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DIGITALIZATION OF THE PEDAGOGICAL PROCESS IN VOCATIONAL EDUCATION SETTINGS IN LATVIA AND CHINA

The topicality of digitalisation processes in the vocational sector stems from digital transformations across almost all spheres of life, including education. The integration of digital technologies has led to a paradigm shift in teaching approaches and methods. It has opened up a myriad of opportunities and a potential for change, while at the same time causing difficulties with access, inclusion, and the digital divide. Digital metamorphoses have prompted vocational educational leaders to transcend purely technological integration, leading to a more meaningful and thoughtful process of comprehensive system refashioning. This study explores trends in digitalisation in vocational education, with particular emphasis on developments in China. The increased adoption of digital transformation has significantly changed vocational education, highlighting existing challenges and prompting the need for sustainable, systemic change. This paper examines challenges and proposes interventions to enhance the effectiveness and resilience of vocational education systems. The speed of digital transformation has progressed beyond the mere adoption of digital tools, leading to the advancement of technology integration in meaningful ways to support pedagogical and institutional goals. Information and Communication Technologies (ICT) have the potential to transform vocational education by fostering personalised, interactive, and learner-centred educational practices. The paper underscores the importance of aligning technological advancements with the specific needs of vocational training to support long-term educational improvement.

Keywords: vocational education, digitalisation, information and communication technologies (ICT), digital transformation, Latvia, China.

Pedagoģiskā procesa digitalizācija profesionālās izglītības iestādēs Latvijā un Ķīnā

Digitalizācijas process profesionālās izglītības sektorā ir saistīts ar digitālo transformāciju visās dzīves jomās, tostarp izglītībā. Digitālo tehnoloģiju integrācija ir ierosinājusi paradigmas maiņu mācīšanas pieejās un metodēs. Tā ir pavērusi daudzas jaunas iespējas un pārmaiņu potenciālu, vienlaikus radot izaicinājumus saistībā ar piekļuvi, iekļaušanu un digitālās plaisas likvidēšanu. Digitālās pārmaiņas ir rosinājušas profesionālās izglītības sistēmas līderus pārskatīt vienkāršotu tehnoloģisko rīku integrāciju mācību procesā, bet ļāva virzīties uz daudz jēgpilnāku un pārdomātāku visa sistēmas digitalizācijas procesu. Šis pētījums aplūko digitalizācijas tendences profesionālās izglītības jomā, īpašu uzmanību pievēršot digitalizacijas procesiem profesionālajā izglītībā Ķīnā. Digitālās transformācijas procesi ir būtiski mainījuši gan profesionālās izglītības saturu, gan formu, izgaismojot pastāvošos izaicinājumus un rosinot nepieciešamību pēc ilgtspējīgām un sistēmiskām pārmaiņām. Rakstā tiek analizēti izaicinājumi un tiek piedāvāti risinājumi, lai uzlabotu profesionālās izglītības sistēmas efektivitāti un noturību. Digitālās transformācijas temps ietver sevī ne tikai digitālo rīku integrēšanu profesionālajā izglītībā, bet rosina tehnoloģiju integrāciju izglītībā jēgpilnā veidā, kas atbilst pedagoģiskajiem un institucionālajiem mērķiem un kompetenču pieejai. Informācijas un komunikācijas tehnoloģijām (IKT) ir potenciāls pārveidot profesionālo izglītību, veicinot personalizētas, interaktīvas un uz izglītojamo orientētu praksi. Rakstā tiek akcentēta nepieciešamība saskaņot tehnoloģiskos jauninājumus ar profesionālās izglītības specifiskajām audzēkņu vajadzībām, lai veicinātu izglītības uzlabošanu ilgtermiņā.

Atslēgvārdi: profesionālā izglītība, digitalizācija, informācijas un komunikācijas tehnoloģijas (IKT), digitālā transformācija, Latvija, Ķīna.

Introduction

In the era of globalisation and the Fourth Industrial Revolution (FIR), society has moved to a new Digital Age, transforming all spheres of life. The digitalisation of societies was shaped by the Internet, Big Data, Robotics, and Artificial Intelligence (AI). Leading to Industry 5.0 requires greater attention to human-machine collaboration and to new technological applications to meet the demands of the modern economy. Both countries, Latvia and China, are undergoing significant digital transformations in education, particularly in the post-COVID era.

Technological advancements, such as patterns of communication, interaction between people, modes of work, business practices, and recreational activities, are radically transforming all aspects of the social sphere. Digitalisation processes and the need to foster the development of digital skills are the most discussed issues in the scientific literature, ranging from basic computer skills to more advanced skills, such as programming and project management (Filho et al. 2023; Haputhanthrige et al. 2024). Digitalisation is crucial to ensure the efficient development of vocational education to meet the needs of the labour market (OECD 2019; Harris, Clayton 2020).

Some of the latest technologies to be mentioned involve Artificial Intelligence (AI), Virtual Reality (VR), Machine Learning (ML), Robotics, and Automation (Menshikov et al. 2024). A growing body of literature explores the integration of technologies in vocational school settings (Andersson, Kopsen 2019; Zhu et al. 2023). Teachers and students who lack sufficient skills risk being excluded from the job market and employment opportunities (Yang et al. 2024). Therefore, vocational institutions need to integrate digital skills into their curriculum by strengthening connections with the industry to ensure students' experience in real-life settings (Haputhanthrige et al. 2024). There is a growing demand to align training with the industry's demands (Esmail, Khan 2024), which is also undergoing digitalisation and automation. Enhancing one's digital skills will increase the chances of securing a job.

As a result of the global pandemic, institutions worldwide have integrated technologies in creative and diverse ways, preparing students for a more unpredictable future in which technology plays a critical role. Vocational education plays a significant role in training the future workforce. Digital technologies foster students' personalised learning and improve teaching effectiveness. The digital transformation in vocational schools in China and worldwide presents numerous challenges, including the availability of infrastructure, teacher digital competence, ethical issues, and heightened awareness of the digital divide. Since contemporary learners are extensive users of digital technologies, the learning process should be enhanced by technology. As many scientists assert, digital technologies have changed teaching approaches towards a more learner-centred approach, allowing for more constructivist approaches, thus encouraging students to be more proactive (Halverson, Shapiro 2012; Kovács et al. 2015; Haleem et al. 2022). Vocational institutions worldwide are advancing digital literacy of teachers to become "digital facilitators" (Cattaneo et al. 2021), thereby fostering an innovative culture in schools that meets the requirements of Industry 4.0 (Ye et al. 2025; Heasly et al. 2025). Vocational teachers play a significant role in ensuring graduates' competitiveness in the job market; therefore, they need to be updated in dual professionalism by shaping their teaching competencies and their professional roles as well (Andersson, Kopsen 2019). Digitalisation has significantly altered existing learning arrangements and approaches to teaching (Perez-Sanagustin et al. 2014; Kyza, Georgiou 2018).

Legislation supporting digitalisation processes

As stated in the UNESCO (2023) report, technologies form the basis for a new social, political, economic, and organisational life. Several analytical reports by OECD (2021, 2023) state that technologies are transforming learning environments by opening up new possibilities and integrating innovative tools and approaches into the curriculum. There is a growing demand for technologically advanced educational institutions worldwide. "The Digital Educational Action Plan 2021–2027" (European Commision 2020a) emphasises the sustainable adoption of technologies in education by implementing a digital education ecosystem and by enhancing teachers' digital skills and competencies as imperatives. "The Digital Competence Framework (DigComp)" (Digital Skills Jobs 2021) highlights the key areas for teachers, including information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. Digital transformations are also taking place in the vocational school sector in China, by optimizing teaching, management, and

resource development. Li (2024) argues that digitalisation processes help empower industry-driven education by incorporating technologies that align with industry demands. The integration of technologies also fosters sustainability. One of the imperatives set in the United Nations Agenda 2030 on the Sustainable Development Goals is to ensure quality education. By integrating digital technologies in education, it is possible to reduce emissions and increase efficiency. Technologies have proven to be one of the most cost–efficient means in education. Technologies enable innovative solutions and access to education for individuals who encounter various obstacles. Digital and green transformations have been seen as the main priorities affecting the workforce. CadeFop (2024) has advocated for a digital strategy to up- and reskill the workforce, ensuring the modernisation of the educational system. In 2022, a revision of the "Vocational Education Law of the People's Republic of China" emphasised the role of vocational education in serving economic and social development. (Ministry of Education 2022, as cited in Ye et al. 2025).

In China, the National Vocational Education Smart Education Platform has launched over 6,700 high-quality online courses. Additionally, 55% of vocational educators have adopted blended teaching methods, and 16 million teachers have participated in online training (China Youth International 2023, as cited by Ye et al. 2025). Digital platforms in China provide vocational schools with digital teaching materials, engaging participants in the co-construction of educational resources (Ye et al. 2025). China has actively participated in UNESCO's initiatives on digitalisation processes in vocational education (Guo, Wang 2025), particularly by adopting UNESCO's "Education 2030 Framework for Action," which aims to enhance learning quality and efficiency through the use of technologies. The digitalisation of vocational education in China has been strengthened by proper policy support, the development of suitable infrastructure, the provision of digital tools, and the availability of digital platforms for learning and collaboration (Ma et al. 2025).

Advantages and difficulties of the integration of technologies

The digitalization process is ambiguous, since it brings along several advantages, such as an increase in productivity and optimization of businesses; it creates new formats for studies, work, and production, at the same time brings along such issues and a lack of access to technologies for some groups of the population, unemployment and displacement from economy, and negative impact on socio-economic development of people, as well exclusion of some groups from participation in the political economic and social spheres of life.

Table 1

Benefits of the integration of technologies in vocational education

Benefits	Descriptor	Authors
Creating an inclusive environment	Provides an opportunity to participate for students with different levels of achievement, Fosters collaboration, engages in the learning process; Allows students with special needs to participate.	Anderson, Galloway 2019; Smith et al. 2019; Sparks 2019; Smith, Yasukawa, Gonczi 2019; Brown, Park 2021; European Commission 2020b; UNESCO 2015a; UNESCO-UNEVOC 2021
Personalised learning, ensuring greater learners' autonomy	Possibility to proceed at one's own speed; Fosters individualisation in education.	Kalyani 2024; Anderson, Galloway 2019; Zhu et al. 2023; Friend et al. 2017; China Youth International 2023

New, innovative learning arrangements	New methods and approaches in teaching, Online platforms, digital tools, and smart devices. Simulation and virtual reality (VR) offer realistic training without the risks associated with real-world experiences.	Yang 2023; Perez-Sanagustin et al. 2014; Kyza, Georgiou 2018; Cattaneo et al. 2021; Zhao 2022; Zhu et al. 2023; Guo, Wang 2025
Interactive and collaborative learning methods	The online environment allows the use of interactive digital tools.	Anderson, Efremova 2022; Haleem et al 2022
Access to educational resources	Availability of digital resources from any location and at a convenient time.	Fenwick, Edwards 2015; Anderson, Galloway 2019; Haleem et al. 2022
Technologies as environmentally friendly tools	Minimising the cost of materials and their sustainability impact.	Anisimova, Efremova 2022; Haleem et al. 2022

Source: elaborated by the authors based on a literature review.

According to research highlighted in the UNESCO (2023) report, the relationships between learning and technology are "complex and non-linear" (p. 2). The integration of technologies should be viewed as context- and subject-specific. Therefore, it is not easy to make generalisations about the impact of technologies on learning. Instead, technologies should be seen as a medium that can be used in various ways. Educators have shifted from a narrow use of technology as a digital tool to viewing it as an integral part of curriculum design, teaching strategies, and assessment. This involves ethical aspects, data privacy, and the impact of technologies on sustainability (Wang et al. 2024).

The use of technology is enhancing effectiveness and increasing accessibility for vocational schools, contributing to quality education and the achievement of Sustainable Development Goals (SDG4) and economic growth (SDG8). Technologies help build more personalised education that focuses on individuals' needs. Technologies also help to bridge the gap with the industry and learn about the latest technological innovations (Prasetia et al. 2025). Still, the authors would like to highlight the benefits of integrating technology into teaching. One of the advantages of integrating technologies is fostering 21st-century skills and changing teaching models and approaches to be more student-centred and constructivist. Among the advantages to be mentioned are instant access to learning materials, a collaborative learning setting, and personalised learning possibilities (Kalyani 2024). If utilised appropriately, digital technologies can create an inclusive learning environment (UNESCO 2015b). To meet the needs of contemporary learners, teachers must utilise interactive digital tools and online platforms. Technology-enabled innovations can significantly facilitate learning. As Rubene et al. (2021) add to the list, such advantages as more individualised learning and the opportunity to develop self-directed learning skills. Ivanova and Kristovska (2023) assert that the success of digital transformation depends not only on the availability of infrastructure but also on people who embrace this digitalisation.

One disadvantage of integrating technology into the learning process is unequal access to these technologies among all students, which highlights disparities in education. Among other limitations to be mentioned are various distractions caused by technology and the overreliance on it, which prevent students from engaging in critical thinking and reasoning and may compromise academic integrity. Ratan et al. (2021) argue that the overuse of technology can lead to mental health problems, including difficulties in achieving a life-work balance. As Rubene et al. (2021) add to the list, negative attitudes towards technologies, negative experiences with using technologies, and the necessity of adopting new pedagogical approaches when integrating technologies may lead to teacher resistance.

Table 2

Limitations of the integration of technologies in vocational education

Limitations	Descriptor	Authors
Increasing social isolation	Increased feeling of lousiness Changes in interaction patterns occur through social platforms, educational forms, and chats	Anderson, Galloway 2019
Fostering inequality	Fostering socio-economic inequalities while unlocking tremendous potential May limit opportunities for some learners.	UNESCO 2015a, 2020, 2022, 2023; Anderson, Galloway 2019
Increased mental health problems	Keeping cell phones nearby reduces sleep quality. May disconnect from face-to-face interaction; Reduces social skills	Ratan et al. 2021
Lack of proper digital skills	Insufficient digital literacy Teachers' digital competency	Anderson, Galloway 2019; Cattaneo et al. 2021; Zhu et al. 2023; Habibi et al. 2023; Lewis 2023
Lack of proper infrastructure	Availability of infrastructure, technological tools, specialised hardware and software as relevant for a particular vocational program Lack of a stable internet connection and reliable technical support Access to technologies, digital divide	Cattaneo et al. 2021; Haleem et al. 2022; Zhu et al. 2023; Habibi et al. 2023; Barzilai-Nahon 2006

Source: elaborated by the authors based on a literature review

Educational models supporting digitalisation in the vocational sector. The Technology Acceptance Model (TAM) *was proposed* by Davis, Bagozzi, Warshaw (1989). The model focuses on the perceived usefulness of technologies, specifically their user-friendly interfaces and their ability to enhance teaching quality. Online platforms are accessible anytime, and teachers have to be able to provide real-life feedback. According to this model, when students and teachers perceive platforms and digital tools as applicable, they are more likely to use them. By adapting the Theory of Reasoned Action (TRA) of use of technology and considering external factors relating to information quality, such as relevance, accuracy, and the factor of system quality that includes usability and functionality as present (DeLone, McLean 2003), participants will be more willing to use new technologies. Numerous factors influence the use of technologies, such as social influences, organisational culture, peer influence, and privacy assurance. The TRA model was expanded to include the dimensions of the Pro-environmental Planned Behaviour model, introduced by Persada (2016), which promotes pro-environmental behaviour and environmental consciousness alongside other factors supporting the use of technologies as environmentally friendly tools.

Table 3

Comparison of digitalisation processes in Latvia and in China

Aspects	Digitalisation of VET in Latvia	Digitalisation of VET in China
Drivers	Driven by EU-aligned policies, coordinated by the Ministry of Education and Science, and enhanced by VET competence centres Financial support from the EU until 2029 for the modernisation and digitalisation of the educational	Driven by the Digital Education agenda, National Strategies to 2030

	process; The Latvian Digital Transformation Guidelines 2020; The Digital Educational Action Plan 2021–2027	
Infrastructure	Enabled by the VET competence centres, enhanced by digital infrastructure since 2007	Smart Education of China, "One-stop platform" for vocational education
Curriculum	Ongoing curriculum modernisation since 2007 according to EU VET recommendations, micro credentials, digitalisation of the study content, and ESF financial support for new educational digital materials	Modernisation according to VET (2023–2025 plan)
Training of teachers, further education, training	EU-funded upskilling, work-based training, efficient digital lifelong learning, and access to digital libraries	Industry-education pilots (2025), Integration of AI
Links with industry	Social partnership, work-based learning, and leadership of competence centres, EU financial support for the modernisation of practical placements until 2029	Formal industry-vocational school integration
Access, equality	Reducing barriers to access education and training, and promoting digital inclusion	Widening access to training in rural areas, National platforms and initiatives

Source: elaborated by the authors.

Research methodology

The methodology employed was expert interviews in Latvia on the progress of digitalisation since the COVID-19 pandemic. The main research question was to identify the pros and cons, the factors contributing to the success of digitalisation processes in Latvia, and how teachers can be supported in implementing digital resources. A follow-up interview for further research will also be conducted with experts in China. This study draws on data from interviews with experts in Latvia employed in vocational schools. In total, four representatives from the administration of two vocational schools in the Latgale region participated in the interviews. In this pilot study, the representatives were selected from the poorest and the most disadvantaged regions in Latvia. All interviews were recorded and transcribed, and the main categories were derived from them, illustrated with extracts.

Research findings

All experts assert that digitalisation is an inevitable part of everyday life in the vocational school setting. As a result of digitalisation, the schools attracted funding to enhance their digital infrastructure in a vocational school.

Advantages and factors of the success of the digitalisation process. One of the experts suggested that: "Much depends on the administration of the school to attract funds for improving digital infrastructure. Our administration was very keen on enhancing the efficiency and effectiveness of the learning process; therefore, all classrooms are equipped with the latest technologies. The other side of the coin is that senior teachers are willing to use all possibilities offered by technologies in the learning process". The experts from the other vocational school were also satisfied with the school's progress in attracting funding and modernising. They noted that the school was successful in attracting funds for digitalisation, but this process takes time to change mindsets and to foster acceptance of digital innovations. "COVID-19 is accelerating the implementation of digital solutions, and many teachers were forced to rethink their traditional approaches in organising learning". In line with OECD (2019), most schools worldwide have successfully embraced digitalisation to prepare the workforce for the future market. The expert remarked that it is not enough to buy the latest technologies, but "for the

digitalisation to be successful, all factors need to be taken into account, including infrastructure, school culture, and teachers' professional development, including advancement of ICT skills, as well as funding, and preparation for the change process. For digital transformations to succeed, integrating technologies alone is insufficient; the most crucial drivers are teachers who believe in and see the innovative potential of technologies to enhance teaching quality. It is more about adopting new ways of thinking, doing, and being, which are more adaptive, flexible, and innovative. This is important for teachers to understand why changes are needed.

Problems encountered as a result of digitalisation processes

Time needed for more personalised learner-centred pedagogy. Identifying economic and political trends may help to build a more resilient vocational system. Shrinking industrial production and negative labour-market trends, which increase unemployment rates, are key determinants of the development of vocational education in many Eastern European countries. As stated in the Global Education Monitoring report (UNESCO 2020), schools need to make efforts to build more resilient and sustainable educational systems. All experts reported on the challenges to maintaining motivation while learning online. Particularly during the pandemic, this was a challenge. As one of the experts reported, "technologies ensure personalised learning, but not many students are ready for such a mode of learning. From what I observe, the students are not so highly motivated to guide their learning themselves" (Expert 2).

Another expert commented that digital transformation cannot take place overnight. "To make a transfer to more personalised, learner-centred, and competency-based learning, it requires time and changes in mindsets" (Expert 3).

Insufficient ITC skills of teachers. Teachers' IT competence refers to their ability to integrate technologies into their practice in a meaningful way, as well as their motivation to apply new digital tools in teaching (Ilomäki et al., 2016). Digital transformation can occur if teachers are equipped with the proper competencies and skills. Teachers need technical support to implement learner-centred competency-based learning. As Dewey (2004) stated: "If we teach students the same way as yesterday, we rob them of their future". One of the experts reported that "the new generation needs different approaches, they spent most of their time on digital devices, which is why learning by the use of technologies seems more appealing to them" (Expert 4).

Another expert reported that digitalisation needs to be carried out while keeping the purpose in mind, not just for the sake of using it: "This is not only about learning how to use digital tools and platforms, but also about how to apply them meaningfully to ensure quality learning" (Expert 3). Teachers complain about the lack of time to learn about new technologies, the scarcity of suitable digital learning content, the absence of digital learning models and approaches, and the inefficiency of these approaches as changes occur rapidly.

Need for support for teachers. Teachers are aware that global transformations require changes in their schools and teaching approaches, but "they prefer introducing changes in small steps. Most of the teachers adapted to changes and were happy about the innovations they introduced in their practice and remained agile towards other changes" (Expert 1). Continuous comprehensive digital literacy training should be available for all teachers: "Teachers need training to be available on how to use technology efficiently, meaningfully, how to use AI not only as a search engine, but in a more meaningful way" (Expert 2). "Some teachers lack the competence and confidence to use some technical devices; therefore, they need support and encouragement to try out new possibilities offered by technologies" (Expert 4). Teachers, especially senior ones, need to be motivated and encouraged to integrate technology into their teaching, as they often lack the necessary skills.

Accessibility of ICT technologies, digital inclusion. As the expert reported, not many students have 24/7 access to technology, and teachers need to be aware of this. There are inequalities in access to technology among learners from disadvantaged families. Despite all students being exposed to

technology, some may not need it because they come from disadvantaged backgrounds. As experts commented, Vocational schools are well-equipped to ensure that all students have access to the needed devices and resources at school.

Digital health, well-being. Another issue raised by the experts was the well-being of teachers and students. They discussed finding the balance between digital immersion and face-to-face communication. Almost all experts commented about overdependence and intensive use of technologies by the students: "The students are spending too much time on technologies and forgetting about their health issues. Technologies fill in almost every aspect of students' lives. They suffer from stress and anxiety. Digital detox and limiting time in front of screens can increase their well-being and productivity, and a more responsive use of technologies". They all suggested that students need to be guided to use technologies purposefully and in a controlled way by helping students to overcome addictions.

Limitations and future research

Digitalisation is an ongoing process with no endpoint. While the paper is timely, it serves as a starting point for continuous exploration as digitalisation processes develop in both Latvia and China. The paper serves as a starting point for further exploration and prediction of the rapidly evolving digitalisation processes in both countries, which require ongoing analysis. A deep qualitative inquiry will be conducted in China to evaluate digitalisation processes. Among the issues to be considered are the insufficient digital skills of senior teachers in applying new pedagogical approaches, including elements of gamification and social learning platforms; the ethical aspects of artificial intelligence (AI); and ensuring equal access to technologies. Data from interpretative qualitative research can be strengthened by quantitative research that requires the identification of categories.

Conclusions

Vocational education trains specialists for various branches of the job market, sustaining industry, and plays a significant role in preparing the future workforce.

Technologization in education brings both challenges and opportunities. The digitalisation of work, changing workplace requirements, and shifts in the job market prompt corresponding changes in vocational schools as well. Vocational training institutions are being affected by digital changes and must make the most of what technology can offer to support a meaningful learning process. Vocational education needs to align with new demands arising from digitalisation, thereby enriching pedagogical processes. This is particularly crucial for the industry-related technical schools where learners are training for a specific field of work.

In the era of digitalisation, the integration of technologies in education has become inevitable. The use of technology in education is inevitable to meet the needs of contemporary learners and prepare them for the demands of the job market. This requires teachers to develop the competency to make learning arrangements in a more interactive, engaging, and student-centred way. It involved the use of online learning platforms and hybrid learning methods.

Among the advantages of digitalisation are the flexibility to learn from anywhere and at any time, instant access to educational resources, innovative learning arrangements tailored to the needs of contemporary learners, personalised learning approaches that foster inclusivity, and the environmental benefits of digital tools. Among the limitations of digitalisation to be mentioned are unequal access to technology, inadequate infrastructure, inadequate digital skills among academic staff, and increased social isolation.

Digital transformation is not only about equipping schools with new technologies, but also about creating a digital ecosystem and culture where everyone embraces change, technologies, and new pedagogical approaches, and applies them with creativity, teamwork, and effective communication.

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