizational support, and workplace inclusivity, adapted to the Thai context through a pilot phase with a small group of IT professionals. Demographic questions captured gender identity, sexual orientation, age, education, role level, and company characteristics, allowing for comparisons across subgroups. Additional items asked about experiences of discrimination, microaggressions, career progression, and access to digital learning opportunities.

(3) Data Integration: In the final stage, the findings from the quantitative and qualitative phases were synthesized to create a comprehensive analysis. The statistical data from the survey provided a picture of what was happening and to what extent, while the interview data offered explanations as to why and how these phenomena occurred. For instance, broad statistical trends related to job satisfaction and occupational segregation were clarified and explained by the detailed personal accounts of specific challenges and the role of digital technology that emerged from the interviews.

Quantitative data were analyzed using descriptive statistics and cross-tabulations to identify patterns in satisfaction, discrimination, and occupational segregation across identity groups and job levels. Where sample size permitted, exploratory analyses compared outcomes for transgender and cisgender respondents, as well as between those in technical versus managerial roles. Qualitative data were transcribed and coded using thematic analysis, following an iterative process of developing, refining, and grouping codes into broader themes. Regular debriefing among the research team enhanced intercoder reliability and helped ensure that emergent themes were grounded in participants' accounts rather than preconceived assumptions.

Key Findings and Discussion

This section presents three key findings from the integrated quantitative and qualitative analysis of LGBTQ+ professionals in Thailand's IT sector. First, there is a marked discrepancy between a general perception of workplace tolerance and the persistence of microaggressions and subtle exclusion in daily interactions. Second, occupational segregation and a "digital glass ceiling" limit LGBTQ+ employees' access to leadership roles despite high overall demand for IT talent. Third, generic, one-size-fits-all diversity policies fail to address the distinct needs of different LGBTQ+ subgroups, underscoring the importance of intersectional, digitally enabled strategies for inclusion.

The Discrepancy Between Perceived Tolerance and the Pervasiveness of Microaggressions

A primary finding of this research is the significant gap between the industry's perceived culture of acceptance and the lived realities of many LGBTQ+ employees. The quantitative survey of 291 IT professionals suggests a broadly positive environment: 82.2 percent of respondents reported being "Satisfied" or "Very Satisfied" with their jobs, yet 27.1 percent reported experiencing discrimination, with transgender respondents (33.3 percent) and bisexual respondents (32.4 percent) reporting the highest rates in hiring and workplace treatment. Taken together, these figures indicate that high overall satisfaction coexists with substantial, unevenly distributed barriers, particularly for specific subgroups.

While the quantitative data points to general satisfaction, the in-depth qualitative interviews with 38 LGBTQ+ professionals and executives reveal that this perception is undermined by the pervasive influence of microaggressions. These subtle, often unintentional, verbal and nonverbal slights rooted in stereotypes about gender identity and sexual orientation constitute a significant source of psychological distress. While

not amounting to overt hostility, the cumulative impact of these daily encounters fosters an environment of alienation, increases emotional labor, and undermines professional confidence. For instance, this constant emotional labor was described by one transgender developer as follows: 'Every time someone uses the wrong pronoun, it's not just a mistake. It's a constant, painful reminder that, even here, I don't fully fit in. It chips away at your confidence until you start to question yourself.' Similarly, a gay professional noted the pressure to self-censor his personal life to maintain a 'professional' image in the face of insensitive inquiries.

Participants described a range of microaggressions, including verbal remarks framed as "jokes," persistent misgendering despite clear correction, and assumptions about relationship status or family plans. Behavioral and environmental microaggressions were also evident, such as exclusion from informal networking events, office banter that normalized heteronormative assumptions, or the absence of gender-neutral facilities in otherwise modern offices. These subtle cues reinforced a sense that LGBTQ+ identities were tolerated only within certain boundaries and at the discretion of colleagues or managers.

Our research indicates that digital platforms offer robust mechanisms to counteract these phenomena. Anonymous reporting systems, for example, provide a confidential channel for employees to report microaggressions without fear of professional reprisal, thereby furnishing leadership with actionable data to address systemic cultural issues. Furthermore, the organizational shift toward remote and hybrid work models can mitigate the frequency of in-person interactions where such biases often manifest, granting individuals greater control over their professional environment and reducing the psychological burden of navigating potentially exclusionary office spaces.

Table 1 synthesizes six recurrent themes related to LGBTQ+ workplace experiences, drawing primarily on this study's interviews while also incorporating relevant contextual insights from other sectors to situate IT-sector findings within a broader employment landscape. It highlights how pressures around identity disclosure, expression, discrimination, mental health, and organizational support manifest across sectors, while also indicating which groups are most affected and what implications arise for targeted inclusion strategies.

1. Pressure to Conceal Identity	Disclosure depends on industry culture; progressive sectors allow openness; traditional sectors create pressure.	Transgender employees; workers in finance/manufacturing/client-facing roles.	Fear of bullying, discomfort, uncertainty in behavior; some disclose at work but hide in public.	Need for targeted inclusion strategies addressing pressure to conform.
2. Freedom of Expression & Voluntary Disclosure	Diverse gender expression accepted in supportive workplaces; discrimination often subtle.	Lesbian, bisexual, transgender employees; younger workers.	12 openly expressive staff; 7 experienced verbal "joking" discrimination; 16 reported mental health effects.	Organizations must address micro-level bias and provide mental health support.
3. Acceptance, Compensation & Career Growth	Performance-based industries provide equitable treatment; subtle bias persists in conservative settings.	Transgender and lesbian employees.	Appearance-based assumptions; client-facing roles influenced by societal norms.	Transparent promotion systems and anti-bias training essential.
4. Experiences with Discrimination	Overt discrimination rare; microaggressions common.	Female and transgender employees.	Misgendering, stereotypes, intrusive comments; conservative industries show stronger norms.	Strengthen microaggression training and enforcement policies.
5. Mental Health Impact	Inclusivity strongly linked with mental well-being; inconsistent policies cause stress.	Transgender employees (highest risk).	Anxiety from misidentification; reduced performance; physical symptoms.	Need for mental health resources, identity-affirming policies, and safe reporting.
6. Supportive Initiatives & Policies	Pride events, workshops, and mentorship highly valued; fairness concerns among a minority.	Transgender and female employees; LGBTQI staff in IT.	Removal of gender titles; equal benefits; emphasis on legal protections.	Comprehensive inclusion policies and national-level protections recommended.

Table 1. Overview of LGBTQ+ Workplace Experiences Across Six Themes

Occupational Segregation and the "Digital Glass Ceiling."

Our analysis identified a distinct pattern of occupational segregation that impedes the career progression of LGBTQ+ professionals. Despite a high industry demand for talent, our data indicate a disproportionate concentration of LGBTQ+ individuals in technical roles (e.g., software development), with a corresponding underrepresentation in senior management and executive positions.

This "glass ceiling" appears to be less a function of overt hiring discrimination and more the result of subtle, systemic biases. This finding aligns perfectly with Trauth et al.'s (2004) Individual Differences Theory, which posits that unique life experiences and individual identity factors—in this case, managing one's LGBTQ+ identity—profoundly shape career decisions and experiences within the IT field. As one highly experienced lesbian project manager articulated, observing less-qualified male peers advance while her own successful projects were overlooked led her to question whether she fit the organization's preconceived "leader archetype"—a clear example of how personal identity intersects with professional barriers. Ultimately, these patterns of occupational segregation have clear economic consequences, reflecting the labor economics framework of our study. The "glass ceiling" translates into measurable disparities in earnings potential and career advancement, representing a quantifiable economic impact of social bias that cannot be ignored.

Several interviewees noted that digital project management and performance-tracking systems, while presented as neutral instruments, sometimes institutionalized existing informal hierarchies. For instance, senior managers retained control over which employees were nominated for high-visibility projects or leadership development programs, and these decisions were then encoded into digital records that shaped future opportunities. LGBTQ+ staff who were perceived as “less compatible” with client expectations reported being channeled into backend or support roles, limiting their exposure to strategic assignments that are often prerequisites for promotion.

However, strategic technological intervention can be instrumental in dismantling these barriers. For instance, virtual mentorship programs and online professional networks can democratize access to leadership development by connecting LGBTQ+ employees with senior leaders based on skills and career objectives. This bypasses the informal, and often exclusionary, social networks that traditionally govern career advancement. Our interview data confirm that such digitally-enabled platforms are highly valued, providing a secure and impartial space for crucial career development discussions.

The Limitations of Homogenous Policies and the Need for Intersectional Strategies

A crucial finding is that generic, "one-size-fits-all" diversity policies are poorly aligned with the varied experiences of different LGBTQ+ subgroups in the IT sector. Transgender and non-binary participants, for example, reported more frequent and severe barriers than cisgender LGB colleagues, including greater exposure to misgendering, heightened scrutiny of appearance, and obstacles to updating employment records to reflect their affirmed identities.

Digital HR systems also play a crucial role in enabling or constraining intersectional analysis. Organizations that collected only binary gender data and did not provide options for sexual orientation or diverse gender identities were unable to track disparities across key outcomes such as hiring, promotion, or turnover. By contrast, a small subset of firms had begun to introduce voluntary, confidential fields for SOGIE-related information, coupled with strict privacy safeguards. These systems allowed HR departments to identify patterns that would otherwise remain invisible, such as higher exit rates among transgender employees or slower progression for bisexual staff in client-facing roles.

This underscores the necessity of an intersectional approach to diversity and inclusion. A monolithic policy framework fails to account for the unique challenges faced by different identities within the community, such as the need for institutional support for gender-affirming healthcare, administrative assistance with updating legal documents, or training on the correct use of pronouns.

Therefore, effective strategies must be meticulously tailored. This requires organizations to move beyond passive tolerance toward active, evidence-based inclusion. Key actions include implementing inclusive hiring protocols designed to attract diverse talent pools; establishing structured mentorship programs that explicitly connect LGBTQ+ staff with senior leadership; and leveraging data analytics to monitor for and rectify pay and promotion disparities. By embedding these practices and utilizing technology as a core tool for equity, organizations can create a genuinely inclusive culture where all employees are empowered to achieve their full potential.

Conclusion and Recommendations

This study shows that Thailand's information technology sector, despite its centrality to national economic strategy and its ostensibly progressive culture, remains shaped by systemic and often subtle biases that constrain LGBTQ+ employees' professional trajectories and well-being. By looking beyond the surface image of social tolerance,

the analysis identifies persistent microaggressions, entrenched patterns of occupational segregation, and their cumulative negative effects on mental health and productivity among LGBTQ+ professionals.

A key insight is that the absence of overt hostility is an insufficient benchmark for inclusion. Genuine inclusion requires proactive, intentional action at all organizational levels, including the systematic identification and remediation of everyday practices that signal to LGBTQ+ employees that they do not fully belong. The interviews describe the psychological toll of environments that tolerate, but do not actively challenge, microaggressions, leading employees to question their competence and place within the organization.

The findings confirm that to bridge this gap, organizations must evolve from a stance of passive acceptance to one of active, accountable inclusion. Digital technologies and innovative practices are central to this process. For example, one practice observed went beyond a simple feedback form, creating an anonymous virtual "safe space" for employees. This platform was supported by a dedicated internal committee that used aggregated, anonymized data to identify and address systemic issues, transforming individual reports into a mechanism for data-driven organizational change.

Based on these findings, the study proposes the following strategic recommendations designed to build a more supportive, equitable, and high-performing environment for LGBTQ+ professionals within the Thai IT sector.

(1) Recommendations for Organizations and Corporate Leadership

(1.1) Establish and Embed Formal Anti-Discrimination Policies:

Go beyond a basic legal statement. Implement and rigorously enforce comprehensive anti-discrimination policies that explicitly name sexual orientation, gender identity, and gender expression (SOGIE) as protected characteristics. These must be "living documents," regularly reviewed and clearly communicated during onboarding and ongoing training. Crucially, they must be linked to transparent, confidential reporting channels and strict non-retaliation clauses to ensure employees feel safe speaking up.

(1.2) Use Digital Platforms for Continuous, Evidence-Based Inclusion Training:

Mandate and invest in high-quality online training for all employees, including senior leadership. This should not be a one-time event. The curriculum must be practical, covering unconscious bias, the tangible impact of microaggressions, the principles of active allyship, and the importance of using correct pronouns. The goal is to build a

shared vocabulary and a common understanding of what a respectful and inclusive workplace looks and feels like.

(1.3) Cultivate and Mandate Supportive, Accountable Leadership:

Train all managers and executives to be active champions of diversity and inclusion. This responsibility should be written into leadership competencies and performance evaluations. Leaders must be equipped with the skills to foster psychological safety on their teams, interrupt bias when they see it, and promote a culture where LGBTQ+ employees feel seen, safe, and valued for their contributions.

(1.4) Leverage Technology for Equitable and Transparent HR Practices:

Employ digital platforms to create secure and confidential feedback channels for employees. Utilize data analytics to conduct regular, objective audits of hiring, promotion, project assignment, and compensation data. This data-driven approach is essential to identify and rectify potential systemic biases, ensuring that career progression and remuneration are based on merit rather than on unconscious prejudice. These practices operationalize the article's central claim that digital technologies, when designed and governed with equity in mind, can function as core infrastructure for inclusive work and learning rather than as neutral administrative tools.

(2) Recommendations for Government, Public Sector, and Industry Bodies

(2.1) Strengthen and Actively Enforce Legal Protections:

Ensure that landmark legislation, such as the marriage equality law and the Gender Equality Act, is effectively implemented with clear and accessible enforcement mechanisms. This provides a legal foundation that empowers individuals to seek recourse against workplace discrimination and signals to employers that inclusive practices are a national priority.

(2.2) Launch and Sustain Public Awareness Initiatives:

Develop and fund national campaigns to highlight the economic and social contributions of the LGBTQ+ community. By promoting positive visibility and challenging outdated stereotypes, these campaigns can help shift cultural perceptions, reduce social stigma, and create a more welcoming environment for LGBTQ+ individuals both within and beyond the workplace.

(2.3) Fund and Promote Targeted Research for Evidence-Based Policy:

Support further academic and industry research into the experiences of sexual and gender minorities, particularly within high-growth sectors like IT. A continuous stream of data and evidence-based insights is crucial for ensuring that both corporate strategies and public policies remain effective, relevant, and responsive to evolving workplace realities.

Future research could build on this study by employing longitudinal designs to examine how changes in legal frameworks, corporate policies, and digital infrastructures alter LGBTQ+ employees' experiences over time. Comparative work across sectors, or between Thailand and other countries in the region, would further clarify which aspects of inclusion are context-specific and which are more broadly generalizable. In addition, closer examination of algorithmic decision-making in recruitment, promotion, and performance evaluation could illuminate how seemingly neutral digital tools contribute to or mitigate inequality.

By implementing these integrated recommendations and continuing to generate context-sensitive evidence, Thailand can ensure that its digital economy is not only a driver of innovation and growth but also a benchmark for diversity, equity, and inclusion that maximizes the potential of all its talent.

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Goh, A. Y. S., Permpoonwiwat, C. K., Kersh, N., Ostendorf, A., Evans, K., Ho, S. (Eds.):
Enriching Learning at Work: Inclusiveness and Empowerment in the Age of Digital Innovation.

ISBN 978-3-99106-195-3 , DOI 10.15203/99106-195-3-14

Enriching Work-Related Learning in Higher Education through Innovation and Diversification

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This paper is based on the project Building Bridges Between Higher Education (HE) and Employment: Learning from Practically-Based HE, conducted collaboratively by the UCL Institute of Education and the Edge Foundation (UK). The paper explores the complexities of fostering graduate employability, a key concern both in the UK and internationally. There is increasing emphasis on preparing young people for the workforce by equipping them with the skills needed in the modern labour market to enhance their employability and long-term career prospects (Robson, 2023; Cranmer, 2006; Prokou, 2008). A qualitative methodology was employed, focusing on case studies from two HE institutions in England. Data were collected through twenty semi-structured interviews with a range of stakeholders, including university staff and students. Our findings highlight that key stakeholders - university staff, industry representatives, and students - are actively engaged in the co-creation of unique learning spaces within higher education. These spaces form new, environments that bridge academic and practical (work-related) domains. The study reveals that integrating theoretical learning, practical experience, and employer engagement requires continuous boundary-crossing across intermediary spaces where education and work intersect. This process is underpinned by innovation, diversification, and the development of new technologies. Although this paper focuses on research conducted in the UK, it also considers aspects of graduate employability relevant across the broader ASEM countries and contributes to the multinational research project by highlighting the global implications of the topic

Keywords: higher education, work-related learning, boundary-crossing, employability

Introduction

This study, conducted collaboratively by the UCL Institute of Education and the Edge Foundation (UK), has also become a part of an ongoing international research initiative- the Asia-Europe Lifelong Learning (ASEM) Network project - conducted across 14 countries in Asia and Europe. The overarching aim of the project is to explore the complexities of work-related learning and contemporary approaches to enriching it through innovation and diversification in different contexts and settings. The ASEM collaboration seeks to investigate these multifaceted issues across diverse national landscapes, highlighting research and developments in workplace learning in both Asia and Europe. It focuses on the contextual and cultural factors that foster inclusivity, sustainability, and resilience in work-related learning, while also examining how innovation, digital technologies, and empowerment are transforming such learning environments. In line with the broader focus of this volume on the inclusive use of digital technologies and innovation to enrich workplace learning and empower workers, this chapter positions higher education initiatives as an integral component of a wider, interconnected learning ecosystem. In particular, the bridging of classrooms and working environments is understood not merely as a pathway to employability, but as part of a lifelong learning continuum in which both innovation and inclusive digital practices play a critical role. In this sense, innovation and digital technologies are framed not only as tools for employability, but also as enablers of social inclusion, resilience, and sustained participation in learning across contexts.

The UK-based project explores the role of higher education (HE) in preparing graduates for the world of work. It investigates how links between academic study and practical experience are fostered, positioning practice-based education more centrally within a diverse and inclusive HE landscape. In England, the HE sector is undergoing significant change, with increasing diversification in provision. As society evolves, bringing new workplace developments - such as the influence of technological innovations and an emphasis on graduate transferable skills and adaptability - the higher education sector is responding by rethinking its provision to meet the emerging demands of industry and society. This shift is particularly evident in the emergence of educational practices designed to meet the needs of contemporary students—by promoting graduate employability and inclusion, as well as those of employers, by producing adaptable, work-ready graduates capable of responding to the rapidly evolving demands of industry, shaped by societal and economic changes, technological developments, and ongoing innovation.

Adaptability and flexible skill sets, which extend beyond theoretical knowledge, are now essential (see e.g. Kersh and Laczik, 2021). The integration of work-related

learning within higher education plays a crucial role in fostering these capacities by enabling students to apply knowledge in real-world contexts, respond to uncertainty, and develop transferable skills such as problem-solving, collaboration, and reflective practice. Through sustained engagement with work-related environments, learners are encouraged to adapt to changing demands and to navigate transitions between educational and professional settings. Innovation, diversification and the integration of work-related learning in higher education are increasingly interconnected, driven by goals to enhance employability, improve life chances, and expand students' career opportunities. This project explores how work-related experiences and practice-based learning spaces within higher education support students' employability through their inclusion in work-integrated learning, shaped by the evolving labour market, industry demands, and technological innovations. Our research question is**:**

How does the use of innovation and diversification in higher education facilitate work-related learning, employability and sustainability for the HE students?

In the context of our study, we explore how key stakeholders create and co-create unique learning environments that connect higher education with industry, and academic learning with workplace practice. Interactions among stakeholders play a critical role in facilitating learning at the intersection of theory and practice (Fettes et al., 2020). Co-created environments - where collaboration between universities, students, and employers takes place - require the creative integration of theoretical and practical knowledge, often underpinned by technological developments and innovations. These environments are most effective when supported by strategies that foster a culture of inclusion and innovation.

Theoretical considerations

We approach the research question from the standpoint of innovation and diversification in higher education through boundary crossing (Tuomi-Gröhn et al, 2003; Akkerman, 2011; Akkerman & Bakker, 2011), focusing on the ways graduates can be empowered and supported to build bridges between higher education and the workplace across diverse contexts. In the literature, the concept of boundary crossing has been used to deepen our understanding of work-related learning and the integration of knowledge and skills across different domains. Boundaries may be crossed by individuals, learning at the intersection of theory and practice, as well as through interactions among actors from different professional or institutional practices (Akkerman & Bakker, 2011; Fettes et al., 2020; Evans, 2009). This process is often complex and multidimensional. As Garraway (2010, p. 212) observes,

"knowledge enters into a new set of social relations when it moves between work and the academy."
Applying this framework to higher education provides a lens through which to explore its evolving landscape and its intersection with practice-based and work-related learning. These theoretical considerations suggest that continuous boundary crossing - especially through the creative integration of theory and practice - is central to fostering transformation and innovation in higher education. Such efforts are underpinned by meaningful stakeholder engagement. Interactions and communication among diverse stakeholders help shape a unique learning ecosystem, one that connects academic study, work contexts, and lifelong learning (Römgens et al. 2020; Spours & Grainger, 2018; Buchanan et al., 2017)

Methodology

This UK-based project undertook two case studies of higher education institutions in England, which are referred to in this paper as University 1 (U1) and University 2 (U2). These cases were selected through purposive sampling to identify both commonalities and differences in the strategies used to enhance graduate employability by embedding work-related learning into the higher education curriculum. Data collection was conducted in two stages. The first stage involved desktop and contextual research focused on the two case study universities. This included an analysis of the skills and industry profiles of the local areas in which the universities are situated.
In the second stage, we undertook empirical data collection to examine the strategies and approaches adopted by both institutions to foster practically based higher education through the diversification and innovation of their provision. We conducted semi-structured interviews with a range of stakeholders from the two universities. These included pro-vice chancellors and other members of the senior leadership teams, heads of schools, lecturers, staff members with university- or school-level professional roles (such as employment engagement officers), and students. In total, 20 interviews were conducted across the two institutions. In this paper, we present findings from interviews conducted with university staff. For analysis of the full dataset, including interviews with students, please see the Edge Foundation report. For the purposes of this paper, university staff are categorised according to their roles. Vice-rectors and members of senior management are referred to as *Senior Leaders (SL)*, while heads of department are referred to as *Middle Leaders (ML)*. In some instances, we describe roles not by their original titles but by terms that are close to

the original (e.g., *Head of Employer Engagement*), in order to highlight specific features of the role while maintaining the anonymity of participants.
The data were analysed using thematic content analysis to identify themes and sub-themes emerging from the interviews. The research adhered to the British Educational Research Association (BERA) ethical guidelines (2024). Ethical approval for the study was granted by the Ethics Committee at IOE, UCL's Faculty of Education and Society.

Findings and discussion

Rethinking Graduate Employability: exploring the role of technology and innovation

The findings indicate that both universities place a strong emphasis on developing graduate employability, thereby fostering inclusive and innovative spaces where working and learning are integrated, and enabling students to experience workplace practices in an inclusive way. A central strategy in both institutions involves enhancing employability through integrating theoretical learning, practical experience, and employer engagement. As noted by one of our participants, *'the institutional DNA is changed'* (MB, U1), and there is a strong emphasis on the view that a degree alone is no longer sufficient to meet the challenges of the 21st-century workforce, and that higher education must prepare students to address these challenges by embedding work-related learning within university studies, to facilitate their transition and inclusion into the world of work.
Our data reveal a wide recognition among university staff that graduates' inclusion in the world of work can be fostered by enabling students to cross boundaries between higher education and the workplace during their studies. Both universities have made a full commitment to fostering employability skills among their students, with the concept of employability extending beyond the goal of simply securing employment. Rather, employability is understood as developing a broad set of skills, adaptability, and preparing students to navigate diverse and changing professional contexts. The changing landscape of higher education, the labour market, and society has reinforced the view that employability must be embedded as a strategy within teaching and learning across all higher education disciplines (Kersh et al., 2025). As defined by one of our participants (SL, U1), employability is not only about equipping students with the skill set needed to remain sustainably employed, but also about uncovering their potential and inspiring them to pursue their professional aspirations:
I think employability is developing the skill set, to meet your desire to make a desirable employment, whatever that is. So, you've got to remember that people come on and do degrees, for a variety of reasons. We need to enable the students to reach

their potential, but also push them in order to develop the skill sets needed for the 21st century. To give them the best possible option, and opportunities not just when they graduate, but 10 years. Because they are not going to stay in the same job, they're going to move between disciplines, it's those wider skills and attributes that are absolutely key and making them employable. (SL, U1)

The importance of preparing students for the demands of the modern workforce, emphasising the need for cross-disciplinary adaptability, creativity, and entrepreneurial thinking has been further highlighted:

We need to ensure that our students have the 21st century skills. So be able to problem solve critical, critical work and be creative mindsets. But also link and be able to work outside their discipline is absolutely key and be able to have an entrepreneurial mindset in the sense that they can go into a different discipline. And they can change their language to something that discipline can understand.(SL, U1)

Developing and supporting students' employability is a multidimensional process within the higher education sector, involving aspects such as career support, skills development, the formation of professional identity, and building students' confidence in their career choices. As Graduate Experience Manager (U2) reflects, students benefit not only from structured career support and skill-building, but also from experiences that develop entrepreneurial thinking and professional identity: these opportunities enable students to engage with a wide spectrum of skills while also fostering social interaction and confidence in their future career pathways:

So you've got that employability that skill development, the career support and skill element, but you've also got the other end of the spectrum, which is the entrepreneurial and the enterprise. So there's a whole range of skills either end and within that spectrum that the students can benefit from- from this kind of exposure and involvement. […] also from the student perspective, there's the social interaction, which I think is really important at this point in time. […] So for me that's a big thing, that social aspect and that social element, but also, you know, it's building the student's professional identity. […] We want our students to be confident in their career choices, and hopefully we can give them enough experience and exposure to you know, that working for an organisation in an organisation as well as on their own to make that decision. That's ideally what we're aiming for. (Graduate Experience Manager, U2)

The role of technology has often been emphasised as a key driver of innovation and diversification in higher education. Responding to these technological developments and preparing students for the new challenges and opportunities of the workplace has been highlighted as one of the central missions of universities. In particular, participants pointed to the post-pandemic shifts in how students want to learn,

alongside the growing need to optimise the use of new technologies (e.g. Generative AI), as major factors shaping the sector of higher education. As a Senior Leader explained:

And I think in terms of things that are really impacting on the sector, [higher education] is that dealing with that post pandemic, change in how people want to learn, I think is a big one. And the huge one at the moment is obviously the optimising for the use of generative AI - artificial intelligence. Artificial Intelligence is absolutely key. (SL, U1)

The ability to respond to new, both social and technological challenges and opportunities fosters students' adaptability and transferable skills, which are essential for their successful inclusion in the world of work.

Now, this [adaptability and skills development] has proven to be really useful for us, as random, unpredictable things like AI have kind of hit the top of the agenda list. (Head of Career Development Centre, U2)

In both universities, the co-creation of innovative learning environments situated at the intersection of higher education and the workplace provides opportunities for crossing boundaries and developing a set of skills, aspirations and identities. Key actors, such as university staff, industry partners, and students, are involved in the co-creation of these inclusive spaces, which are designed to bridge theory and practice. These hybrid environments allow students to engage in meaningful experiences that transcend traditional academic boundaries, fostering collaborative learning and co-creation and enhancing employability.

Learning through working and learning spaces in the context of higher education requires the establishment of an ecosystem that actively involves all key stakeholders. Our study suggests that such unique learning ecosystems are developed and sustained through boundary-crossing processes driven by three interconnected elements: (1) innovative curriculum development, (2) stakeholder collaboration, and (3) the bridging of classroom and work environments.

Innovative curriculum development

In both universities, innovative curriculum development reflects a shift from traditional disciplinary provision toward approaches that align with the cross-disciplinary nature of industry collaboration, evolving skills demands, and rapid technological change. This enables both students and academic staff to navigate boundaries between learning and working, theory and practice, and academia and industry. A guiding question in this process is: *What do students need to learn in this subject to apply their knowledge in real-world contexts?* This presupposes a curriculum that is '*built around students*,' taking into account their aspirations and

needs while enhancing their employability through practice-based learning and industry engagement. A key principle of curriculum development in this context is its outward-facing orientation, characterised by strong connections to the world beyond the university. This innovative, demand-led approach ensures that course design is informed by labour market needs, with particular emphasis on the requirements of local industries - a focus highlighted by both universities in the study.

The core principles of curriculum redesign are strongly underpinned by the following interrelated elements:

- embedding work-related components into the curriculum,
- developing students' transferable skills, and
- equipping them to navigate and use technological innovations, while recognising both their strengths and limitations.

Embedding work-related components occurs through a range of initiatives that involve employer engagement - such as work experience opportunities and industry encounters -as well as practice-based learning within higher education. This may include hands-on practical activities, simulations, and project work. In addition, it is increasingly regarded as good practice to involve employers in programme and module design, including the development of assessments.

They [employers] are really keen to get involved in curriculum development in what we do, and so they're quite open to suggestions as to how they can get involved with that. (Graduate Experience Manager, U 2)

Offering a rich and varied curriculum experience is at the heart of curriculum development efforts in both universities. This approach not only provides disciplinary and work-related learning, but also fosters graduates' transferable skills- skills that cannot be developed solely in lecture theatres but require a variety of different experience as part of HE studies:

It's those career supporting skills that are most important, such as your critical thinking, your problem solving your communication. And those skills can't be learned in a lecture theatre. And that is kind of the bones of what we're, that's the foundation for what we're doing, I think. And those skills take time, and a number of different experiences will help build those. So I think that's kind of where we're coming from, with that rich and varied curriculum experience that we're trying to offer (U1, Head of Employer Engagement)

Similarly, U2 also highlighted the importance of aligning curriculum development with evolving industry needs and labour market trends and recognising the value of continually monitoring future trends and sector-specific developments to ensure that

academic programmes remain relevant and responsive. Faculty members play a crucial role in identifying these developments and disseminating insights across subject areas, as illustrated in the following comment:
So I think really, in terms of the curriculum development, it's keeping an ear to the ground and keeping an eye on what the industry changes are and the requirements and where the job market level labor markets going. Looking at relevant industry and sector statistics and things. And there's other staff in the faculty three or four that are very heavily involved in these areas that then drip feed it down to everybody else. So it's always covered for the specific specialisms as well. (ML, U2)

Technological innovations are further reshaping the landscape of both higher education and industry, with significant implications for curriculum development, university–industry cooperation, and graduate employability. AI systems, in particular, create opportunities for innovation in higher education, but they also require careful implementation and a rethinking of traditional graduate programmes to ensure that these technologies are used to enhance graduates' employability, transferable skills, and career opportunities.
I'm telling academics, because if you look at the impact, I mean, I know Chat Gpt is the most well-known AI system out there, but there are a lot of AI systems out there that are going to decimate traditional academic programs and employment. I tell the academics: When I was at high school, we had two classrooms that were full of typewriters and girls learned to type because there was a big job opportunity for typing pools. Within five years of the computer becoming affordable, there wasn't a single typing pool left in the UK. The same is going to happen for a lot of industry sectors, with new technologies. As a university, we have to embrace that, work with industry to provide the talent pool to meet that. But that will be a process of change that could have significant impact on a few key industries that you know, you could classify as typing pills. (Head of Employer Engagement, U1)

What also emerges from out study is that the expansion of technology and AI systems may provide additional incentives for the higher education sector to strengthen employer engagement strategies. One approach is industry involvement in curriculum and assessment design, which helps make assessments more authentic by reflecting industry practices and enabling students to engage with practical activities and real-life tasks to demonstrate the workplace relevance of their classroom learning - through 'mirroring industry practices':
Because when people start talking about AI, people also start talking about authentic assessment. And if you've got an organisation with real work, and real problems and real opportunities, involved in the learning and teaching that you are providing,

you've got sort of on the doorstep options for authentic assessment. (Head of Career Development Centre, U2)
We have a commitment to kind of authentic assessment and creating learning environments and timetables that mirror industry practices. We employ a lot of academics who have had previous careers or kind of concurrent careers in professional disciplines. (ML, U2)

In redesigning curricula across all disciplines, both universities are adopting an outward-looking approach that places strong emphasis on making learning relevant to the world of work and responsive to technological innovations, with employer engagement recognised as one of the most crucial dimensions for enhancing students' employability, fostering authentic learning experiences, and building closer partnerships between universities and industry. Both universities reported facing some common challenges in sustaining meaningful employer engagement. These include aligning academic and industry expectations, managing differences in timescales and priorities and balancing responsiveness to labour market needs with broader educational aims. Such challenges highlight the complexity of integrating employer perspectives into curriculum design and redesign.

Stakeholder and industry engagement

The key question in curriculum redesign- *What do students need to learn in this subject to apply their knowledge in real-world contexts?* - directly connects to the second dimension, which involves fostering collaboration between higher education and industry to co-create spaces for industry-engaged learning. Such collaborations are facilitated through diverse methods of communication and partnership, ensuring that learning environments are informed by current industry needs and practices. Industry engagement is also strongly associated with institutional maturity and university culture, both of which underpin the learning ecosystem within higher education. As noted by a Senior leader in U1:
I think it's the institutional maturity around this industry, collaboration and strategic partnership viewpoint. I could point to every school now and identify a number of areas where we have strategic partnerships. So, it's now in the culture of the university to develop these partnerships. (U1, SL)

Employer engagement in higher education takes many forms, encompassing both formal and informal learning opportunities. It may be embedded within the curriculum through programmes such as placements or work experience, or offered through extracurricular activities such as networking events and collaborative initiatives with industry representatives. Increasingly, employers are also invited to

serve on university- industry advisory boards, contributing to curriculum development. Such opportunities for engagement are widely regarded as valuable in exposing students to employers and enabling them to begin learning about their chosen industry and developing their professional networks.

The University offers students, a lot of opportunities to engage with industry, work with industry, do industry relevant projects, so that when they do go for a job, they have got industry awareness and knowledge, and they know what industry are looking for. They've got experience, rather than just hey, I've got my degree. (Head of Employer Engagement, U1).

While employer engagement is considered an important component of higher education studies, it faces a number of challenges, particularly in incentivising employers to get involved and in developing sustainable relationships. Instances of employer engagement are often transactional rather than long-term and sustainable , and in many cases rely heavily on personal contacts. Developing sustainable and trusted relationships and collaborations with employers is regarded as a complex process:

So as you all know, relationships are all about people. You don't have it in between institution and institution, its people and people. And you have to establish credibility with the relevant people inside an organization. And that counts for both the University and the industry partner. Academics don't trust easily because they like to build a relationship with someone they know they are not being used and abused, if that's the wrong term. And they are sometimes sceptical. But I've been able to establish a very good working relationship with a number of academics around the university who reach out to me and ask for support, or I can take industry to and know that the academics will do a good job. […] So, it's emphasis on establishing credibility through delivery and meeting the clients, the customer's requirements (Head of Employer Engagement, U1).

Links between the workplace and higher education have been incentivised by growing social demands to innovate workplace practices and incorporate technological advancements. This need often pushes businesses to look toward higher education for expertise and support in implementing innovative solutions. As highlighted by our data, one area, for example, where this collaboration becomes particularly relevant is automation, as companies increasingly recognise that streamlining processes and adopting automated systems are essential for remaining competitive. This motivates companies to recognise the reciprocal benefits of working with universities and develop collaborations. However, the reality of these collaborations can be complex,

as noted by the Director of Strategic partnership in U1, and some companies reported previous difficult experiences of collaborating with universities:
Another one was, there's a company that does basically road painting, they paint all the lines on the motorways, they put down cats eyes, temporary and permanent ones. All their directors came from the bottom of the company up. […] It's proper, hard-working men develop the company from scratch. They realise they have to automate their systems to increase the speed. But they have spoken to many other universities and been stitched up. They've gone into some projects and the university said, yeah, we can do that. (Head of Employer Engagement, U1)

Digitalisation and digital skills have been identified as another trend that may incentivise employers to offer internships or work experience to higher education students. Employers increasingly expect students undertaking work experience to be 'up to date with digital skills.' While such skills can facilitate students' inclusion in the workplace, they may also risk excluding those students who are less technologically oriented:
there's two sides that actually saw the internship side of things, the amount of digital roles coming through were very, very high. There was a disproportionate number of those. So you know, they were in high demand […] with those digital skills. But like you say, there's another side of that, and it can sort of exclude other students as well, who maybe aren't as digitally, sort of up to date as well. (Graduate Experience Manager U2).

Providing students with the skills to become digitally confident would enable them to demonstrate these abilities to employers, thereby enhancing their chances of securing internships or work experience opportunities. For universities, this also means building sustainable relationships with companies that are interested in offering such opportunities to students who can contribute valuable digital skills to the workplace.
So there is a lot of digital roles on the internship side. And then with the sustainability, we're getting a lot of requests for placements [for such roles]. Because obviously, it's going to be on every well, it is on every employer's agenda. So yeah, we've got to have a bit of a strategic approach to that one. (Graduate Experience Manager, U2)

Similarly, at U1, the Head of Employer Engagement described how the university's expertise in developing and using VR incentivised an employer to offer students a real-life project
I did a fantastic project between art schools and media and [name of bank] , around a student project. They [the bank] wanted to do some VR stuff. I knew of the academic in the school, and had the individual relationship with that guy. And was

able to then position it to [Bank], and then act as sort of like a mediator, but, you know, the glue, so that I could make sure the project would work (Head of Employer Engagement, U2)

A key benefit of this project was embedding industry collaborations within degree programmes that students can translate these experiences directly into their employability profile. As the Head of Employer Engagement further explained, this project not only provide learning opportunities but also offer tangible evidence of their technical skills and professional engagement that students can showcase to future employers:
But students are able to reference the work they've done. Just take the VR project with [the bank], you know, the students that do that project, it's on their CV that they, it's on the [bank] website, their project. So, when they say oh, we've worked with [the bank]. It's a very compelling argument on their job application. Give me an example of where you work with industry. Oh, I've worked with [the bank] on this, this and this. So that experience this is what I mean by your degree won't get you a job. What will get you a job is your degree plus, referencing all this industry engagement.(Head of Employer Engagement, U1)

For less technical subjects, such as those in the humanities, establishing direct partnerships with employers can be more challenging. Universities, therefore adopt creative approaches to identify potential collaborative projects that allow students to apply their skills in relevant contexts. As one interviewee (head of department) explained, this is particularly evident in how English majors are encouraged to see the wider industry value of their discipline:
So thinking not of English as a broad study of literature, study of linguistics, creative outputs, that might be more kind of, poetry and prose, but as what industries would particularly kind of benefit from really kind of qualified and, articulate English students. So that brings you in to quite an interesting conversation, because then you're thinking about well, there's publishing, there is kind of the fringes of journalism, but then there is the screen writing and there's creating content for video games. (ML, U2)

Bridging the classroom and the work-related environments

Using innovative practices and technological developments to help students to cross boundaries between working and learning, provides affordances for integration theory and practice. Bridging the classroom and the workplace entails the creation of innovative learning spaces that enable students to integrate academic knowledge with practical experience. These environments are typically co-created by academic

institutions and industry partners to ensure that learning is both meaningful and applicable to real-world contexts. Within higher education, creating such spaces involves curriculum development, employer engagement, and the integration of work-related learning with academic knowledge, often enriched by the use of technology and innovation..

Such spaces could be either purposefully or incidentally created and co-created, for example, through collaboration between students, university staff and other stakeholders. The example below, from a Head of Department in the area of Creative Industries at U2, illustrates how students on the Media Studies course benefit from a hub that provides opportunities for interaction and collaboration:

we've created physical spaces, for example. We have something called a media hub, I know this is quite common, I'm not claiming this is innovative. We've got a media hub, which is a space where interns, professional staff are based. Students kind of work with each other. They can work on projects, they can ask questions get help work together, but we also have had various external kind of people base there. So we have had a BBC journalist base there. We've got a TV company and the whole idea is bringing them in to this community of practice where they feel increasingly, like they belong to a professional community. (ML, U2)

Engaging through such spaces with a range of stakeholders and undertaking collaborative projects facilitate the crossing of boundaries between education and employment, as well as between theoretical study and practical activity. The Head of Department further described this as 'breaking the barriers' and building relationships through work-related spaces:

so anytime we can get students on a placement, you know, into work shadowing, or bring people in so that they're just in that environment. That's the stuff that breaks down the barriers and allows them to build relationships. (ML, U2)

Another example of innovative initiatives from U1, is a new project that enables students to cross traditional boundaries through the creation of practice-based, collaborative spaces. The Director of strategic engagement described the development of a microbrewery, bakery, café and bar as a unique learning space to integrate real-world industry practices into academic programmes, offering students ongoing, hands-on projects that bridge education, employment, and creative practice.

So I'll take the recent project, the microbrewery, bakery, cafe and bar. So, that project, there is a new project for the university. It's completely separate from traditional what we're doing. […] So that project there is, there's a real working microbrewery, a real working bakery and a cafe and bar. So, I'm engaging with students on one project is the graphic design of beer can labels. I'm working with the

academic, this will be a rolling project. We're not a volume producer of beer, we produce batches of specialized beers and craft beers and whatever there called. So, there will be a demand for having different labelling, different graphics designs for each batch of beer. So, it means that we can have a rolling project for students for the next 10 years because it will never be the same project it will be a different beer. So, it's working with the academic to contextualize that in a way that can be integrated into the academic programme as a student project. (Head of Employer Engagement, U1)

This project exemplifies how innovative spaces can provide authentic, real-world learning opportunities while simultaneously contributing to the local cultural environment. By embedding such initiatives into the academic programme, students are able to engage in sustained, practice-based projects that evolve over time, fostering creativity, collaboration, and stronger links between education and industry:
So students will be given a brief. They'll meet the head brewer and me, and will identify what the objectives are from a branding perspective. What are the unique attributes of the beer, and then the students will have to design the graphics for the can labelling. Then one will be picked, printed on the can, and away we go. So that's just one project. (Head of Employer Engagement, U1)

At U2, Media Studies students have the opportunity to gain work-related experience through collaboration with a community radio station, which becomes a co-created learning space where they can practice their skills and learn from professionals. This provides 'a useful introduction to professional expectations' and offers 'professional workflows and great resources' (ML, U2). Engaging with real-life projects allows students to experience what it is like to work in a professional environment, with all its challenges.
that radio station is a brilliant project. […] it's a community radio station, but it's Ofcom regulated. So the kind of expectations on students because they're putting output out there, is immediately a kind of introduces them to those kinds of standards and challenges. And, you know, if they swear on air, you probably get away with it, if it's a campus radio station, but if you swear on air with Ofcom, it triggers all sorts of kind of compliance issues. So things like [name of the Radion Station], you know, not only is it kind of a useful introduction to professional expectations, and professional workflows and great resources, it's like a brilliant community for them.(ML, U2)

In developing learning spaces that integrate academic knowledge with practical experience, both universities are adopting an outward-facing approach - effectively horizon scanning - to anticipate the emerging needs of industry.

One of the things I do is horizon scan to identify in what direction should we be looking at from an industry engagement perspective. Where are industry going in the next three to five years? To use the horrible Wayne Gretzky quote, good hockey players skate to where the puck is. Great hockey players skate to where the puck will be. Okay. So that's Wayne Gretzky, the ice hockey player. So, I look to try and find out where the puck will be, from an industry perspective in the next three to five years. And identify that direction.

The emphasis is on anticipating how innovation and technological development contributes to enriching and reshaping the contemporary workplace, and to exploring what higher education can contribute by sharing scientific knowledge through collaborations and partnerships. Such approaches create opportunities to demonstrate to employers that partnerships with universities can provide reciprocal benefits, which is crucial for incentivising employer engagement. Anticipating and addressing future employer needs requires rethinking and refreshing curricula, as well as developing 'institutional knowledge,' to ensure that graduates' skills align with the expectations and demands of industry. As described by the Head of Employer Engagement (U1):
I can give you a good example. When I first started here, autonomous vehicles were going to be big, and this is one of the biggest failures as well, or the universities failures. So autonomous vehicles are going to be massive. It's coming whether we like it or not. Most vehicles now have some level of automation inside them for driver, you know, assisted driving or whatever it is, but in the next five years it's going to be a reality. You will see fully autonomous vehicles on the road. So, five years ago, I was working with a number of academics, and I secured the acquisition of a level four autonomous vehicle from a company called [name of the company. So, we started developing some really good institutional knowledge around autonomous vehicles in the university, and we were literally ahead of the game.

Another area for future development is data science: *'Data science is one of them. We do a lot with a local law firm who realized that data is the next. It's a big thing, day to day data*' (Head of Employer Engagement, U1). As noted by a Senior Leader (SL) at U1, graduates who can demonstrate skills in this area have a greater chance of employability.
A lot of them get hired. The data science students were all hired, two of them by that company and the other students were able to go to other companies because of the experience they've got. In fact, our data science programme is one of the most successful in fact, most of our students are hired before they graduate. (SL, U1)

The growing expansion of Artificial Intelligence presents another opportunity to connect with industry by educating job-ready graduates, equipped with contemporary skills, including social skills, such as networking, that enable them to cross boundaries between learning and working spaces.
[it's important] that they are developing their skills for critical AI, for example, that is the latest one. Industry is using it now and going great, this is a great tool. We need to make sure our students are all prepared for this when they leave whatever their discipline. So, it's making sure that we are building in opportunities to develop skills and attributes that are desirable for stakeholders, in my opinion. (SL, U1).

In this way, AI, technology, and innovation act as enablers for building bridges between higher education and employment. Through co-created learning spaces, students are able to integrate work and study, applying their academic knowledge in professional contexts while developing the adaptable skills employers value.

Conclusion

Innovation and diversification of HE education provision has been at the centre of strategies to enhance employability and inclusion of graduates into the world of work. Embedding employability and practically based education into teaching and learning is becoming increasingly important in higher education. This includes initiatives such as employer engagement, curriculum (re)design, and shifts in academic staff and industry representatives perspectives, all of which contribute to the ongoing process of bridging the gap between the classroom and the work environment.
Together, these three interrelated dimensions offer both a conceptual framework and practical affordances for enriching practically-based higher education. While universities often share these broad strategic aims, differences in approaches can be observed within both institutions, e.g. across faculties, departments, and programmes. Within the same university, strategies may range from structured work-integrated learning models (e.g. placements) and formal employer partnerships embedded at programme level to more flexible approaches that integrate work-related learning through informal or ad hoc arrangements. By embedding and sustaining workplace learning, institutions can better respond to the evolving needs of the labour market and society, shaped by social, economic and technological developments. As students engage in the integration of theory and practice, they develop an increased awareness of the dynamic employability landscape - an essential factor in fostering the transition from education to employment. Technology increasingly plays a connecting role in bridging universities and industry, by incentivising employers, academic staff, and students to develop collaborations. However, employer engagement continues to

present challenges, and when employer engagement, curriculum design, and pedagogical practices are not fully aligned, a range of issues can arise. These may include fragmented learning experiences, uneven student access to opportunities, and tensions between academic and labour market priorities, as also highlighted in existing research. (e.g. Suleman et al., 2021; Koseda et al, 2025; Kersh et al., 2025). Spaces where learning and work intersect introduce elements of the real working world within the protected environment of higher education. These spaces support students in developing resilience, adaptability, and the capacity to manage uncertainty- critical attributes for success in today's rapidly changing professional environments. (Kersh et al. pp. 21-22). Students highlighted the value of engaging in work-related tasks, employer-led projects, and reflective activities within these spaces, which enabled them to experience professional tasks, receive formative feedback, and build confidence in navigating workplace expectations. To sustain these environments, universities build long-term partnerships with industries, ensuring that both educational and professional needs are met. Employers contribute to curriculum design, offer internships, and real-world case studies, thus ensuring that the learning experiences remain relevant and adaptable to industry trends. The findings also carry implications for higher education institutions and policymakers, who must consider how to structurally support and scale these approaches to ensure equitable access to work-integrated learning opportunities. Continued investment in stakeholder collaboration, curriculum innovation, and digital infrastructure will be essential.

Acknowledgment

We thank all research participants for contributing to the successful completion of the project. This was a joint research project of the Edge Foundation and UCL Institute of Education, where Edge has funded the UCL Institute of Education researcher's time to collaborate.We thank our co-researchers in this project Katharine Emms and Joe Latimer.

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The following anthologies from the ASEM Hub LLL Research Network 2: Workplace Learning have already been published as part of this iup conference series:

Chisholm, L, Fennes, H., Spannring, R. (Eds.) (2007). Competence development as workplace learning. innsbruck university press.
https://www.uibk.ac.at/iup/buecher/9783902571250.html

Chisholm, L, Lunardon, K., Ostendorf, A., Pasqualoni, P.P. (Eds.) (2012). Decoding the meanings of learning at work in Asia and Europe. innsbruck university press.
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Ostendorf, A., Permpoonwiwat, C. K. (Eds.) (2017). Workplaces as Learning Spaces - conceptual and empirical insights. innsbruck university press.
https://www.uibk.ac.at/iup/buecher/9783991061168.html

Evans, K., Ostendorf, A., Permpoonwiwat, C. K. (Eds.) (2023). Resilience of Vocational Education and Training in Phases of External Shock - Experiences from the Corona Pandemic in Asian and European Skill Eco Systems. innsbruck university press.
https://www.uibk.ac.at/iup/buecher/9783903122734.html

Workplace learning has undergone a significant transformation in recent decades, driven by accelerating technological innovation, globalisation, and shifting organisational expectations. The emergence of digital technologies offers new opportunities to enhance learning and development in organisations, empowering workers. Yet, alongside these opportunities lie challenges, such as ensuring equitable access to digital resources, addressing ethical dilemmas, and mitigating the risk that technological advancements might inadvertently exacerbate existing inequalities or create new forms of exclusion.
This anthology examines learning at work through the lens of human-centred technology and innovation, drawing on the concepts of inclusive use and Boyadijeva's socially embedded capability to focus on empowerment across diverse contexts of adult learning, including the workplace.

The Research Network on Workplace Learning (RN2) of the Asia-Europe Education and Research Hub for Lifelong Learning (ASEMLLL) focuses on learning in, for and through workplaces across Asia and Europe. Workplaces exist not simply in companies and public services, but equally across a wide range of organisational and social contexts, including in non-profit-making NGOs, Universities and Colleges, and in diverse forms of self-employment. The network was established in 2005, and since then, its membership has expanded to 25 countries. Our network consists of members representing countries in Asia and Europe (and beyond). Members are now active in Austria, Australia, Brunei, Canada, China, Cuba, the Czech Republic, Denmark, Finland, France, Hungary, Georgia, India, Ireland, Italy, Japan, Latvia, Lithuania, Laos, Malaysia, Romania, Singapore, South Korea, Thailand, United Kingdom. The work of the Research Network has centred on a series of collaborative projects, leading to the publication of a series of five anthologies, including the present volume, which represent staging posts in our shared work and network development.

ISBN 978-3-99106-195-3
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