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Digital technology application in higher education: Some international experiences and lessons for Vietnam

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Abstract

Digital technologies are becoming increasingly important in higher education as they not only reshape and digitize communication between faculty and students on campus but also – in the age of globalization – extend education to the world. It also makes it easier for individuals who would not otherwise have access to face-to-face education to participate in distance education programs. The application of digital technologies in higher education aims to improve the quality of teaching & learning, increase access to technology, enhance student engagement and learning experiences. Such capabilities of digital technologies present new opportunities for universities, and allow them to operate in a completely new market. In addition to all these benefits, the penetration of digital technologies into higher education also brings certain difficulties that higher education institutions face when adopting technology, including infrastructure issues, faculty training, and student acceptance. The aim of this article is to overview international experiences in the application of digital technology in some developed countries, thereby making recommendations for the application of digital technology in higher education in Vietnam, including: Some general recommendations for the state and higher education institutions; Dissemination of digitalization policies in universities; Government support for universities; Universities supporting lecturer training; Universities support students in learning and research in the digital environment.

Keywords: Digital technology; Education; Higher education; Digital education; Digitalization

1. Introduction

According to Bereznoy (2018), the implementation of the digital revolution on a global scale is increasingly bringing us into a new reality [2]. According to W. Dittler (2017), today, the trend in education is the digital revolution, which, on the one hand, affects the labor market and requires the formation of new competencies among teachers, and on the other hand, leads to the restructuring of the entire education system. Experts have seen the prospects for improving quality in the educational segment, which are technological transformations. Thus, as a result of introducing artificial intelligence tools to learners, personalized learning paths will be created, taking into account the abilities, knowledge and preferences of each person. Big data analytics will allow us to track learning outcomes. The use of cloud computing solutions will provide access to the latest technologies and their implementation as quickly as possible in practice. Modern education would be unthinkable without the search for new materials and methods of teaching and learning. This is partly due to social changes, due to the widespread penetration of digital technologies into all areas of life, including education. Scientists in various disciplines have been exploring digital media and the areas of research they affect, talking not only about digitalization but also about media, trying to understand all the technical aspects of the "problem" and explaining how digitalization processes can affect social behavior in educational institutions [22]. According to the literature on "Education in the Age of Digital Change, Russland" (2018), when we talk about digitalization, we first of all mean infrastructure, hardware and software, the list of internet platforms and services [6].

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Universities and other educational institutions, which were the pillars of written culture and the types of books and newspapers in the recent past, are also facing the challenges of digitalization. There are increasing questions about digital capabilities, resources and implementation capabilities of individuals and organizations. It is important to understand the human limitations of digitalization for educational institutions themselves, and in particular, how teachers and learners should respond to this issue [6]. According to the literature on "The digital future of education" (2019), one of the serious problems of current education and schools is the increasing lag behind other areas of social life and the requirements of the digitalization of the economy. This lag includes certain dimensions. First, educational institutions do not use digital tools as effectively as they have been actively and effectively used in other areas of activity. Second, educational institutions do not use the capabilities of digital technology to: increase learners' motivation (through learning experiences, interactive teaching materials), personalize learning (multiple educational materials, choice of pathways, learning support in case of any difficulties), simplify the daily activities of managers and teaching staff (reporting, monitoring, verifying the nature and effectiveness of work) [17]. In general, lecturers are very proficient in digital technology, but in reality, the use of digital technology in the teaching process, lecturers still have a lot to update [17]. This is evidenced by the results of a research group on the special project "Digital knowledge of teachers" [17], implemented by the NAFI Analysis Center (2019). The level of understanding of digital technology of university teachers/lecturers was measured, and the level of use of ICT in teaching (abbreviated as - ICT competence) was measured [17].

The aim of this article is to overview international experiences in applying digital technology in some developed countries, thereby making recommendations for applying digital technology in higher education in Vietnam, including: Some general recommendations for the state and higher education institutions; Dissemination of digitalization policies in universities; Government support for universities; Universities supporting lecturer training; Universities supporting students in learning and research in the digital environment.

2. Research results

2.1. Overview of digital technology in education

2.1.1. Definition of digital technology

The connection between fields and digital technology has been growing and changing rapidly. To understand this, let's look at the research literature to come up with a contemporary definition of digital technology. Clarifying the meaning of digital technology. Digital technology is considered a cultural tool, but there are often general and inconsistent concepts of what digital technology is. These concepts may not always reflect the diverse experiences we have with digital technology in our lives.

When we talk about the digital technology we use, screen devices are often the first thing that comes to mind. Although screens play an important role in many people's daily lives, there are many other digital technologies that also contribute to our lived experience. Some of the issues in this content are more obvious, others are not so clear. Many forms of digital technology are so deeply embedded that we may not even realize their influence on the way we understand, experience, and make sense of the world. For example, using self-service scanners at the grocery store, algorithms that suggest what to watch or listen to next on online services, or data dashboards that record the activity on a particular device's screen. With this in mind, this article offers the following definition of digital technology:

According to Danby et al., (2020), we refer to digital technology as tools, systems, and devices that can create, store, or process data. The data processing and logic capabilities of digital technology are enabled by microprocessors that are programmed to perform a variety of functions. Digital technology refers to devices such as personal computers and tablets, tools such as cameras, calculators and other digital devices, systems such as software and apps, augmented reality and virtual reality, and less tangible forms of technology such as the internet [4]. According to Unicef. (2021), imaginative and non-digital technologies, including props used in game scenarios, can help people develop knowledge, skills and understanding of digital technology [20]. For example, using both digital and non-digital technologies (those that require external power sources such as lamps, flashlights and projectors) can help people explore: State – a flashlight has two states, on and off, controlled by external input; Systems thinking – a thermometer records changes in temperature that can be tested by changing its position; Design thinking – how to use technology to achieve a specific outcome. The goal is for people to use digital technologies effectively and become confident with digital solutions for a variety of situations [20].

From this definition, we acknowledge the ever-changing nature of digital technologies. We see this as a "dynamic" definition that will evolve over time and that we will be informed by the scientific research organizations on digital

technologies, and by the way we contextualize, recontextualize the insights in the laboratory, and of course the insights that people share as they interact with digital technologies in real life.

2.1.2. The Importance of Digital Technology in Education

According to "Twelve Solutions for New Education, School of the Digital Age" (2018), digital technologies have become increasingly present in everyday life, making them less visible than the heavy computers of the past. The latest digital technologies help solve key tasks in the educational process that modern universities based on traditional technologies cannot solve or solve with low efficiency. Among these benefits of digital technology, the use of digital technology brings practical benefits, demonstrating the importance of digital technology in education, including: (1) Achieving the goal of "slow-progressing" students in sustainable educational outcomes (students with behavioral and cognitive characteristics); (2) Overcoming the shortage of educational resources in teaching at school; (3) Eliminating the overload of lecturers with daily activities, freeing up their time for educational activities and enhancing creativity; (4) Developing people to adapt to modern digital technologies, primarily in their application, the user's choice of a wide range of technologies, as well as the production sector and different levels of the economy [18].

According to UNESCO Recommendations (2011), teaching staff, like any worker in any other profession, must have digital literacy, that is, the basic knowledge, skills and attitudes necessary to develop in a digital society. In developed countries today, without the necessary digital literacy, the work of any person, including teachers, seems impossible, not to mention that digital literacy is a key factor in improving professional information technology (IT) competence. Educators around the world are even more aware of the benefits of skillfully using modern information and communication technologies (ICT) in the field of education. ICT contributes to solving problems wherever communication and knowledge are of particular importance. This includes: increasing the learning outcomes of learners and their motivation to learn; developing learning processes, implementing joint projects and communicating within the school network; improving the quality of interaction between schools and parents; improving the quality of the organization and management of the educational process. This is not surprising, given the opportunities that ICT offers to improve the quality of life of modern society and open economy, which are always available to the educational sector [19].

Thus, digital technology is becoming an increasingly important factor in higher education, bringing many practical benefits. Some highlights of the importance of digital technology in this area include: (1) Access to information: Digital technology makes it easy for students to access rich learning resources from the internet, e-libraries, and online databases. (2) Flexible learning: Online learning platforms allow students to learn anytime, anywhere, helping them manage their study time more effectively. (3) Interaction and collaboration: Digital technology facilitates students to interact with instructors and peers through forums, online study groups, and other communication tools. (4) Personalized learning: Using technology allows instructors to create customized teaching programs that suit the needs and learning styles of each student. (5) Assessment and feedback: Digital technology helps instructors monitor student progress and provide timely feedback through online assessment tools. (6) Technology skills development: Students are equipped with the necessary technology skills, which are very important in modern learning and research environments. (7) Enhanced teaching quality: Faculty can use technology tools to enrich lectures, from videos, graphics, to interactive simulations. (8) Scalability: Online learning programs can serve a large number of students, helping to increase equitable access to education for more people, more subjects.

2.2. International experience in applying digital technology in higher education in some advanced countries

2.2.1. Digital technology in US education

According to Gerard Danford (2016), in the US, the application of digital technology in education is mainly the responsibility of states and school leaders. The federal government does not directly develop or operate digital tools to manage the system, nor does it directly provide digital teaching and learning resources, but supports states and schools in developing digital ecosystems through various funding programs [8].

The federal Department of Education, supported by many federal agencies, supports the digitalization of the education system. It designs and revises the national strategy for digital education and tries to minimize the potential digital divide through a number of mechanisms aimed at equity in implementation across educational institutions [8].

The federal government also supports innovation, research, and exploratory development in digital education, by monitoring the adoption of digital technologies in schools, funding (or directly conducting) research on the use of these digital technologies, and ensuring that researchers have access to relevant educational data. The United States has a sector-specific approach to data and privacy. There is no general data protection regulation, but there is sector-specific

regulation, including for the education sector, as well as regulation related to learner data. States have autonomy to establish their own data governance policies outside of federal regulations [8].

Learning Management Systems (LMS)

According to "Country digital education ecosystems and Governance © OECD 2023 - 29 United States (2023)" and Gray, L. and L. Lewis (2021), the federal government does not operate a national learner information system, but it supports all states in developing and using such tools through the Statewide Longitudinal Data Systems (SLDSs) program, and provides a range of services and resources for this purpose. This program has facilitated and facilitated the design, development, implementation, and expansion of vertical learner information systems, and is used in all states in the United States [3, 10].

According to the Data Quality Campaign survey, as of 2023 and Gray, L. and L. Lewis (2021), all vertical learner information systems contain a unique identifier. All states, including standardized assessment scores, although not always broken down by all federally mandated learner groups (e.g., 13 states do not share data broken down by gender). In many states, student information systems are provided in real time, displaying both analytics (with limited access) and public dashboards. While information is collected and available at the state level, the federal Department of Education collects some of this data in aggregate format (attendance, state student test scores, etc.) through the National Center for Education Statistics (NCES). The provision of such data is required by law, the Education Act. Many schools (states) share student information with state agencies (as required by state law) before transferring it to the federal government. For example, in Colorado, the first application for SLDSs funding was made in 2007, for $4 million. It spurred the development of Colorado's Longitudinal Education Data Action Plan (LEAP), which built on the foundation of the statewide learner record system launched in 2002. The action plan's first major initiative aimed to expand the data warehouse with longitudinal projections and detailed student-level analysis, graduation and dropout data, migrant and homeless data, teacher/instructor statistics, and special education status. The second major effort aimed to automate the transfer of data files, between local and state education agencies, and between the state and the federal government. The third major effort was to expand local data reporting and analysis tools with broader access to data and professional development opportunities. In 2010, a new $17 million grant was awarded to Colorado to improve the quality of school monitoring, the state's learner information system, with better data collection features, interoperability across agencies, and functions that ensure stakeholders have easy, timely, and reliable access to information. In 2020, another $2 million grant is aimed at further expanding the capabilities of the school monitoring process, connecting with the federal labor and employment agency and across agencies, expanding the education system and reporting tools for schools and administrators [3, 10].

While some states do this, it is often local districts that provide their schools with a learning management system (LMS). These can be publicly owned, especially in large districts (like New York City), but most are licensed from education service providers. In smaller districts, schools will typically use the same learning management system, while in larger districts there may be more variation due to different needs, which may lead some schools to use the district-provided learning management system while others use other management systems, such as Google Blackboard, Classroom, Canvass, Moodle. These platform systems facilitate course management, content delivery, grading, and communication between instructors and students. They create a centralized environment where students can access materials, submit assignments, and participate in discussions. Learning management systems typically display analytics dashboards. A smaller percentage may interact with state-level and other digital tools and provide a repository for learning content and other relevant content. Most do not provide communication tools, which is a function that is often handled separately. At the school district level, there are data elements that all learning management systems must track, but others will vary depending on the district's educational jurisdiction (Federal Education Law) [3, 10].

Digital Technology Applications in Online and Blended Learning & Teaching

According to "Country digital education ecosystems and Governance © OECD 2023 - 29 United States (2023)" and Gray, L. and L. Lewis (2021), in the United States, the federal government is typically responsible for providing digital resources for teaching and learning, although not always, and is limited to a supporting role, except for learners with special needs. Since 1965, the federal government has been prohibited by law from setting curriculum requirements or standards. States and districts are responsible for providing various types of digital teaching and learning resources that are appropriate to their school curricula. They typically purchase resources as a service that schools, teachers, and learners can use and complement with external resources and select according to their goals and needs [3, 10].

Open Access Resources

Although many Open Education Resources (OER) are accessible to all, learners, teachers, and schools, the federal government plays a limited role in providing them. Learning content produced by public television and radio stations

and their respective social media channels play a role in dissemination. Significant public investments in public libraries and museums, which produce some of the online educational content, can also be noted in this category. Additionally, online textbooks are publicly licensed and funded by federal government programs. The OER ecosystem for teaching and learning is supported by many non-governmental actors, notably NGOs and philanthropies. For example, the relevant OER platform, which brings together thousands of OER, is managed by the Institute for the Study of Knowledge Management in Education (ISKME), which is largely funded by philanthropic organizations and other donations (e.g., the William and Flora Hewlett Foundation). Private universities in the US also contribute, such as the Massachusetts Institute of Technology's (MIT) Open Courses. The most popular Massive Open Online Courses (MOOCs) platforms (e.g., Coursera, edX, e-books, online journals, and open access course materials) are service initiatives initiated by private universities in the United States that provide a combination of paid courses (sometimes free) and self-paced learning resources, while reducing costs for learners and increasing access to high-quality educational materials [3, 10].

Accessible Resources

The federal government's role in providing teaching and learning resources to teachers and learners under the Education Act is limited to supporting and learning tools for learners with special needs. This also applies to digital tools. Under the Individual Disabilities Education Act (IDEA), the federal government provides grants for digital learning tools and assistive technology for learners with disabilities, as well as online platforms for teachers/instructors with special needs. The Office of Special Education Programs (OSEP) administers state and local grants for this purpose. Under the Assisted Technology Act, each state must have at least one Knowledge Center that provides resources and support for educational technology (e.g., screen readers, text-to-speech software, etc.). The Department of Education funds all of these centers, allowing parents and educators to test specific assistive technologies and evaluate whether they work before schools purchase them. Aside from federal support to ensure some level of access, the Department of Education does not directly provide or subsidize digital tools and resources for teaching and learning. Instead, states and school districts can provide digital teaching and learning resources to their schools. Most recent statistics indicate that in the majority of public schools, educators and learners have access to a variety of static and interactive digital learning resources, as well as digital assessment resources and online platforms to enhance teaching and learning. A survey conducted by NCES during the 2019-2020 school year found that 45% of public schools reported one computer per learner, with one-third assigned privately. About half of public schools reported using interactive electronic textbooks or self-contained instructional programs. Since the COVID-19 crisis, "smart tutoring systems" have also become more popular in education. Smart tutoring systems are used in classroom teaching, sometimes in the classroom, sometimes for homework, including for learners with special needs [3, 10].

Online and blended learning

Completely online courses, a hybrid model that combines face-to-face and online components. Advantages: Expand access to education, provide flexibility for learners, and often use multimedia resources to enhance the learning experience. Disadvantages: Learners may feel disconnected from instructors and peers, leading to feelings of isolation and reduced motivation. They may have difficulty organizing and managing their own time, leading to reduced learning effectiveness. Not all learners have access to modern technology, which can cause a "gap" in the learning process [3, 10].

Some standard resource classifications

There is no national standard classification or mainstream standard for digital teaching and learning resources. Since some states voluntarily adhere to the same curriculum framework for certain subjects, notably the Common Core State Standards (for mathematics, arts, and English language arts) and the Science Standards, they provide a common standards-based taxonomy for digital learning resources to be tagged. As of 2023, in the United States, 41 of the 50 states have adopted the Common Core State Standards, and 27 of the 50 states have adopted the Science Standards [3, 10].

Data Governance and Digital Technology in Education

According to "Country digital education ecosystems and Governance © OECD 2023 - 29 United States (2023)" and Gray, L. and L. Lewis (2021), the United States has adopted a sectoral approach to data protection. There is no general data protection regulation, but rather sector-specific regulations. Education is one of the sectors with data protection laws. For example, the Family Educational Rights and Privacy Act (FERPA) and several other laws related to protecting learners on the internet. States have the autonomy to establish their own general or specific data protection and privacy laws or regulations in addition to the federal laws or regulations. For example, California has a cross-cutting data protection law (Act). Digital tools are commonly used (e.g., Google Classroom) and benefit from a FERPA exemption, whereby software vendors may process student data on behalf of schools, although such data cannot be transferred to any third party without explicit consent from the school. Where consent is given, all data must be de-identified and non-

re-identifiable. The data protection rights of educators and school personnel are governed by federal labor law and their employment contracts. The federal government implements common statistical rules regarding access to and administrative use of educational data that the government collects for public or private research and development purposes. Federal policies focus on increasing the availability of educational databases for research purposes. This includes data available through the Department of Education, the Institute of Education Sciences, and the National Science Foundation, among other federal agencies. Federal regulations include requirements for funders to make data public as well as guidelines for making data sources accessible. Most states have similar regulations regarding administrative access to data, although the level of access and implementation rules vary from state to state [3, 10].

Aside from federal rules on data protection and privacy, there are no federal rules governing access to digital tools and resources in education. The federal government provides guidelines, and states and school districts issue their own regulations. For example, during the COVID-19 pandemic, state assessments are often administered remotely with digital proctoring, requiring states and school districts to publish relevant rules [3, 10].

As of 2023 and Gray, L. and L. Lewis (2021), there are no federal regulations on automated decision making in education, and few, if any, states are likely to adopt this approach. No state uses "high-risk automated" decisions for learners. Individual states, such as California, which has more data privacy laws than others, can develop rules and guidelines to inform access, use, and automation of digital technologies. In 2023, the White House and the Department of Education will issue federal guidance on the use of automated decisions involving artificial intelligence (AI), and an AI Bill of Rights is in the works. The draft of the bill focuses on promoting safe and effective systems, addressing protections against algorithmic discrimination, and ensuring data privacy rights. The bill also calls for improved notice and explanation whenever an automated system is used and about the impact it may have on certain outcomes; as well as "human alternatives" and the ability to opt out. Similarly, interoperability in education is not governed by federal regulations, but does have federal guidance. For example, the Common Education Data Standards (CEDS) promote semantic interoperability by identifying the most commonly used education data elements to support efficient data exchange within and across states (and for federal reporting). This initiative is led by the National Center for Education Statistics with the support of a Stakeholder Group that includes representatives from states, districts, higher education institutions, state agencies of higher education, other educational organizations, federal program offices, interoperability standards organizations, major education associations, and nonprofit organizations. Additionally, the Office of Educational Technology emphasizes the importance of interoperability in its National EdTech Plan, Developer Guide, and Infrastructure Guide. Finally, at the state and local level, many nongovernmental organizations support state departments of education and school districts in providing guidance on interoperability between systems. However, the majority of efforts toward interoperability are driven by voluntary efforts. Similarly, there are no federal regulations regarding data portability in education [3, 10].

Supporting Innovation and Research and Development (RD) in Digital Education

According to "Country digital education ecosystems and Governance © OECD 2023 - 29 United States (2023)" and Gray, L. and L. Lewis (2021), developing a national edtech ecosystem requires a vibrant edtech industry as well as robust research and evaluation of technology and its use in schools. Providing incentives to support research and development (RD), funding edtech startups, and funding academic research are typical innovation tools used by the government [3, 10].

The National Center for Science and Technology Statistics' annual survey of federal research and development funds provides a map of federal agencies that implement RD programs through federal funding, some of which are education-related. Over the past five years, federal funding has supported significant academic research on the use of digital technologies to improve learning outcomes and engagement for learners, including learners with special needs, to predict dropout, to support instructional and school management functions, and to improve the efficiency of assessment and certification. The federal government also conducts monitoring and evaluation of the nation's digital infrastructure. A notable example is the NCES EdTech Equity initiative launched in 2019. This initiative aims to close the relative gaps in data collection on a number of issues at the intersection of EdTech access and equity, such as access to technology outside of school, and how technology is integrated into learners' learning of technology-related knowledge and skills. This initiative specifically involves a study of the use of educational technology for instruction in public schools and the creation of an educational equity dashboard. Several organizations provide additional information nationally. For example, at the state level, the State Educational Technology Directors Association (SETDA) produces an annual "State EdTech Trends" report, the Consortium for School Networking (CoSN) provides additional details on the use of EdTech tools in education, and the Center for Assistive Technology Act Data Assistance (CATADA) documents the provision of assistive technology to learners with special needs. At the federal level, according to government officials, a focus has been placed on attaching evidence requirements to tools and resources purchased with some federal funds in states,

districts, and schools. The Every Learner Succeeds Act's definition of "evidence-based" should really be prioritized, defining evidence along a continuum from "promising" to "proven" by a randomized controlled trial [3, 10].

The Department of Education's Institute of Education Sciences (IES) funds state education agencies, universities, and educational research organizations, as well as regional, regional, and RD labs and support centers, as opposed to individual EdTech companies, to develop digital learning resources and educational software that can be used at all levels of education [3, 10].

Federal regulations include requirements for funders to open access to data as well as guidelines for making data accessible. While this is not data about digital education, which is scarce, it certainly improves the effectiveness of educational research. The federal government documents the public administrative datasets it manages, although they are only a small portion of the US. educational datasets, and communicates its RD priorities publicly and clearly through its research programs. Federal research programs (especially IES and related science education programs) are prestigious and well-funded, but they represent a small portion of research funding in the US., which is supported by philanthropies, limited liability companies, and, in fact, universities. In addition to conducting their own RD for digital tools and resources, US. educational agencies have established relationships with other education stakeholders, including nonprofits and private companies, to support digital innovation in education. Such partnerships typically occur at the state level, although the Department of Education's Office of Educational Technology regularly engages with organizations, companies, and EdTech developers through ongoing collaboration, consultations, and work related to specific projects. The Office of Educational Technology is the primary office within the Department of Education for outreach to the EdTech developer community. However, as noted above, no federal grants or monetary incentives are allocated to specific EdTech companies by federal agencies. The National Science Foundation also supports a variety of organizations conducting research on specific learning technologies. For example, the AI Institute for Active Learning conducts research on learning environments focused on AI-driven content, learning analytics, and natural language processing. Digital Promise is another example of a global nonprofit that promotes equitable educational systems through technology research and development. Such organizations foster local or national communities of practice as they regularly host forums or consult with education stakeholders and learners [3, 10].

Future activities, additional priorities of the US. Department of Education emphasize the broad scope of effective use of technology in education, as well as the development of online educational platforms and resources. More granular prioritization of specific digital resources occurs at the state and local levels. Online education platforms and digital resources, as well as classroom analytics, learning management systems, and student information systems are common priorities for states [3, 10].

On the research and development front, the Department of Education launched in February 2023 and began the process of driving scalable, high-reward, rapid-to-delivery solutions by building a federal education research and development infrastructure that will be based on the Advanced Research Projects Agency (ARPA) model [3, 10].

That RD model began with the Defense Advanced Research Projects Agency (DARPA), a federal agency that has helped guide technological innovation and breakthroughs in technology for defense and national security for more than sixty years. The goal of this ARPA-style initiative in education is to follow the example of ARPA-E (Energy-E) and ARPA-H (Health-H), and operate within an innovation ecosystem that includes academic, business, and government partners to foster an environment conducive to a culture of innovation in education. Such an infrastructure would ultimately support state, local, and federal education agencies in using evidence-based educational practices—including those related to digital infrastructure in schools [3, 10].

2.2.2. Digital technologies in higher education in Germany

A study of German universities, conducted at the end of 2018, surveyed leaders, focusing on the importance, strategy and goals of digitalization, the embedding of digitalization in information technology (IT) governance, the current status and framework conditions of digitalization and digital infrastructure [9]. The survey found that digitalization had affected most university functions before the pandemic. However, while the majority of institutional leaders (83%) considered digitalization important, its current status was still assessed as relatively low (at 20%) [9].

According to University Duisburg-Essen (2017), more than 50% of universities had formal strategies or concepts for the institution. 70% had a clear strategy specifically for teaching and learning, most of which emphasized the importance of digitalization to improve the quality of teaching [21]. 60% of respondents highlighted the need to improve the efficiency and quality of many administrative services through the digitalization of administrative work [21].

There are significant differences between different areas of higher education (HE) activity with regard to the use of Information and Communication Technology (ICT). In terms of teaching and learning, over 85% of universities have implemented a student information system (SIS) and a learning management system (LMS). To support research, 30% of universities have a fully or partially operational research information system (RIS) while 18% have a data management system (DMS) [9, 21].

Administrative functions and services have benefited from digitalization to a much greater extent than research and teaching. All student data is stored and managed with the help of the SIS, mentioned above. As a result, all data on student applications, enrolments and completions are processed in this system. Financial data is processed by the resource management system (RMS) and data related to premises, buildings and facilities is processed by the computer-aided facilities management (CAFM) system [9, 21].

According to Kerres, M. (2020), prior to the pandemic, HEIs had been gradually developing their institution-wide digitalisation strategies and ICT governance structures. While many IT systems and applications were used across the institution and for different functions, they were not coordinated or only partially integrated. The question of who was responsible for digitalisation at the university level in general was not clearly defined. Many units within the university such as faculties, departments, institutes or research centres and central services such as the library or the university hospital had their own IT structures and responsibilities. However, in three-quarters of HEIs, responsibility lies with a single person or committee. Larger HEIs have a central information officer (CIO) or a central information committee. Key players are often computer center directors or vice presidents who are also involved in developing the overall digital strategy of the institution. During the pandemic, there has been a strong push towards digital teaching, leading to steeper teaching curves for many faculty, accelerating the process of capacity development [12]. According to Zawacki-Richter, O. (2020), large investments are being made in technical infrastructure, faculty are acquiring knowledge of media technology, and taking advantage of services provided by educational consultants and instructional designers. Exams and tests are conducted with the help of computers (e-assessment) and some university rectors and vice rectors may have been keenly aware of the value of their Center for Teaching and Learning (CTL). Some issues remain, which are not yet clearly defined [23]. According to Kerres, M. (2020), after the pandemic, more than 50% of universities have an institutional digitalization strategy, but in many cases this strategy does not involve teachers and learners. Overall, the study shows that digitalization is particularly developed in universities with computer science, engineering, science and mathematics (STEM subjects). However, in general, it would probably be fair to summarize the developments at German HEIs as follows: “There is no management strategy, no teacher training, no debate about technological design or politics, no debate about pros and cons – we just do it” [12].

According to European Commission (2020b), the overall strategy and management plan for such digitalization requires considerable effort and resources from many parties, not to mention cooperation and coordination between them regarding multiple products and services and hardware and software providers. For HEIs, things become more difficult when public authorities are involved as rule-makers and funders. The main tool of the state government is to influence HEIs to further digitalize through regular performance agreements (“Leistungsvereinbarungen”-Performance Agreements). In these agreements, a number of specific targets are defined that a given institution must achieve by a certain date. In similar agreements, special funding for the realization of different targets is included [7]. According to Lübcke, M., Bosse, E., Book, A., Wannemacher, K., & Gilch, H. (2022), a study on digital teaching and learning, based on a survey of German university rectors at the height of the pandemic in September 2021, found that more than 50% of institutions already had an overall digital strategy, although in many cases it was established without broader engagement of lecturers and learners [13]. Respondents predicted that in the future, 40% of teaching will be entirely online while the remaining 60% will be partly traditional classroom-based and partly “blended learning”, i.e. a combination of traditional and online learning. This view resonates with that of another important stakeholder group – students. While students appreciate the ability to study remotely, which saves them time and travel costs, and appreciate the ability to study at their own pace and at their own time, they perceive that studying in a virtual environment deprives them of some of the important advantages and appeals of on-campus education. Examples of such advantages include the ability to interact with other students not only in the classroom or lab, but also in campus-wide activities such as “orientation days, sporting events, club fairs,” where they can find and bond with other students with similar interests. Meeting and socializing at restaurants and cafes on campus is another way for students to interact by sharing information and exchanging ideas on both course-related and general topics [7].

Higher education from the student’s perspective is more than just classroom learning. It is also the place and time to develop social and civic skills, as well as confidence in students' character and personal identity. These social functions of HE are extremely important in preparing citizens for their future lives, and they cannot be fully realized online [7].

2.2.3. Organizing digital teaching and learning in the Canadian higher education system

Flexible learning

According to Johnson, N., Seaman, J. and Poulin, R. (2022), this is probably the main motivation for students right now. Many Canadian students are working part-time (even if they are "classified" as full-time students) to help defray student costs and pay for university tuition, or have to commute long distances to school from where they live. Most online students are not really "distant" students at all. They are often home within an hour or so of their commute, but their time is valuable and online learning gives them more flexibility in managing their time. Covid-19 has reinforced the "flexibility" of online learning. Faculty also like the idea of working primarily from home. Online learning is really just another aspect of the digital age, where employers, employees, students, and faculty all want more "flexibility and control" over their lives [11].

Access to digital technology

According to Donovan, T. et al. (2018), although there are still significant gaps in internet access, especially in remote rural areas, most Canadian university students have easy and convenient access to the internet. Most have computers, tablets, and mobile phones, and they feel comfortable using them for learning purposes. Likewise, faculty have access to relatively easy-to-use technology to deliver, such as learning management systems (LMS) and video conferencing [5].

Support from Teaching and Learning Centres

According to Naffi, N. (2020), the move to digital learning is not a huge technical leap for faculty, although some faculty training in the use of technology is beneficial. However, this is now easily accessible through the Teaching and Learning Centres that most Canadian universities and colleges have established. The value of these support centres has been greatly enhanced by Covid-19. Previously, less than 10% of faculty had taken advantage of the expertise of staff at these centres. During Covid-19, more than half of faculty have received at least some assistance from such centres. However, perhaps the greatest value of these centres is not the technical support but rather the need for faculty to reconsider the design of their courses to enhance active learning and better manage student workloads [14].

Lifelong Learning

According to Seaman, J. (2023), this is a more strategic development driven by changing demographics and the economy. The number of students graduating from high school in Canada each year is decreasing or flat due to demographic reasons. Canada's birth rate was 1.4 per woman in 2020 [16].

The main increase in recent years in student enrollment has come from international students. There will be more than 800,000 international study permit holders in Canada by 2022, up 30% from the previous year. At some smaller Canadian higher education institutions, international students make up more than 60% of the institution's total student population. Canada aims to admit about 500.000 new immigrants each year. Accepting international students can make the path to immigration easier [16].

International students are an important source of funding for Canadian universities and colleges. Direct government funding for post-secondary institutions varies by province, but over the past 10 years it has been flat or declining per student. This funding cut has been more than offset by higher tuition fees for international students. However, this is a volatile education market and is vulnerable to disruptions in global politics. There are also signs that the education market is reaching capacity in Canada [16].

There are serious labour shortages in many sectors of the Canadian economy as the baby boomer generation retires, particularly in areas such as health care and other fields that require post-secondary education. The federal government's strategy is to meet this challenge through increased immigration. However, there are still barriers from professional associations and provincial governments to accepting foreign degrees (or even degrees from another province). This has led to a need for courses or programs that allow students to update or transfer their existing qualifications [16].

Finally, the economy is changing. While manufacturing, agriculture and mining, Canada's three main industries, remain in high demand, the skills required are changing. In particular, there is growing growth from new job markets. For example, more people work in the film and video game industries in British Columbia than in mining, forestry and agriculture combined [16].

As a result, many older Canadians are looking to update their existing qualifications or skills or need to move into new areas of study as their jobs change. This has led to a proliferation of "micro-credentials" but has also increased the demand for professional master's programs. These older adults have families and may still be working, and need the flexibility that digital learning can provide [16].

The needs of the digital economy

According to Royal Bank of Canada (2018), while this is perhaps the least influential reason for the push by educational institutions toward more digital teaching and learning, in the long run it is perhaps the most important reason for the Canadian economy. Recent reports, highlight that automation, artificial intelligence, remote work, remote shopping, and other elements of the digital age require knowledge and skills that are different from those essential in the industrial age. Digital learning helps learners develop these knowledge and skills better. It enhances general digital literacy, but is also better suited to teaching the soft or advanced intellectual skills that people will need not only to work but also to live in the digital age [15].

According to Bates, A. (2022), digital learning can be used to enable students to find, evaluate, and apply knowledge, to: become "stewards" of knowledge. However, this requires not only the use of digital technologies, but also a redesign of the curriculum to encourage such learning. Fortunately, we will see that the resources to enable this to become a reality are now available [1].

2.3. Lessons from international experience in applying digital technology to Vietnamese higher education

- *Lessons from the US:* The provision, regulation, and management of digital infrastructure in education are primarily the responsibility of states and school districts. The federal government does not directly develop or operate digital tools to manage the system, nor does it directly provide digital teaching and learning resources, but it supports states and school districts in developing their digital ecosystems through various funding programs. The federal Department of Education, supported by a range of federal agencies, supports the digital transformation of the education system. It designs and revises the national strategy for digital education and attempts to mitigate potential digital divides through a number of equity-oriented mechanisms. The federal government also supports innovation, research and exploratory development in digital education, by monitoring the uptake of digital technologies in schools, funding (or directly conducting) research on the use of these technologies and ensuring that researchers have access to relevant educational data. There is a sectoral approach to data and privacy protection. There is no general data protection regulation, but there are sector-specific regulations, including for the education sector, as well as regulations relating to learner data. Countries have autonomy to set their own data governance policies in addition to federal regulations.
- *Lessons learned from Germany:* The digitalisation of higher education is multifaceted, depending on general factors such as income levels, online connectivity, industrial development and the level of digital skills of the population. This digitalization process is particularly complex in Germany, despite the country's strong economy, well-developed technical infrastructure, and generally efficient education system. The reason for this complexity lies in Germany's constitutional structure, with 16 federal states responsible for higher education, while the federal government only has regulatory authority over certain areas related to higher education; namely student support, research, and international relations. However, due to its overall responsibility for the economy, the federal government also has overall authority and responsibility for digitalization in Germany. As a member of the EU, Germany is subject to and subject to EU laws and policies, many of which view digitalization as a key driver of innovation and competitiveness. Although the EU has little direct authority over education, digitalization of education is playing an increasingly important role. In addition, Germany is a member of the Bologna Process, an agreement on the voluntary convergence and coordinated reform of the higher education systems of member states.

Digitalization is also part of the effort to create an efficient, high-quality and transparent European ESG (Environmental, Social & (Corporate) Governance). Germany's higher education sector is predominantly public, so decisions on the creation and use of data in teaching and learning, research, management and services are made by state legislatures and education ministers. Both the federal and state governments are supported by advisory bodies, most importantly the Standing Conference of Ministers of Education and Cultural Affairs and the Science Council, which provide research-based information and advice for coordinated national policies and reforms. In contrast to other countries, especially smaller and less industrialized ones, Germany's lack of connectivity, infrastructure and funding is not the biggest problem in the digitalization of higher education. Rather, the difficulty lies in the lack of coordination at the institutional and regional levels to create compatible digital systems, as well as in institutional strategic planning processes that involve digital experts but also users, especially lecturers and students.

Overall, some aspects of the digitalization of higher education, especially online or blended learning, are changing the nature of higher education and learning. As a result, higher education institutions are also changing. These institutions will no longer be the primary model for the organisation and delivery of HE and many of the facilities found in a traditional educational institution such as libraries, lecture theatres, student accommodation, sports facilities etc. will disappear or be limited to on-campus HEIs. The not-too-distant future will show what this means for teaching and mentoring, learning societies, student life and support, community service and engagement and other elements associated with traditional HE.

- *Lessons learned from Canada:* Digital education has reached such an acceptable level in Canada that it is now are being incorporated into both on-campus and distance education. The rise of digital education is breaking down the previously clear distinction between face-to-face and distance education. Ultimately, digital learning offers students in Canada a more diverse range of ways to access post-secondary education. However, digital education is moving beyond increased accessibility and flexibility for learners. It is beginning to impact teaching methods, with a shift from formal presentation to a greater focus on knowledge management and the development of intellectual and operational skills. However, there is still a long way to go before all of Canada's higher education teaching and learning is fully digital. Although valid data collection methods have not yet been applied to fully measure the level of digitalization in teaching and learning, it is likely that less than a third of instructors in 2022 will have shifted from traditional, classroom-based teaching methods that rely heavily on lectures and labs supported by student reading to a more learner-centered, digitally-based learning environment. However, this trend is shifting toward digitalization and has been accelerated by the Covid-19 teaching emergency.

Most Canadian higher education institutions have extensive infrastructure to support digital education. More and more student services are being digitized and delivered online and on-demand, especially due to Covid-19. Most Canadian students have good internet, computer, and mobile phone connections. However, there are still gaps or gaps in access, especially in more rural or remote areas of Canada and for students from low-income families where data costs or lack of devices can be an issue. Most university and college authorities are supportive of the move to digital teaching & learning. Faculty resistance to online learning in particular remains significant, but is decreasing year by year. Again, remote learning during the emergency has significantly reduced resistance to online learning. Overall, students are welcoming digitalization because it gives them more flexibility. There is still some resistance to some professional accreditation bodies for fully distance education degrees, but even that is slowly changing as the professions themselves become increasingly digital. Government support for digitalization varies by province, but most local governments have dedicated funds or established agencies to support the move to digital teaching & learning. The main focus of these support agencies is professional development, inter-institutional collaboration (e.g. in the development and sharing of OER), and special initiatives, such as BCcampus' Open Textbooks program and Contact North's distance learning hubs. However, universities in particular remain highly autonomous. There are few mandatory requirements from the government. While governments in Canada and senior administrators in higher education have promoted and encouraged the move to digital teaching & learning, most adoption has been through the initiative of individual faculty or academic departments in response to what they perceive to be student needs. Canada is on the right track and making some progress on digitalization in higher education.

3. Conclusions & recommendations

The possibilities and importance of digital spaces should be evaluated in their proper role, which allows, together with images and texts, to supplement the lessons taught in other formats, such as simulations, videos, audios, etc., taking into account the social element of the changes taking place. Educational materials are designed as open educational resources, their use does not violate copyright and they can easily be introduced into the classroom. However, it would be a mistake to assume that "digital technologies automatically provide solutions to all problems in higher education and contribute to improving the learning environment by themselves". Because the teaching method – be it collaborative learning, project method, input lessons or teacher-centered lessons – does not depend on technology. And, their use often leads to changes in the corresponding teaching method. Only the active, purposeful development of the interaction between learners and teachers can make the learning process better and more flexible.

Therefore, "digital technology" should be considered as one of the means to improve the quality of education and one of the tools to amplify the power of human "natural intelligence". But in any case, the development of their application practices cannot be considered as the goal of education. Here, the "means" (when they are considered the goal of the institution) are replaced by the real goal of the education and training system - the spiritual uplift and the harmonious, comprehensive development of each person.

In order to improve the effectiveness and further support the digitalization of HEIs in Vietnam, the article puts forward the following recommendations that may be considered.

Recommendations

- *Some general recommendations for the state and higher education institutions*
    - *Increase investment in information technology infrastructure:* Ensure that all higher education institutions have strong, stable and modern information technology infrastructure to support online teaching and learning; there should be specific investment policies for upgrading facilities, Internet networks and learning support software. *(ii) Encourage research and innovation in educational technology:* Create an environment for research, testing and application of new educational technologies such as artificial intelligence, machine learning, virtual reality (VR), augmented reality (AR) in higher education; encourage initiatives in developing applications, software and learning support tools, improving the quality of higher education. *(iii) Ensuring equity in access to technology:* The government and universities need to have policies to support students in remote areas, those in difficult circumstances so that they can access information technology, learning software and online learning tools. *(iv) Creating a flexible learning environment that adapts to learners' needs:* Encourage universities to develop online courses and programs, blended learning so that students can study at their own pace and time; need to develop online or "blended" learning programs (a combination of online and face-to-face learning) so that students can easily access, while reducing pressure on time and costs. *(v) Improving the ability to manage and monitor learning through technology:* Universities need to apply data analysis technologies to monitor learning progress, evaluate students' learning outcomes, thereby having timely interventions; Use technology to improve curriculum management and exam administration, facilitating both teachers and students.
- Dissemination of digitalization policies in universities
    - Government policies only provide top-down direction for change. How individual institutions implement them will vary, as each institution has its own systems, processes, teachers and learners to consider. To help HEIs implement digitalization effectively and provide practical support for policy implementation, MOET should provide clear guidance, criteria and assessment frameworks. MOET should coordinate and regularly promote national-level training, webinars and other promotional activities nationwide to increase awareness of the policies and effectively disseminate policies and supporting resources related to digital technology policies in higher education.
- *Government support for universities*
    - MOET and relevant ministries should increase investment and support for universities. Recognizing the concerns and challenges facing HEIs, such as cost, standardization, and infrastructure, is important to ensure that HEIs feel fully supported in their digitalization process. The government should allocate special funding for digitalization projects in HEIs, especially in the provinces, to support the implementation of new technologies and infrastructure, by establishing digital infrastructure such as high-speed Internet, hardware and software systems, and cybersecurity measures to ensure the delivery of online courses. In addition, the MOET should collaborate with private companies, research institutes, and international organizations to support digitalization initiatives in developing new technologies and innovative solutions for universities. The MOET should also support and encourage research on good practices in digitalization of universities for nationwide dissemination. Changing the mindset of university leaders should also be a priority. The Ministry of Education and Training should provide training for university leaders to understand the benefits of digitalisation and the scope and requirements of digitalisation to develop digital literacy and knowledge of advanced digital technologies applied in education. The leaders will then be confident in engaging and supporting the digitalisation process at their HEIs.
- *Universities supporting lecturer training*
    - HEIs should support the development of digital skills for HEI teaching staff and students through training programs and capacity building initiatives. Additional training and support for teachers is needed in the following key areas: *(i) Intellectual property awareness:* in particular, priority should be given to new important areas of digitalization, such as copyright, intellectual property, cybersecurity and privacy, that teachers may face. *(ii) Pedagogical practice:* for pedagogical practice, training should provide teachers with the knowledge and skills to teach effectively online, manage classrooms and engage students. How to apply digital tools such as discussion forums, virtual group projects and online quizzes should be included to help teachers promote student engagement and collaboration with colleagues. *(iii) Digital skills:* digital skills training empowers lecturers with digital skills, trains lecturers to be competent in using digital tools in teaching, thereby improving the quality of teaching,

such as how to prepare online teaching materials, how to use tools to design digital lessons, record and edit recordings suitable for the classroom; create attractive visual content; use multimedia tools to create highly interactive, aesthetically pleasing and easy-to-understand presentations for learners; and use tools to set up online quizzes and competitions. *(iv) Encourage innovation in teaching methods:* Universities should apply blended learning, integrating online and face-to-face learning, to maximize learning effectiveness; use technology to design lively, interactive lectures that are suitable for students' learning needs. *(v) Digital mentoring for senior lecturers:* senior lecturers need to be trained intensively to acquire digital skills and HEIs should provide a "team unit" of essential support and facilities and resources within universities for senior lecturers to increase their confidence, knowledge of digital technologies and ultimately their digital engagement.

- *Universities supporting students in learning and research in the digital environment*
    - Additional training and support for students is needed as most HEIs have so far invested mainly in digital infrastructure, digital data platforms to operate and manage HEIs, including teaching and learning. Investments should also focus on developing online services for students, including: *(i) Digital skills training:* universities should provide comprehensive training for students, including web search skills, to ensure learners can maximize online learning opportunities. Students also need to be proficient in using digital tools to participate in learning effectively and learn collaboratively with their lecturers and classmates. *(ii) Paperless administrative procedures:* students can be provided with automated consultations and feedback regarding their administrative requirements and the admission requirements of potential students. Students can register for all processes of writing dissertations, submitting papers, registering for courses, changing programs and courses, paying tuition fees, exempting tuition fees or applying for scholarships online. *(iii) Building a comprehensive digital learning ecosystem:* Developing effective online learning platforms, open resources and learning management systems (LMS) for students to access learning materials, participate in online courses; providing technology training courses for students to familiarize themselves with and proficiently use online learning tools and platforms; Cooperate with organizations and businesses to build open learning platforms and high-quality online learning programs. *(iv) Training on developing personalized learning models:* students' learning is different in terms of goals, pace and methods. Therefore, training should specify how to apply technology to develop personalized learning models that better suit the needs and abilities of each student.
    - Digital technology plays an important role in improving the quality of teaching and learning at higher education institutions, including: Teachers and learners can easily access flexible learning and teaching resources; Technology platforms allow students and lecturers to interact more easily via forums, video calls, or chat applications; Digital technology helps improve the efficiency of administration and assessment for the teaching staff, by using online tools to administer, test, evaluate, grade and provide quick feedback; The use of technology helps students develop necessary digital skills in learning and life, such as software skills, online teamwork and information management; Digital technology allows personalization of the learning process according to the needs and speed of each student; Technologies such as virtual reality (VR), augmented reality (AR) can create more engaging learning experiences, helping students easily access and understand complex concepts. Thus, digital technology not only contributes to increasingly improving the quality of higher education through the "capacity and attitude" of "approaching it" of schools and lecturers, but also contributes to creating a dynamic and creative learning and research environment, preparing learners with the necessary skills to succeed in the future

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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