University Training in Response to the Requirements of Industry 4.0

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Abstract

In the context of Industry 4.0, university training is supposed to provide learners with the qualities and skills necessary to live and work in the digital environment. A relatively new issue for Vietnamese universities is how to train human resources to meet the requirements of working in the digital environment. In order to meet the training requirements, many difficulties are posed, ranging from awareness and identification of the elements of citizens' digital competence to technical infrastructure, training programs, and pressure on lecturers and managers. The article introduces digital competence and the digital capacity frameworks for citizens and for students based on existing studies. It thereby assesses the common difficulties and challenges of higher education and proposes a number of solutions to train human resources to work in the digital environment. This immediately aims to implement the Prime Minister's Decision No. 749/QD-TTg approving the "National Digital Transformation Program until 2025, with orientations until 2030".

Keywords: Digital competence, university, training to work in the digital environment, Industry 4.0.

1. Introduction

Industry 4.0 poses many challenges for the education sector. In particular, training activities which are the core of the university are also strongly affected in terms of content, methods, organization forms, and training support conditions. The world is entering the era of digital transformation and education is also facing great opportunities and challenges. According to UNESCO (2018), to enter Industry 4.0, people must have digital competence. Citizens' digital competence is understood as the combination of human abilities in using information and digital technology to live and work effectively in a developed digital environment.

Digital competence is becoming crucial in the industry 4.0 era. Digital technology plays an important part in many fields ranging from education, business, and healthcare to politics. People with high digital competence will have more opportunities to succeed in life and will promote social innovation and progress. In addition, it increases efficiency and reduces time at work, supports the development of industrialized economies, and helps achieve sustainable development goals. Thus, it is an indispensable factor in the personality model of people living in Industry 4.0 (UNESCO, 2018). In the creation of citizens' digital competence, education and training play a decisive role. So, this is an opportunity as well as a great challenge for the training activities of universities.

According to the World Bank's Business Environment Analysis Report (The World Bank, 2016), Vietnam ranked 90th out of 189 countries participating in the business environment ranking. With the impact of Industry 4.0, developing countries like Vietnam will be forced to change their competitive advantages. In particular, preparing labor resources occupies a crucial role. With its working-age population representing about 60%, Vietnam is still in the golden population period. However, due to a severe shortage of highly skilled laborers and skilled technical workers, Vietnam's human resource competitiveness index only reached

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3.39 out of 10 points and the competitiveness of the economy ranked 73/133 countries (The World Bank, 2014). Therefore, in order to increase competitiveness, there is no other way than to reform and change the training of human resources.

In this context, the Prime Minister of Vietnam approved the "National Digital Transformation Program until 2025, with orientations until 2030" with a direction toward the following: By 2025, 80% of online public services will reach level 4, 100% of the Government's reporting regimes will go online and digitized; and Vietnam will rank among 70 leading countries in e-government. In this Decision, the Ministry of Education and Training was tasked with adjusting and supplementing training programs at all levels to train human resources in information technology, digital technology and artificial intelligence, data science, cloud computing, etc.; applying the integrated model of science, technology, engineering, mathematics, and arts, business operations and enterprises; providing career guidance for students so that they have skills ready for the digital environment; and implementing digital transformation in the education sector (Prime Minister, 2020).

There is little research done in Vietnam on the issue. Tien et al (2020) paper is related to the development of business universities in Vietnam, as they are more flexible than others in applying technologies and other innovations. They stress intensive e-learning technology to optimize the cost of teaching/learning. According to Tri et al. (2020), "main findings the industrial revolution 4.0 has actively contributed to the cause of educating people, fostering talents, training human resources for socio-economic development. However, this revolution also brought negative aspects to Vietnamese higher education. Developing higher education in the context of industrial revolution 4, it is required that the Government have appropriate solutions and policies in the coming time" (p. 3). "Universities need to apply new technology, using multi-tools such as computers, projectors, lectures electronics, smart boards, electronic textbooks, especially teaching software (E-Learning). Accordingly, the organization of classes, assignment of assignments, tim limits, checking assignments, providing documents, receiving feedback, adjusting student activities, etc. are all manipulated on computers" (p.12). However, Tier's article either doesn't involve any empirical research or has not relevantly presented it.

This article comes from the context of Industry 4.0, introducing the digital competence frameworks for citizens and for Vietnamese students; thereby identifying the opportunities and challenges that university training is facing. On such a basis, it proposes a number of solutions to help universities improve the quality of training, contributing to the successful implementation of the Government's "National Digital Transformation Program until 2025, with orientations until 2030".

2. Methodology

The research was conducted through secondary data analysis. Search engines such as Google Scholar, ERIC, Academia, Research Gate, as well as books, magazines, and legal documents of the state were used. The article presents an overview of official documents and research results in Vietnam and abroad on the digital competence framework for citizens. Through analysis, evaluation, and synthesis, it highlights opportunities and challenges in the training activities of universities in Vietnam in response to the requirements to meet human resources for Industry 4.0. For the purposes of analysis, more than 30 sources of documents from UNESCO and the European Commission, Vietnamese political documents (20 reports and decisions during 2011-2022), and about 11 research studies were applied. The major sources are cited in the article. The population of the studies included state managers, employers, lecturers, researchers at research institutes, and graduate students. The codification of key concepts and sub-concepts was applied for research purposes.

On the basis of UNESCO and the European Commission documents, the article introduces the concepts of "digital competence" and "digital competence framework for citizens" in which digital competence is one of eight competencies in the lifelong learning

framework (Figure 1) and the digital competence framework for citizens includes five main areas (Table 1). From the recommendations of UNESCO and the European Commision, studies were conducted in Vietnam to develop a digital competence framework for students (section 4.1.3) and a digital competence framework for civil servants (section 4.1.4), which are the output requirements in training digital competence for human resources working in the 4.0 industrial environment that universities will have to meet. With those requirements, there will be many opportunities and challenges posed in university education. Due to the wide issue and time constraints, the article relies on available research to analyze and clarify the advantages and disadvantages in the current university education; from there propose solutions to improve the effectiveness of digital competence training at universities in Vietnam.

The data on digital competence and the digital competence framework used in the article are based on officially published scientific documents from UNESCO, the European Community and articles in specialized journals by authors both inside and outside the country. The current situation of advantages and difficulties of Vietnamese universities in meeting the requirements of training digital competence for industry 4.0 is drawn from domestic research, mainly from evaluations in Party resolutions, reports on the implementation of the Education Development Strategy until 2021 of the Ministry of Education and Training, university textbooks and research works of some typical authors.

The analysis of the current situation is focused on basic variables/issues: 1) Awareness, considered as a prerequisite issue; and 2) Three categories that determine the quality of training activities (from a philosophical perspective), which are program content, training methods and means of supporting training activities. The article has summarized the manifestations and consequences of the main difficulties in training (Figure 2). From these results, based on the legal corridor framework, the orientation of the education development strategy and the directives of the Government to propose solutions for digital competence training in the period 2021-2030.

With official theoretical sources, assessments of advantages/difficulties based on the current situation, the selected variables for analysis are fundamental to determining the quality of training and the orientation of university education development based on the legal basis of the state; the proposed solutions aim to promote advantages and overcome disadvantages are reliable. Hopefully, the research results will be a good reference for training digital competence for citizens at Vietnamese universities or areas with similar conditions.

3. Research questions

The following research questions were formulated to be answered in the research:

1. What are the elements of citizens' digital competence? What are the orientations on the digital competence framework for citizens that Vietnamese universities must train?

2. In order to form digital competence for learners to meet the requirements of Industry 4.0, what difficulties and advantages are universities facing?

3. What are the solutions to improve the effectiveness of training activities?

4. Discussion and results

4.1. Digital competence and digital competence framework
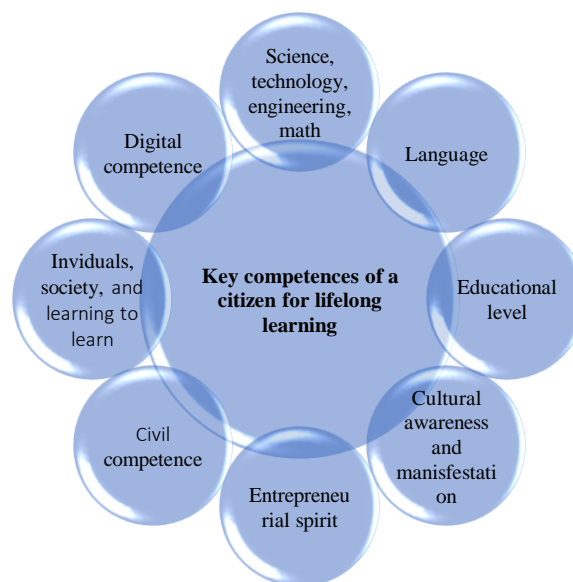
4.1.1. Digital competence

According to Secker (2018), the concept of digital competence was formed more than 20 years and is often used at the same time as other concepts such as digital skills, information competence, communication competence, or academic competence.

As claimed by UNESCO (2018), *digital competence is the ability to access, manage, understand, combine, communicate, evaluate, and create information* safely and appropriately through digital technology to serve simple tasks to complex ones as well as start-ups. Digital competence is the ability to access, manage, understand, combine, communicate, evaluate, and create information in a safe and appropriate way through digital technology to serve the manual labor market as well as high-end jobs and business start-ups. Digital competence includes specific competencies such as the operation of devices and software, exploitation of information and data, communication and collaboration in the digital environment, digital safety and security skills, creation of digital content, learning and development of digital skills, and application of digital competence to careers.

As stated by the European Commission (Vuorikari et al., 2022), in the digital era, no matter who you are, you must, first of all, be a digital citizen or a citizen with digital competence to live, study, and work safely and prosperously. Digital competence is one of the key competencies for lifelong learning. It was first defined in 2006, and then updated by the European Commission in 2018. Accordingly, digital competence is among citizens' eight basic competencies for lifelong learning, which cannot be ignored in modern human competence.

Thus, digital competence is an indispensable quality of people in Industry 4.0. It is built mainly through learning and training and must be placed in a state of continuous supplementation and updates through regular and lifelong learning.

Figure 1. Digital competence in the digital competence framework for citizens for lifelong learning

(Source: Vuorikari et al., 2022, p.5)

4.1.2. Digital competence framework for citizens

On the basis of determining the position of digital competence in the framework of lifelong learning competence of citizens, the European Commission developed a digital competence framework expressed in 5 basic areas shown in Table 1 (Vuorikari et al., 2022).

Table 1. Competence framework for citizens in key areas

No.	Area	Competence	Manifestation
1	Alertness to information and data	Browse, search for, and filter information and digital content	Clarify information needs, search for data and content in digital environments, access them, and navigate between them. Create and update personal search strategies
		Evaluate data, information, and digital content	Analyze, compare, and critically evaluate the credibility and reliability of data sources and digital content. Analyze, interpret, and critically evaluate data, information, and digital content
		Digital data and content management	Organize, store, and retrieve data in digital environments; organize and process them in a structured environment
2	Communication and Collaboration	Interact through digital technologies	Interact across different digital technologies and understand the appropriate digital media for a given context
		Share through digital technologies	Share data and digital content with others through digital technologies. Act as a mediator and know how to practice.
		Attract citizenship through digital technologies	Participate in society through the use of digital services. Seek opportunities for self-empowerment and citizenship to be engaged through appropriate digital technologies
		Collaborate across digital technologies	Use digital tools and technologies for collaborative processes, and jointly build and create data and resources
		Online Code of Conduct	Be aware of norms and conduct in the use of digital technology and cultural diversity in that environment
		Digital identity management	Create and manage one or more digital identities which can protect your own reputation, knowing how to handle the created data
3	Content creation	Develop digital content	Create and edit digital content in different formats, expressing themselves through digital media
		Integrate and rebuild digital content	Modify, refine, and integrate new information and content into existing blocks of knowledge and resources to create new, original, and relevant content and knowledge
		Copyrights and licenses	Understand how the use of copyrights and licenses applied to digital information and content
		Programming	Plan and develop a chain of commands to solve a problem
		Protect devices	Know how to protect devices, and digital content, and understand risks and threats

4	Safety	Protect personal data and privacy	Protect personal data and privacy in the digital environment; understand how personal information is used and shared; can protect themselves and others from harm
		Health and well-being protection	Able to avoid risks and threats to physical and psychological health when using digital technologies
		Environmental protection	Aware of the environmental impacts of digital technologies and their use
5	Problem-solving	Solve technical problems	Identify technical problems when operating devices and using digital environments, and address them
		Identify needs and meet the technology	Assess needs and identify, select, and use digital tools to meet technology and address them; tailor and customize the digital environment to individual needs
		Innovative use of digital technology	Use digital tools and technologies to generate knowledge and innovate processes and products
		Identify the digital competence gap	Understand digital competence that needs to be improved or updated; be able to support them in developing digital competence

(Designed by the researcher)

4.1.3. Digital competence framework for students

As recommended by UNESCO for the digital competence framework for citizens, some authors in Vietnam proposed a digital competence framework for students with 7 competence groups (Tran D.H & Do, 2021) as follows:

I. Operate devices and software, including the following competencies: Operate digital devices and software/services, and evaluate and select technologies.

II. Information and data competence: Identity needs and solve problems, seek and evaluate information, think critically, store and organize information, and use and distribute information.

III. Communication and cooperation in the digital environment: Digital citizens - rights and public services in the digital environment, participation and operation of communities/groups/forums, interaction and sharing of information; empathy - communication, awareness of behavioral norms and understanding of the public/context, development, and practice of codes of conduct in the digital environment.

IV. Digital content creation: Innovate with digital content and technology, create digital content, licenses, and copyrights, and use programming languages.

V. Security and safety in cyberspace: Understand and master the digital footprint, protect digital identity and privacy, ensure digital security, and protect the environment in the practice of digital competence.

VI. Learning and development of digital skills: Grasp the trend of online training, use tools and teaching methods in the digital environment, plan and control learning progress, and evaluate the learning process in the digital environment.

VII. Digital competence related to occupations: Identify tools and technologies specific to the job, search/evaluate/select and use content and data specific to the job.

4.1.4. Reference digital competence framework for cadres and civil servants

Nguyen (2022) proposed reference values for the development of the digital competence framework for civil servants in Vietnam, including 5 basic areas based on the European digital competence framework for citizens (Table 1) and added the sixth area of digital competence corresponding to the professional characteristics of civil servants: i) Selecting and using specialized digital tools and technologies for a public service area; and ii) Understanding, analyzing and evaluating data, specialized information, and digital content for a specific public service area in the digital environment.

4.2. The advantages and disadvantages posed in digital competence training

The output of the training process on the digital competence of students and then digital competence for people working in socio-economic sectors has been shaped. With such new requirements, universities must be prepared to embrace fundamental changes and successfully manage them. In the current context, what advantages and disadvantages should be noted in building universities' vision and orientation in the coming time?

According Tran (2018), the impact of Industry 4.0 on education is huge, creating both opportunities and more and more challenges for educational institutions. *First,* Industry 4.0 has created a high training demand for educational institutions. In all sectors, breakthroughs in new technologies will have a stronger impact on social life. In Industry 4.0, the vocational education system will be affected very strongly and comprehensively, and vocational training categories will have to be continuously adjusted and updated. The domestic and international labor markets will see a strong divergence. *Second, it changes everything in training institutions.* In order to meet the requirements of human resources for the creative economy, it is necessary to change training activities, especially professions to be trained, contents, forms, and methods with the strong application of information technology. Accordingly, the old teaching methods are no longer suitable. With the application of the achievements of Industry 4.0, learners anywhere can access the school's library for self-study and self-research. *Tight funding and increasing investment demand* are also one of the main points that make science and technology applications underdeveloped in universities.

Decades ago, Toffler (1970) believed that the world would witness very rapid changes. Those changes in technology made it impossible for people to pursue to manage them and it would be the "shock of the future". He correctly predicted that schools in the hyper-industrial era would have to experiment with different arrangements including the following: classrooms with many teachers and one student or group of students; students are organized into temporary task and project groups; students switch from teamwork to individual work and return to teamwork; schools must swap all of the above so that students can gain experience before they go into the temporary organization of the hyper-industry. These fundamental changes in perceptions, contents, methods, and teaching conditions would be huge challenges for universities.

Compared with the requirements for training activities set out in the digital competence frameworks for citizens and for students and based on the comments and assessments in recent studies (MOET, 2021; Phan, 2018; Vu, 2019; Hoang, 2020; Le, D.P, 2018; The party, 2013; Le, K.T, 2022) some advantages and difficulties can be drawn as follows.

4.2.1. Advantages

The training of digital competence for students is a global trend that universities in Vietnam have realized and are working hard to meet. The Party and State are interested in directions and investments; Resolution 29/NQ-TW of the Party on the fundamental and comprehensive renovation of education and Decision No. 749/QD-TTg of the Prime Minister approving the "National Digital Transformation Program until 2025, with orientations until 2030" create an important premise for training activities.

- Basically, schools have at least minimal resources to support digital competence training, including computer labs, online libraries, e-learning platforms, and training professionals.
- The training in digital skills will help students become more confident in the use of technology, which will support them in their careers and later life. Therefore, their learning motivation will be boosted.

4.2.2. Disadvantages

The awareness and thinking about digital competence of society in general and the forces at universities, in particular, are not good. Some managers, lecturers, and students have yet to realize the importance of acquiring digital competence and do not know how to use modern technologies. Changing their mindset will take time and effort from managers, lecturers, and relevant forces.

The contents of training programs, learning materials, etc. are still facing difficulties and need to be completed and supplemented. Currently, the teaching content is still heavily relying on outdated theories and teaching methods, has not promoted learners' activeness, initiative, and self-study methods, is unsuitable for different characteristics of subjects and disciplines; the school's programs have not been associated with economic and social life or focused on the education of life skills and promotion of creativity, practical capacity and self-study of students (Le. 2022). In addition, the integration of such content into the training majors, the innovation of teaching methods, the uniformity of policies, working regimes, operating mechanisms of the training process, etc. will be initial huge difficulties that need to be solved.
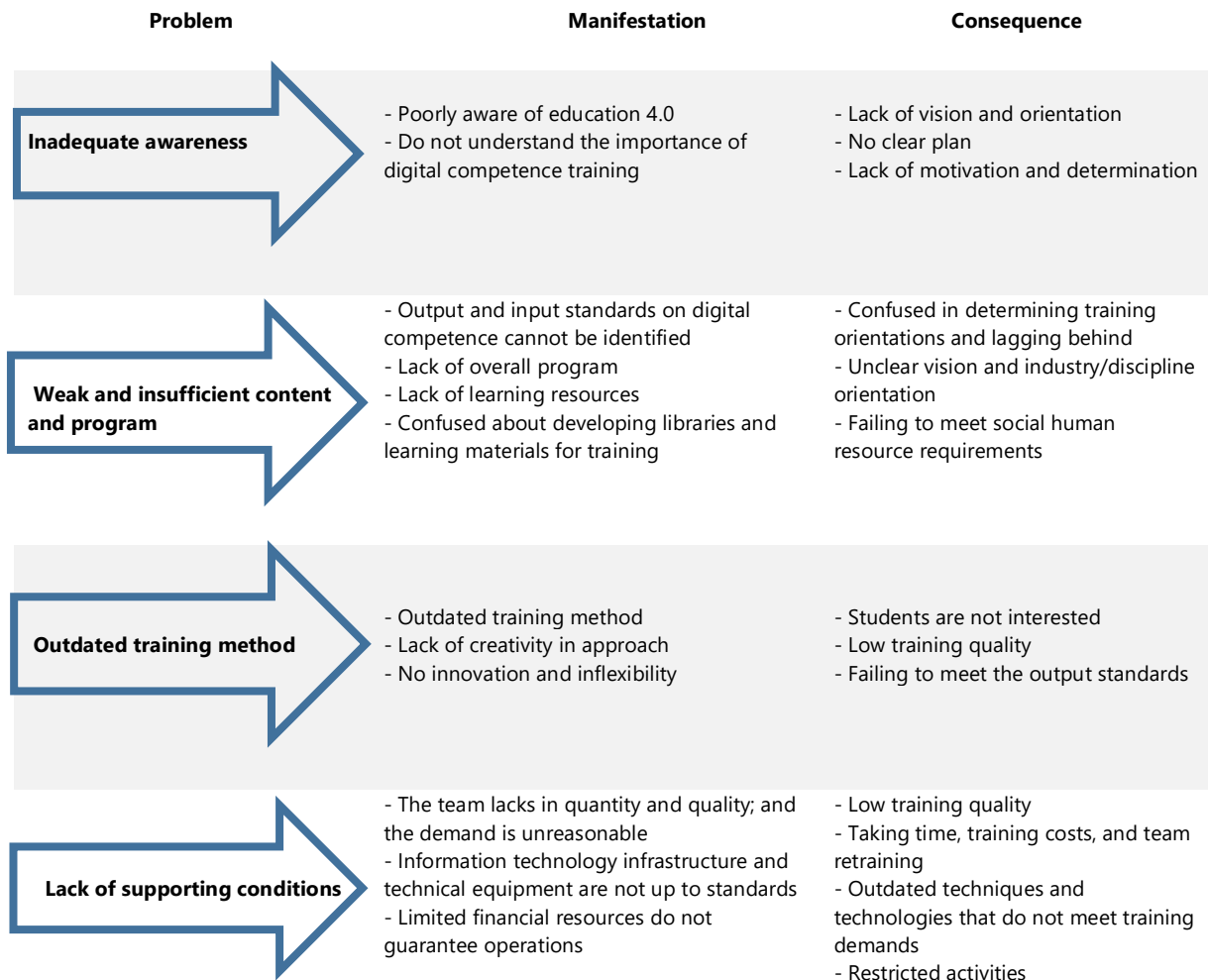
Most universities still lack training experts; a minority of lecturers do not keep up with the requirements of educational innovation; training methods are slow to innovate; and a few lecturers are irresponsible and uncommitted to the profession (Le, 2022). The areas related to digital competence are very diverse and complex, requiring trained lecturers and professionals with wide knowledge and good skills. However, it is quite difficult to find people with expertise in this field; meanwhile, the process of training and retraining human resources in general and experts in this field seems to have just started. Therefore, it will pose many difficulties and require time for planning, training, retraining, etc. to meet the acquisition and organization of new methods and forms of education as well as the inheritance of advanced achievements from the outside.

There is a lack of financial resources, facilities, and techniques to support training in the digital environment. Currently, the mobilization and allocation of financial resources for education leave much to be desired; loans in educational projects are still limited; libraries, laboratories, subject classrooms, and teaching facilities are not guaranteed (Le, 2022). Many universities will find it difficult to provide adequate resources for digital competence training. In addition to financial difficulties, major issues are a synchronous investment in technical infrastructure and data warehouses, and the guarantee of the system compatibility between

universities and society, and between lecturers and students. Therefore, it will be extremely difficult for socialization to get sufficient resources for implementation.

The main difficulties and shortcomings can be visually presented in Figure 2.

Figure 2. Manifestations and consequences from major difficulties in training

Problem	Manifestation	Consequence
Inadequate awareness	- Poorly aware of education 4.0 - Do not understand the importance of digital competence training	- Lack of vision and orientation - No clear plan - Lack of motivation and determination
Weak and insufficient content and program	- Output and input standards on digital competence cannot be identified - Lack of overall program - Lack of learning resources - Confused about developing libraries and learning materials for training	- Confused in determining training orientations and lagging behind - Unclear vision and industry/discipline orientation - Failing to meet social human resource requirements
Outdated training method	- Outdated training method - Lack of creativity in approach - No innovation and inflexibility	- Students are not interested - Low training quality - Failing to meet the output standards
Lack of supporting conditions	- The team lacks in quantity and quality; and the demand is unreasonable - Information technology infrastructure and technical equipment are not up to standards - Limited financial resources do not guarantee operations	- Low training quality - Taking time, training costs, and team retraining - Outdated techniques and technologies that do not meet training demands - Restricted activities

(Designed by the researcher)

4.3. Some solutions for digital competence training

From the requirements of the digital competence frameworks for citizens and for students and based on overcoming of difficulties and promotion of the advantages of the current university training practice, higher education institutions need to implement a number of solutions to form digital competence for students and aim to better meet the requirements of training human resources working in the digital environment for socio-economic development as follows.

4.3.1. Raising awareness for managers, lecturers, and students of the role and importance of digital competence training

There are certain steps to raise awareness of the role and importance of digital competence training:

−   Introduce digital technology trends and their impacts on business, education, and learning so that they understand and affirm the role and importance of digital competence training in today's society.

−   Introduce an overview of the necessary digital skills and competence for citizens to keep up with digital technology trends, including the use of digital software and tools, data and information management, digital production and marketing, creation of digital value, etc. to make managers and lecturers understand the requirements of digital competence output standards of students, and make students understand the knowledge, attitudes, and competencies they must have after learning, thereby creating good coordination and cooperation in training and retraining.

−   Strengthen career guidance, implement experiential activities, penetrate production and business practices; implement practical projects, create digital products, and develop skills in programming and application development; give specific examples of how to apply digital technology to improve operations and create value in different fields, including business, education, health, diplomacy, culture, and art to form attitudes, methods, and motivation in learning and scientific research for both managers, lecturers, and students.

−   Provide guidance on the use of digital tools for online interaction and learning, including online learning support platforms as well as synchronous and asynchronous tools. Provide and introduce online learning materials and resources on digital competence, and their applications in different fields.

4.3.2. Strengthening training and refresher for lecturers and technical experts

The following activities should be implemented to strengthen training and refresher for lecturers and technical experts:

−   Develop strategies, long-term planning, and annual plans for intensive training for lecturers on the technologies and skills needed in digital competence training, including online teaching methods, tools, and techniques.

−   Organize regular training in online learning, online teaching technology, and online teaching support tools.

−   Select and send experts in specialized fields to specialized training institutions at home and abroad for professional training in order to provide them with the knowledge and skills necessary to design and develop high-quality online courses.

−   Organize scientific seminars and exchange experiences between lecturers to update them on the latest knowledge and improve their teaching ability.

−   Promote research and development activities on digital competence training, so that lecturers and professionals can participate in the process of creating high-quality online educational products.

−   Build a favorable environment for self-study and creativity so that lecturers can share experiences and learn from each other, thereby creating a community of lecturers and colleagues specializing in digital competence training.

4.3.3. Developing curriculum content, building a system of digital documents and data, and improving training systems focused on digital competence

First of all, universities need to design training programs focused on digital competence, including the identification of training objectives and areas that need to improve digital competence for students; design training programs in accordance with the above objectives and areas, divided into specific courses and components; allocate teachers, equipment, and teaching support facilities to ensure the quality of teaching.

Renovate library activities, build a database for lectures, learning materials, and multiple-choice questions related to digital competence; update the teaching schedules and learning outcomes of students to evaluate the effectiveness of the training program and adjust as necessary.

Develop learning materials such as creating high-quality lecture content and learning materials and promoting students' critical thinking; and provide learning materials in various forms (videos, presentations, e-books, multiple-choice questions, etc.) to suit the needs and learning styles of students.

Constantly improve the training system focusing on digital competence, with emphasis on ensuring the synchronization between courses and the components of the training program; enhance the interaction between students and teachers through online support means and face-to-face classes; organize seminars, share experiences, and train teachers to improve the quality of teaching; facilitate students' access to the latest technologies and use of electronic applications in practice.

Strengthen research and development of new training programs related to digital competence, including online, in-person, or blended learning programs.

4.3.4. Improving information technology infrastructure and creating a good learning and training environment for students, helping them develop digital competence

− Invest in standardized laboratories, computer labs, and classrooms equipped with information technology and modern technical equipment for libraries, laboratories, workshops, etc. so that students can practice and hone the necessary skills in the field of digitalization.
− Build a strong enough Internet to help lecturers and students access online documents, information, and courses without interruption.
− Organize training courses and seminars on digital technology and new technical applications, helping managers, lecturers, and students to grasp, update and develop their digital competence.
− Create conditions for lecturers and students to work in groups, exchange experiences, and practice self-study together. Activities such as online discussion, sharing documents, and creating blogs are utility activities.

4.3.5. Strengthening the mobilization of financial resources in the direction of socialization to support investment and training activities in the digital environment

− Universities promote scientific research and technology transfer to attract domestic and foreign investors.
− Develop high-quality teaching programs to attract international students to study in Vietnam.

− Reform the financial management mechanism and attract funding to promote investment in education and scientific research. Universities adopt a financial autonomy mechanism to arrange and calculate reasonable and economical expenditures to improve the efficiency of using limited financial resources.

− Diversify financial resources by seeking funding from international organizations and industries. Strengthen the promotion and communication of the quality of education and scientific research of universities to attract the interest of investors and sponsors.

− Develop training programs in association with enterprises to develop products, services, and solutions suitable to the needs of the market; and make the most of joint venture and partnership capital to increase financial capacity.

− Support students in difficult circumstances to study, create an equal learning environment, and contribute to building the culture and brand of the university.

4.3.6. Converting universities into lifelong learning facilities

Training digital competence for citizens in the context of rapid change requires building a lifelong learning environment for all people, all levels of education, and all levels of training; in which universities are one of the important links. They need to quickly organize the transformation into lifelong learning facilities according to the orientations (UNESCO, 2022):

− Participate in developing and submitting to the Government for the promulgation of policies and legal corridors to create favorable conditions for lifelong learning.

− Develop a broad approach to lifelong learning that aligns with the three missions of teaching, research, and social engagement.

− Renovate financial support policy for the universities and for learners to expand lifelong learning opportunities.

− Diversify the curriculum and separate knowledge so that learners can study flexibly.

− The training format should be geared towards addressing the diverse learning needs of learners and include the formats of degree or non-degree conferral.

− Extensive implementation of flexible learning pathways, with acknowledgment, validation, and recognition of previous learning outcomes.

− Promote flexible teaching methods in person, online, or in a diverse way; and expand community participation through approaches suitable to local reality for everyone to participate smoothly.

5. Discussion

The major conclusions of the research are as follows:

- It is essential that Vietnamese university teachers' digital competence is timely increased. This can be achieved via regular pieces of training updating their knowledge and skills, as the technologies applied in education develop fats. They should be able to communicate efficiently via digital technologies and, desirably, to create the content themselves, to fit the needs/levels of their students.

- University curricula should change in order to enable students to develop relevant digital skills for continuing education as well as professional applications.

- The infrastructure should be improved: universities equipped with the sufficient number of computers, up-to-date software, and high-speed internet.

- Financial support is needed for better adjustment of education to industry requirements, as well as research on innovative teaching.

These findings are in line with Abouelenein's (2016) findings who held a study with 135 Saudi universities' academic staff. The results of his study revealed that staff needs training in the area of teaching (planning- preparation- execution- teaching strategies- technology- learning resources- evaluation of teaching performance indicators- learning outputs) are needed to enable the teachers to improve the preparedness of the graduates to their future careers. Not only conducting training is needed, but the quality of those trainings should reflect the newest standards. The results of Abouelenein (2016) confirm that "staff needs training on surveying the Internet, designing educational websites, file compressing, concurrent communication search engines, file upload and download in order to achieve high quality of their teaching and research work and community service" (p. 1190). Designing an educational environment rich in technology and its products was emphasized. Special training sessions on scientific research is needed especially its ethical aspects.

Petruziello et al. (2023) underline academic staff's level of technological skills for their students' employability. Their study with 127 Italian university students disclosed that the qualification of and the support from the teaching staff increases their employability opportunities as well as psychological well-being.

Our findings go hand in hand with Stachivá et al research on employee education to match the requirements of 4.0 industry challenges. Austria, Germany, and Switzerland were viewed as advanced innovator countries, while Slovakia and the Czech Republic as moderate innovators. The survey included a total of 1482 organizations, of which 489 respondents were from Slovakia, 419 respondents from the Czech Republic, and 574 respondents from Austria, Germany, and Switzerland. The role of university/industry partnership was underlined in order to achieve teachers' and students' relevant technological skills. "Partnerships and networking activities will help to develop a common approach to education, development, and sharing of approaches to developing specific skill requirements or employee knowledge" (p. 14).

6. Conclusions and Recommendations

Training human resources to work in the digital environment is an indispensable requirement in Industry 4.0. This poses opportunities and challenges to educational institutions in general and universities in particular. Universities must first have a clear strategic orientation to proactively train students to meet the requirements of the digital competence framework. The problem is urgent, so it is necessary to be proactive so as not to create heavy psychological pressure on managers, lecturers, and students in implementation. In order to ensure systematicity, synchronization, and mutual support in implementation, we recommend the following:

- The Ministry of Education and Training should coordinate with the Ministry of Labor, Invalids, and Social Affairs to submit to the Prime Minister for inclusion in the Education Development Strategy and the Vocational Education Development Strategy for the period 2021-2030 a comprehensive program on synchronous implementation of teaching, vocational guidance and vocational training on the development of digital competence for citizens, ensuring continuity from general

education and vocational education to higher education. Based on the overall orientation, it is necessary to determine the mechanism of assignment and decentralization of curriculum content, teaching methods, standards and norms on working regimes, and standards of supporting means and equipment.

- Educational institutions in the national education system should review and complete the output standards of educational and training programs, which determine the factors that must be formed in terms of digital competence suitable to each level of education and psychological characteristics in line with students' ages; thereby integrating them into teaching and educational content for implementation.

- Develop a plan and synchronously implement the content, training programs, and professional training on management and teaching in the field of digital competence training for educational administrators and teachers at all levels. Training and retraining programs must be synchronized with teacher training schools and regular training programs at all levels.

- The Ministry of Finance should review and finalize the norms and regimes for state budget allocation in the direction of taking into account the digital competence training content; and continue to should on prioritizing state budget policies for digital competence training activities. At the same time, it is essential to perfect the mechanism of socialization of investment resources, autonomy, and self-responsibility in financial revenue and expenditure; and expand the mechanism of cooperation, joint venture, science and technology transfer, etc. for educational and training institutions.

- All levels and branches should regularly inspect, supervise, periodically review and evaluate digital competence training activities, and support for prompt adjustment and improvement.

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