

DIGITAL TRANSFORMATION IN EDUCATION AT THAI NGUYEN UNIVERSITY OF TECHNOLOGY

Duong Thi Thao (MA)

Faculty of International Affairs, Thai Nguyen University of Technology,
Thai Nguyen, Viet Nam

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Abstract: Thai Nguyen University of Technology was established under the Decree No. 31/CP/1994 of the Government along with the establishment of Thai Nguyen University of Technology on the basis of the predecessor branch of Polytechnic University in Thai Nguyen Iron and Steel area. The current training scale of the University is about 8,000 students of all training levels with 21 undergraduate training programs and 07 master's degree programs. In the face of changes in domestic and international situations, the University has jointly adopted new countermeasures in which digital transformation is an important content and solution in development. This article generalizes the basic issues of digital transformation in education, the current situation of this issue at the Thai Nguyen University of Technology today with pointing out the achieved results and difficulties in the implementation. From there, the author proposes some solutions to promote the digital transformation movement in education at the University.

Keywords: Digital conversion; Education; Industrial Technical University; Reality; Solution.

I. INTRODUCTION

As we all know, the continuous development of science and technology proves that digital transformation is a new trend, especially in education. Digital transformation plays a very important role in improving the quality of training as well as contributing to the "digitization" of work processes, reducing workers towards leanness, improving work quality, and quality of the University's office. In particular, this is also the optimal method in teaching and learning in the context of epidemics such as the recent Covid-19 pandemic. However, digital transformation is a new concept in many professions, including education, it includes a mixture of many opportunities as well as challenges, especially for training institutions with special characteristics about learners like the Thai Nguyen University of Technology with about 80% of the learners being from the northern midland and mountainous provinces of Vietnam. Therefore, accurately identifying those advantages and disadvantages will make an important contribution to proposing solutions to promote and enhance digital transformation at the University today.

II. CONTENT

1. General overview of digital transformation in education

1.1. Some concepts

- *Digital transformation:* It is the process of using technology to change current working models and methods in order to create new values and improve work quality.

- *Digital transformation in education:* The process of using technology focusing on two main areas, namely digital transformation in management and digital transformation in teaching, in order to improve the quality of the University's operations.

Accordingly, digital transformation in management is the implementation of digitizing information, digitizing work processes and managing all data by interconnected systems between units/divisions in the University; between lecturers and learners; between the University and the student's family; between University and society, etc. in order to expand space, enhance interaction and exchange of information among stakeholders.

Digital transformation in teaching activities is the application of technology in teaching and learning activities such as: digitizing lectures; use new teaching methods supported by technology; use digital libraries and electronic libraries; open learning resources; virtual labs, etc. to enhance the adaptability of the training institution to the requirements of the actual situation and improve the quality of training.

1.2. Steps/stages in digital transformation of the education sector

Normally, digital transformation in education at training institutions generally takes place with the following stages:

- Spontaneous stage: At this stage, concepts and issues related to digital transformation have not been popularized and mentioned widely in universities. The teaching activities of the lecturers have been active in the use and application of technology products. However, that application is due to the needs of some lecturers themselves, not forming a movement or a unified activity in the whole system. Some forms of digital transformation in teaching are: online classes through the use of the internet; teaching with supporting tools such as computers, projectors, etc. Similarly for management activities is the use of technology in working and exchanging information.

At this stage, meaningful digital transformation activities in the university are mainly due to individual needs, not yet systematic. However, initially, the leadership of the University recognized the necessity of digital transformation as a necessary requirement for the development of the University and began to pay attention, support, encourage and replicate this model in the University.

- Basic digital transformation stage: The basic feature at this stage is that the University has taken the initiative in implementing digital transformation through specific teaching and management activities such as: develop a university year plan and assign detailed teaching by online method; assign quotas for specialized faculties/lecturers to develop online lectures/tests to create an online bank of lectures for teaching activities; conduct online teaching combined with face-to-face throughout the university year; organize periodic computer-based exams at least once a year for subjects taught online. At this stage, the University has a detailed plan for internal training by inviting experts to train to improve the quality and quantity of qualified teachers for online teaching.

This period has had the initiative of the management team in finding and devoting resources for digital transformation in the University. However, the resources for digital transformation at this stage often focus on existing products, strengthening infrastructure, and continuing to train and replicate the staff and lecturers who are doing the teaching activities with elements of digital transformation.

- Full digital conversion stage: The characteristic and basic requirement of this stage is that the university must issue a plan for the university year in which detailed assignment of the implementation of online learning for all modules included in the program is required; implementing teaching with the integration of online teaching and face-to-face teaching for many years; organize regular exams and tests on computers and through mobile devices; detailed plan on fostering to improve digital transformation capacity for lecturers and administrative staff.

At this stage, the capacity and comprehensive quality of the faculty and management staff of the University have been confirmed; adequacy of quality infrastructure. The University's digital transformation plan focuses on maintaining and improving the quality of current results while gradually modernizing infrastructure, faculty capacity and management qualifications in digital transformation.

- Smart university stage: This is a period marking the completion of the digital transformation process in the University, which is demonstrated by the fact that all lecturers are proficient in technology skills and have creative application capabilities; modern infrastructure and equipment used daily in work and teaching; 100% built-in electronic lectures;

data/teaching results and management activities of the University are scientifically electronic; the system is capable of integrating and connecting in many ways.

Based on the basic characteristics/requirements of each of the above digital transformation stages in education, universities can determine their level in this process to develop appropriate strategies in the implementation roadmap of the University digital transformation.

1.3. Opportunities and challenges for the education industry when implementing digital transformation

- Opportunities

In Vietnam, in the education development policy for the period 2025-2030 of the Ministry of Education and Training, it has been identified that it is necessary to accelerate the digital transformation process, implement digital transformation extensively and evenly in all universities across the country. Implementing digital transformation brings opportunities for the development of universities in Vietnam, such as:

+ Equal digital access opportunities: With the digital transformation, learners in geographical areas and all levels of education have the same opportunity to access learning materials and resources. This creates equal learning opportunities for all subjects.

With the application of technology in teaching, the organization of classes is not only done by face-to-face but also online classes, along with the digitization of lectures, learning resources will help learners save much costs than face-to-face learning. This is a favorable condition for many people with different living standards to have the opportunity to access education, especially at higher education levels.

+ Opportunity to participate in adjusting the student's study program: All learning methods or creating innovations in education are aimed at improving the quality of training, taking the learners as the center. Therefore, the digital transformation process not only allows teachers and staff in the University to participate in the adjustment and development of training programs, but also creates opportunities for learners and stakeholders to participate in this work through survey activities. The use of technology products related to connection systems and software helps learners and stakeholders such as: Businesses, employers, former learners and even foreign partners can easily contribute ideas to the University's training program from practical requirements. This shows that the benefits and opportunities brought by digital transformation for both training institutions and learners and stakeholders in adjusting and giving suggestions to develop training programs are very clear.

+ Training high quality team: It is clear that digital transformation in education places certain requirements on the qualifications and ability to apply technology in teaching and work management activities for lecturers and staff in the University. Therefore, the faculty and staff are also constantly learning and refining skills and knowledge to be able to apply technology in their work to be able to adapt to practical requirements.

Especially, for the teaching staff, not only are the requirements set on the ability to use technology in teaching but also the digital transformation process in education with the trend of Vietnamese education integrating with international education, opening many opportunities in exchange and cooperation in learning and research, from which lecturers have the opportunity to participate in many international study programs to contribute to improving their professional qualifications.

Digital transformation also creates an important foundation for the education of countries to integrate, learn from each other's experiences and models of progress because digital technology products help to bridge the gap between the education systems among countries.

- Challenges

Besides the opportunities, digital transformation in education also poses many challenges for educational institutions in general.

+ Technology infrastructure challenges: The digital transformation process imposes certain requirements on infrastructure to ensure the provision of necessary equipment for teaching and learning activities. One of the main activities of education digital transformation is online teaching, so it is imperative to have an online teaching service system. In addition, the requirements for compatibility between single software may also be a challenge for some universities because of their habit of operating independently so far.

+ Challenge of management thinking and ability to use technology

The digital transformation process poses new requirements, including changing management skills to adapt to the new situation, and this is not an easy problem for some managers because they have a lot of experience in the traditional management style. On the other hand, digital transformation requires leaders to have qualifications and ability to use technology in management. Therefore, this issue poses certain challenges for managers.

Along with that are also these challenges for the faculty and staff. Thinking "afraid to change" is also a factor that creates difficulties in the digital transformation process in universities and educational institutions. The ability to keep pace with new things and the ability to use technology in teaching and professional activities for a part of people who have worked for a long time, and the mindset that is afraid to change habits is also a challenge for digital transformation in the universities.

+ Create inequality between regions

Digital transformation can create inequalities across regions within the same country. In areas that are less economically developed due to the transition in education requires large funds to invest in building technology infrastructure. This will create difficulties for students in disadvantaged areas when there is a lack of devices to serve learning and access to open resources compared to students in economically developed urban areas.

In addition, students with special categories such as disabilities, belonging to disadvantaged groups in society may face difficulties in accessing and using technology devices when they do not have separate devices for this student group. Therefore, this will be the risk leading to the greatest inequality of opportunity among student groups when implementing digital transformation in education.

2. The Current Situation of Digital Transformation at the University Of Industrial Technology

2.1 Current status

- *Obtained results.*

Today, the University of Industrial Technology under Thai Nguyen University of Technology is a multidisciplinary training institution at undergraduate and graduate levels. The University of Industrial Technology - Thai Nguyen University of Technology is a high-quality human resource training institution; scientific research; consulting, applying and transferring technology to meet the requirements of sustainable development of the country and international integration. The university focuses on building a modern, cooperative and humane educational environment; create a friendly, useful and practical living and learning environment, in order to promote learners' passion for learning, research and creativity; training necessary skills to help learners become independent in perception, collaborate in activities to improve their adaptability and create new values for the collective, community and society; educating on codes of conduct, social and professional ethical standards in order to promote learners to regularly cultivate and practice ethics, culture of behavior, and to be aware of their responsibilities towards themselves, their families and the society. That is the foundation for future success.

Regarding organizational structure, the University has 23 units, including: 08 departments, 05 functional centers, 10 specialized units (09 faculties, 01 center), 01 science and technology organization is the High-Tech Research Institute of Industrial Engineering, 01 Open Training Institute.

In terms of human resources, up to now, the University has a total of 483 officials and employees, the average age is 39 years old, the number of doctors under 45 years old is 67/92; 22 young doctors were trained and trained abroad, the number of associate professors under 45 years old was 7/16 people; number of lecturers with IC3 certificates: 255/362 lecturers, international foreign language certificates: 289/362 lecturers.

With the goal of becoming an application-oriented national and regional standard university in the field of science, engineering and technology; is a prestigious center for research, application and technology transfer in the country and in the region; As a basis for providing high-quality human resources to serve the community, making an important contribution to the socio-economic development of the country, the University has had many policies to develop and is one of the Among them is the strong implementation of digital transformation in the University in special areas in teaching.

Basically, the University's digital transformation strategy achieved important results in the following aspects:

About the results of scientific research and technology transfer

The importance of scientific and technological activities has always been affirmed in the University's development strategies, plans and policies. Not only focusing on promoting research activities, the University gradually sets higher requirements for research results and especially encourages research that comes from the requirements of practice, researches transferring knowledge, models, management and governance tools to management agencies and the business community.

In the period of 2018-2022, the University has completed and accepted 188 topics, including 01 basic research topic of the NAFOSTED Foundation, 187 university-level projects; successfully registered 03 state-level projects with a total budget of nearly 1.0 billion VND, 10 ministerial-level projects with a total budget of over 3.0 billion VND; successfully registered 05 provincial projects with a total budget of nearly 2.3 billion VND, the total funding for projects ordered from enterprises reached 0.365 billion VND; The lecturers have published in domestic and international specialized scientific journals 1263 graded articles according to the regulations of the State Council for Professor titles, including 722 international articles (the number of articles science ISI/Scopus is 426 articles); organized 03 international seminars, conference proceedings published by Springer Publishing, listed in Scopus, Q4, with an acceptance rate of about 33%; co-organized domestic science and technology seminars (in collaboration with the Military Academy of Science and Technology), the articles published at the conference were published in the Military Science and Technology Research Journal, which is the prestigious science and technology journal of the military today.

The results in scientific research activities and technology transfer of lecturers make an important contribution to the teaching work in the use of research results in teaching.

About building a system of classrooms, practice rooms, experiments, working rooms with a system of modern equipment for training

The university has 28 practical laboratories under specialized faculties and 02 workshops under the Experimental Center with thousands of equipment and machinery to meet the learning and training requirements of students. Every year, through ordered projects, the university invests in upgrading and cloning experimental and practice equipment to better meet the increasing learning needs of students, especially for majors with many students.

The university has an advanced and modern IT technical infrastructure system, which meets the requirements of digital transformation of the university at the present time and in the future, including: a system of 11 data storage and processing servers, an internal network system connected to the whole university by optical cables with a length of nearly 8000 meters, including more than 70 devices connecting and sharing data in the network system., more than 1400 fixed network connections, 13 broadband internet lines with a total bandwidth of 1400 Mbps, the wifi system is installed and covers all working areas, lecture halls, campuses, dormitories, and library. In recent years, with the strong trend of digital transformation in education, the University has invested in 59 smart lecture halls integrating face-to-face and online teaching functions. This system is very suitable for international training, the distance system helps to increase interaction between lecturers and online students.

IT application is one of the important factors for effective training. The university applies IT in management, administration, teaching support, and scientific research by effectively deploying, using and exploiting a wide range of computer software, website systems and electronic portals. This is one of the important results in digital transformation at the University of Industrial Engineering in recent years.

Table: List of computer software, website, email

No.	Software name	Applied areas
1	Edusoft.Net Software	<i>Includes more than 40 modules/features:</i> Manage training activities; student management; HRM; tuition management; scientific management; managing CSVC and assets; dormitory management; association management; outpatient management; managing extracurricular activities; alumni management; test management, etc.
2	Internal Portal (http://porttal.tnut.edu.vn)	Course registration and course registration review; information on student's background, class schedule, exam schedule, study results, training results, tuition fees, graduation review results, inpatient and outpatient status; update student records; update health insurance; boarding registration; survey; online certificate registration; sending and receiving university messages and

No.	Software name	Applied areas
		announcements; send and receive feedback; provide internal information, regulations, regulations, guidelines, forms for learners.
3	Website system (http://tnut.edu.vn)	<i>Including the main website and 28 of the units and mass organizations:</i> - Provide online information of the University to staff, lecturers, students, students and researchers of the University in order to serve management, administration, teaching, learning and scientific research activities. - Promote and inform about the University's activities and achievements to relevant individuals and units on the Internet environment. - Provide complete, accurate and timely information on the Party's guidelines and policies, State laws, management and administration documents of the University, Thai Nguyen University of Technology, the Ministry of Education and Training related to the performance of the duties of the University.
4	ILIB library management software	Manage documents, manage readers, manage borrowing and returning documents
5	Digital document management software that integrates training programs (http://ebook.edu.vn)	Manage all digital documents of the University according to the curriculum; provide materials via the intranet and the Internet for learners quickly, conveniently, closely with the modules in the e-learning program; for statistics and reporting.
6	Elearning system	The university's elearning system provides detailed course outlines along with digital lectures and other materials to help learners actively participate in distance learning and research.
7	VnptiOffice document management software	Manage and process internal documents of the university
8	Manage multiple choice test - TestOnline	Organize online test for some subjects in the university
9	Software for English exam A2, B1	Organize foreign language exams for students
10	MISA	Manage financial activities
11	Email system	Internal email management and exchange system; Each student and lecturer is provided with an account with the extension @tnut.edu.vn
12	MS TEAM. online learning system	Online teaching and learning support system; each student and lecturer is provided with an account with the extension @tnut.edu.vn

In the period from 2018 to now, the University has invested about 10 billion VND for maintenance and repair of infrastructure and upgrading of IT equipment. Of which, about 20% of new computers and information technology equipment were purchased. In addition, the university uses regular funds to maintain and repair computers, intranet systems, and internet connections throughout the university.

The university's learning resources are concentrated in the university's library. The university's library consists of 02 buildings, with a total library construction area of 4,550 m², scientifically arranged with all functional rooms, namely 6 reading rooms with 400 seats, 03 borrowing rooms, and computer lab. The university has a rich source of learning materials, with full textbooks and reference books for all modules, meeting the training and scientific research requirements of learners as well as lecturers. The university library has 6,361 titles which are textbooks and reference books, with a total of 94,854 books, more than 1,300 theses and theses, nearly 2,000 digital documents, with more than 500,000 pages. In addition, the library also connects and shares databases with the library of Thai Nguyen University of Technology, libraries of universities in the country. The university has 70 classrooms fully equipped with projectors, lights, electric fans and internet, air conditioners. These are also important conditions to ensure teaching and learning in the context of digital transformation with increasing requirements and demands from lecturers and students in terms of learning materials for training.

About innovating the working process towards specialization to increase efficiency

In addition to enhancing the application of information technology in communication and work processing, the University has built a system of processes according to the ISO 9001: 2015 quality standard to systematize work and perform work in the direction of specialization, reducing focal points, increasing the use of technology in work, increasing work efficiency through the application of information technology. Accordingly, the University has issued and put into operation 58 core ISO processes. This is one of the important results in digital transformation expressed through the specialization of administrative workflows.

- *Some limitations and difficulties*

Digital transformation at the University of Industrial Technology has been carried out relatively quickly in order to keep up with the trend of modern education and has achieved many results, but there are still many difficulties and challenges.

Firstly, infrastructure and IT systems, although equipped and invested, are still at a limited level, not really worthy of a scientific and technical training institution, especially in the context of the industrial age 4.0 at present. The strong development of science and technology with many achievements has put requirements for the adaptation and updating of lecturers' lectures and practical and experimental equipment to keep up with reality and the requirements of historians in the community. This poses limitations in digital transformation practice and also challenges in the next steps.

Secondly, the mindset of digital transformation is not uniform among lecturers. In general, most lecturers have innovative thinking, update the situation and apply technology products for teaching. However, at different levels of awareness, the use of technology in teaching by teachers is different. Most young lecturers quickly adapt and use technology proficiently in teaching while older teachers have limited use of technology and a fear of change, leading to digital transformation in teaching disproportionately within the University.

Thirdly, a part of students has difficulty in catching up with digital transformation because they do not have adequate conditions for technology. Most of the students of the University of Industrial Technology come from the northern mountainous provinces of Vietnam, some students have difficult living circumstances, are in policy areas, and are particularly difficult areas. Therefore, equipping technology products for learning is not guaranteed. During the period from 2020 to 2022, the University is heavily affected by the Covid 19 pandemic, in order to adapt to the epidemic situation, the type of distance learning, online training is applied at the University. This is a time when digital transformation and application of technology in teaching are quite popular at the University. However, as stated, many students do not have enough academic conditions such as: internet, technology equipment, etc. so learning may be interrupted or not guaranteed in quality.

3. Solutions to improve the quality of digital transformation at the University of Industrial Technology

On the basis of the results achieved as well as the limitations and difficulties in the process of digital transformation at the Thai Nguyen University of Technology, the University needs to come up with solutions and strategies that are long-term and specific to this problem. Some basic solutions are suggested as follows:

Firstly, raising awareness about the importance of digital transformation in education: It is necessary to raise awareness and popularize ideas for each lecturer and university administrator to understand the importance and meaning of digital transformation and jointly build a digital culture in the University. Along with that, the University is interested in fostering and improving skills and professionalism in the application of technology for all lecturers and university administrators to achieve the goal of successfully implementing the digital transformation in education. Training and fostering management staff in information technology and information security skills and knowledge necessary to operate in the digital environment and meet the requirements of digital transformation.

Secondly, complete the database in the University: One of the important conditions for digital transformation is to build a shared database system to be able to communicate, smoothly and share data in a synchronous and systematic manner among the units in the University; between institutions and individual lecturers and students. At the same time, promoting the development of digital learning materials (for teaching - learning, testing, evaluation, reference, scientific research); forming a digital repository of open learning materials and open learning materials for the whole industry, linking with the world, meeting the needs of self-study and lifelong learning; continue to innovate teaching and learning methods based on the application of digital technology, encourage and support the application of new education and training models based on digital platforms. Deploying an educational social network with unified control and orientation, creating a digital environment for connection and sharing among educational authorities, universities, families, teachers, lecturers, students, develop open online courses; deploying a shared online learning system for the whole industry to serve the training of lecturers, and to support teaching for students in disadvantaged areas.

Thirdly, build network infrastructure and technology equipment: Network infrastructure and technological equipment must be renewed, especially in areas with poor connectivity to help narrow the regional gap. Enhance the combination of technologies such as Big data, AI, Blockchain with specialized digital databases to build information collection systems that make forecasts, predictions and create suitable applications and services to each learner.

Fourthly, complete the legal document system and application of management software: perfecting the policy and legal system plays an important role in educational management as well as ensuring the interests of learners. Accordingly, it is necessary to agree on the provisions on: data mining and sharing; form in teaching; effective management of the online course; university opening conditions. Digital transformation in education implemented by the application of management software is the solution applied by many institutions today. The software integrated with outstanding features will bring an effective university management solution, helping universities to enhance their professional skills and manage student records and teaching records quickly with only simple mouse click. At the same time, the development of online courses contributes to the training of teachers to support teaching in difficult places.

III. CONCLUSION

Properly understand digital transformation, properly assess the current situation, correctly identify and forecast the challenges of the problem to build a reasonable digital transformation implementation roadmap to quickly improve the quality and efficiency of training, which is important for universities in the current period. Digital transformation in higher education institutions should be seen as a long-term strategic solution, associated with strong and radical reforms in teaching, learning and training management, not a situational measures to deal with Covid-19. In digital transformation, the most important thing is not technology, nor the investment of funds, but the highest political determination of the head of the educational institution and the willingness to change of lecturers in universities. The initial results of digital transformation at the University of Industrial Technology show that it both meets the requirements of Vietnam's educational transformation and is an appropriate solution for education during the pandemic, especially experiencing the severe effects of the recent Covid-19 pandemic. With those meanings, the University has been making important strategies to implement the Project of Building an e-university - the foundation is digital transformation in all activities of the University and the core is teaching activities.

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