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Research Article

Exploratory Study on Factors Influencing Digital Transformation in Higher Education in Vietnam

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Abstract

Digitization, digitalization, and digital transformation are the levels and stages of digital technology application development. Digital transformation involves using digital data and technology to fundamentally and comprehensively change all aspects of socio-economic life, reshaping the way work is done and relationships are formed in society. Digital transformation in Vietnam is taking place in many fields such as commerce, tourism, business, finance, and education. Vietnam's Ministry of Education and Training has policies, regulations, and programs to promote digital transformation in the industry, from nurse-school education, primary education, secondary education, high school education, vocational education, and higher education. This paper employs quantitative research methods to construct a model investigating the factors influencing digital transformation in the education sector in Vietnam through surveys of educational managers, lecturers, and learners. From data collected with 193 valid responses, using SPSS.22 to process data analyze data, and formulate regression equations the study identified five factors influencing digital transformation in the higher education sector in Vietnam, including Infrastructure resources, Information technology, and the Internet, Government policies, Human Resources, and Readiness for Digital Transformation. The study proposes a few recommendations to relevant parties such as the government, universities, and learners in building and operating digital transformation in teaching and learning at universities.

Keywords

Higher Education Digital Transformation, Influencing Factors, Vietnam

1. Introduction

In the context of the strong development of the Fourth Industrial Revolution as it stands today, digital transformation has become an inevitable trend across all sectors and types of enterprises. It presents both opportunities for development and challenges, with the risk of falling behind if not given due attention. Digitalization in education covers the entire education system, from primary school to university, and includes the entire education system [13]. However, there is still a scarcity of studies on digital transformation in the field of education, particularly in higher education in Vietnam. The Vietnamese Government has issued a digital transformation plan for the education sector in 2022 [14]. Like India and many other countries, Vietnam also has difficulties in digitally transforming higher education [4, 17]. Therefore, the authors chose to study the factors influencing digital transformation in the higher education sector in Vietnam to dis-

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cover and assess the extent of influence of these factors on digital transformation in the current Vietnamese educational landscape. This serves as a basis for proposing solutions to promote digital transformation in the education sector in Vietnam in the near future.

2. Literature Review, Theoretical Basis, and Research Methodology

2.1. Literature Review

Worldwide studies on digital transformation in the field of education include several notable works. For instance, Irina Yakovenko et al explored the application of blockchain technology in education, demonstrating its significant role in the digital transformation process [8]. The education system is increasingly undergoing changes based on advanced technologies, and the advantages of blockchain technology lie in data storage and control, allowing easy access to documents everywhere and the potential of blockchain in education regarding databases and the development of the education system through online learning. The research also highlights some benefits of using blockchain in educational organizations such as unified databases, accelerated document processing, and promoting digital transactions, all of which enhance digital transformation in education. Abdulrahim Fatma Mabrouk (2020) and Bence Bogdandy et al (2020) study on digital transformation in education amidst the COVID-19 pandemic revealed that students greatly favor digital education, with half of them willing to continue using it in the future [2, 3]. Nguyễn Tuấn Anh (2021) [1] and Mahlow, C., & Hediger, A. (2019). [9] research indicated that "the availability of strong digital infrastructure and learning systems have contributed to the remarkable success of digital learning during this challenging period of COVID-19," which are prerequisites for digital transformation in education. Additionally, providing digital learning training for both teachers and students also impacts the success of digital transformation in education. Therefore, the application of digital learning in the context of COVID-19 presents a better learning opportunity. Meanwhile, Norton, A., Shroff, S., & Edwards, N. (2020) study emphasized the challenges and influencing factors in accepting and using e-learning as a teaching tool in higher education [11]. Thus, it will help develop a strategic plan for the successful implementation of e-learning and view technology as a positive step towards development and change.

In Vietnam, research on digital transformation in the field of education includes studies such as Ngô Thị Thu Dung (2021) which provided an overview of knowledge regarding digital transformation in education [5]. The research elucidated the essential factors for successful digital transformation in education, emphasizing the importance of a solid infrastructure combined with modern digital software technologies. These factors are crucial for achieving successful digital transformation. Additionally, the study identified some limitations in Vietnam's digital transformation in education. Through the research, the authors demonstrated the importance of digital transformation and provided a comprehensive understanding of the factors influencing digital transformation in education [3]. FPT Digital (2021) and Ngô Thị Thu Dung's study (2021) highlighted the significance of digital transformation in university teaching and education in general [6, 5]. The study revealed the necessary factors and conditions for digital transformation in teaching, ranging from network infrastructure, digital environments, specialized resources, and modern equipment, to educational strategies. All these factors are equally important in the process of digital transformation in teaching. The author emphasized that for successful digital transformation in education, thorough and synchronized preparation in all processes is essential. Another study by Phùng Thế Vinh (2021) analyzed the digital transformation landscape worldwide, particularly in universities such as those in the United Kingdom, noting that "new technologies and digital processes will change the approach to education." [16]. New technologies like cloud computing, artificial intelligence, etc., have altered the education sector. Digital transformation will enable universities to provide better learning environments and offer improved distance learning solutions based on modern technologies. The study also analyzed the current situation in Vietnam, pointing out a significant advantage in digital transformation, which is the widespread use of mobile phones and the internet. This initial favorable condition will aid the digital transformation process in education; universities are proactively adopting new educational technologies to implement new learning methods. However, the study also identified some challenges in the digital transformation process, including weak technology infrastructure, lack of experience and skills in educational institutions and in online learning environments respectively, cybersecurity risks, ineffective data collection and sharing, and the absence of legal frameworks. Consequently, the research also proposed specific solutions for the successful digital transformation in education.

2.2. Theoretical Basis of Digital Transformation

Currently, there are various perspectives on digital transformation, and there is no unified understanding. According to Svetlana Zizikova et al. (2023), "digital transformation is understood as the use of new digital technologies, such as social media, mobile devices, analytics, or embedded devices, to enable significant business improvements such as enhancing customer experience, streamlining operations, or creating new business models." [14]. "It is a change in work organization, driven by emerging new digital technologies and innovative business models. It is more about implementing a technological solution; it is the integration of digital technologies, human factors, and organizations" [11]. "It is the

overall and comprehensive process of individuals, and organizations in terms of lifestyle, work methods, and production methods based on digital technologies" [15].

Digital transformation in the field of education focuses on two main aspects: digital transformation in educational management and digital transformation in teaching, learning, testing, assessment, and scientific research [10, 12]; demonstrating changes in teaching methods, using information technology, and modern devices in teaching and learning. The use of information technology and modern devices creates conditions to meet the needs of students and teachers, thereby helping learners and teachers maximize their cognitive abilities, creativity, and initiative in teaching and learning [1, 10, 16].

2.3. Research Methodology

The research method predominantly used in this study is the quantitative research method, combined with statistical analysis and qualitative research. To conduct model validation, the research team designed a questionnaire comprising content related to factors influencing the digital transformation process in Vietnamese education, evaluated on a Likert scale of 1-5 (1 - strongly disagree, 5 - strongly agree), along with the personal information of the respondents. The questions were designed to be easily understandable to ensure the research objectives. The sample size was chosen using the sampling method of Hair et al [7]. Accordingly, the research team surveyed with a sample size of 193 to ensure an adequate scale for analysis.

2.4. Research Model

Inheriting from published studies on digital transformation and combining with the reality in Vietnam, the authors propose a research model of factors influencing digital transformation in the higher education sector in Vietnam as follows:

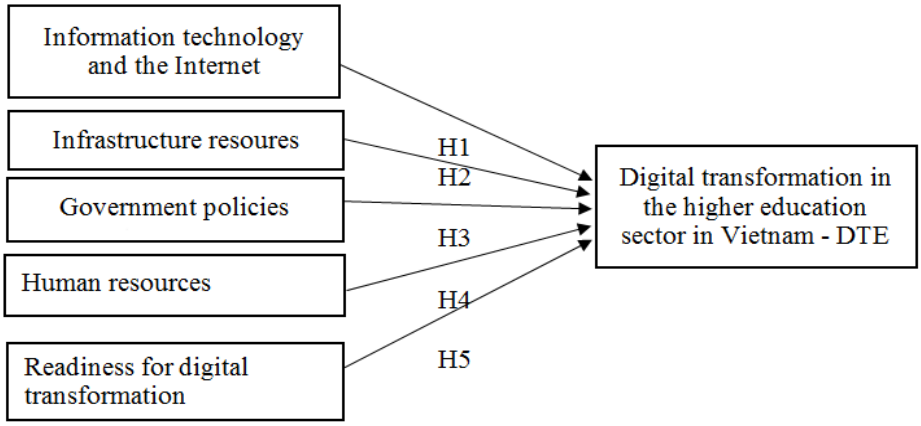

Figure 1. *Research Model "Factors Influencing Digital Transformation in the Higher Education Sector in Vietnam" Source: The Authors.*

3. Research result and Discussion

3.1. Description of the Study Sample

The survey results of the 193 research samples are described in Table 1 below:

Table 1. *Description of the Study Sample.*

Study Sample		Frequency	Percentage ratio
Gender	Male	89	46,1
	Female	104	53,9
Type of enterprise	18 - 22	94	48,7
	23 - 35	31	16
	36 - 45	39	20,3

Study Sample		Frequency	Percentage ratio
Occupation	Over 45	29	15
	Student	91	47,1
	Student's Parent	23	12
	Lecturer	52	26,9
	Managerial personnel	27	14

Source: Results of data processed using SPSS

3.2. Testing the Consistency and Convergence Validity of the Research Scale

The results of the exploratory factor analysis (EFA) and Cronbach's Alpha reliability coefficient show the following:

Firstly, the calculated Cronbach's Alpha coefficient for the 6 components of digital transformation in the higher education sector in Vietnam shows that all 5 independent variables and 1 dependent variable have Cronbach's Alpha coefficients > 0.6 and are higher than the Cronbach's Alpha coefficients of the observed variables in each component (Table 2). The observed variables in each component all have Cronbach's Alpha coefficients > 0.6 and total item correlation > 0.3. Therefore, it can be concluded that the scale consisting of 25 variables ensures reliability, meets testing standards, no variable is excluded from the model, ensuring consistency and all are included in the exploratory factor analysis (EFA).

Secondly, the exploratory factor analysis of the independent variables using the principal component extraction method with Varimax rotation for 20 observed variables of the 5 components yields a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy = 0.919 > 0.5 (Table 4), indicating that the factor analysis is appropriate, and Sig. (Bartlett's Test of Sphericity) = 0.000 < 0.05, indicating that the observed variables are correlated with each other in the population.

Thirdly, all 5 independent components have Eigenvalues > 1 (the smallest Eigenvalue is 1.721), indicating that all 5 components meet the analysis requirements. The smallest Eigenvalue = 1.721 at the 5th factor, so the 5 factors extracted from EFA are significant in summarizing the information of the observed variables. The total variance explained is 65.349% > 50%, indicating that 65.349% of the data variance is explained by the 5 components. Factor loading coefficients above 0.657 (>0.5) (Table 3) demonstrate the appropriateness of EFA and the statistically significant relationship between the observed variables and the dependent variable, Digital Transformation.

Table 2. *Summary of EFA Analysis Results for Variables.*

Symbol	Variable Name	Eigenvalue	Variance Explained	Cronbach's Alpha	VIF	Normalized KMO (HSHQ? - ND)
Independent variables						
CN	Information technology and the Internet	9,366	35,021	0,809	1,567	0,254
CSVC	Infrastructure resources	2,781	10,077	0,848	1,493	0,198
CP	Government policies	1,939	7,534	0,867	1,564	0,174
NL	Human Resources	1,856	6,878	0,840	1,592	0.236
SS	Readiness for Digital Transformation	1,721	5,839	0,911	1,429	0.186
Dependent variables (DTE)						
DTE	Digital transformation in the higher education sector in Vietnam	3,656	65,349	0,878		

Source: Results of data processed using SPSS 20.0

Table 3. *Results of EFA Analysis of Observations of Independent Variables.*

No.	Observed Variables	Factor loading coefficients of the components				
		1	2	3	4	5
1	CP3	.789				
2	CP2	.758				
3	CP1	.725				
4	CN1		.694			
5	CN3		.675			
6	CN2		.658			
7	CN5		.793			
8	CN4		.751			
9	SS2			.732		
10	SS3			.716		
11	SS1			.685		
12	SS4			.657		
13	CSVC2				.804	
14	CSVC1				.795	
15	CSVC3				.738	
16	CSVC4				.729	
17	NL2					.691
18	NL3					.769
19	NL1					.753
20	NL4					.761
Eigenvalue		9.366	2.781	1.939	1.856	1,721
Variance explained		35,021	10,077	7,534	6.878	5,839
Total variance explained		65.349%				

Source: Results of data processing using SPSS 20.0

Table 4. *Result of KMO Test for independent variables.*

KMO coefficient of studied samples		0.919
Bartlett test	χ^2	4513.919
	df	230
	Sig.	0.000

Source: Results of data processed using SPSS 20.0

Fourthly, the results of running EFA with 5 components of the dependent variable, Digital Transformation (DTE), show an Eigenvalue = 3.756 > 1, ensuring analysis requirements are met. The total variance explained is 68.776%, meaning these observed variables explain 68.776% of the total variation in the assessment of "Digital Transformation in the Higher Education Sector in Vietnam." Factor loading coefficients above 0.773 (>0.5) and Bartlett's test <0.05, with a KMO coefficient of 0.878, demonstrate that EFA is appropriate and the observed variables have a statistically significant relationship with the dependent variable, Digital Transformation (DTE) (Table 5).

Table 5. Results of EFA Analysis of the scale of the dependant variable Digital Transformation (CDS).

Observed variable	DTE1	DTE5	DTE3	DTE2	DTE4
Factor loading coefficient	0.858	0.818	0.823	0.789	0.773
Eigenvalue	3.756				
Total variance explained	68.776%				
KMO coefficient	0.878				
Sig (Bartlett's test)	0.000				

Source: Results from data processed using SPSS 20.0

Based on all the values obtained from the EFA analysis of the 5 components of Digital Transformation (DTE) as shown above, it can be concluded that: Digital Transformation (DTE) has achieved convergence, and the observed variables in this study adequately represent the research concepts that need to be measured.

3.3. Model Testing and Research Hypotheses

Based on the results of the EFA analysis of the extracted factors of the research concept, which were then included in the confirmatory factor analysis (CFA), the Beta weight results (Table 6) of the observed variables are all greater than 0.05, with a significance level of $p < 0.001$. It can be concluded that all observed variables are significant in the model. The independent variables all have a direct impact on the dependent variable, Digital Transformation (CĐS). Therefore, the research model is appropriate for the collected data, and the hypotheses of the research model are all accepted [7].

Table 6. Results of the regression coefficients of the dependent variable.

Variables	Unstandardized regression coefficients		Standardized regression coefficients	F value	Sig. T	Collinearity	
	Beta	Multicollinearity (ĐLC - đa lũy cực đại? - ND)	Beta			Variance	VIF
C	.105	.145		.720	.472		
f_CN	.236	.031	0,198	7.693	.000	.640	1.426
f_CSVC	.100	.031	0,254	3.203	.001	.728	1.634
f_SS	.234	.030	0,174	7.821	.000	.700	1.454
f_NL	.076	.032	0.236	2.373	.018	.628	1.632
f_CP	.101	.033	0.186	3.057	.002	.622	1.675
$R^2 = 0.696$, F = 95.865; Sig.(F) = 0.000, p<0.001							

Source: Results of data processing using SPSS 20.0

3.4. Testing the Linear Correlation Between Independent and Dependent Variables

Through the Pearson correlation matrix test (Table 7), it is shown that all observed significance levels Sig. = 0.000 < 0.05, and the absolute correlation coefficients between variables range from 0.474 to 0.636. This means that all independent variables are linearly correlated with the dependent variable, and this correlation ranges from moderate to strong.

Table 7. Results of Pearson correlation analysis of the research model.

		f_CĐS	f_CN	f_SS	f_NL	f_CSVC	f_CP
f_CĐS	Pearson correlation	1	.636**	.474**	.583**	.537**	.559**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
f_CN	Pearson correlation	.636**	1	.389**	.336**	.491**	.453**

		f_CĐS	f_CN	f_SS	f_NL	f_CSVC	f_CP
f_SS	Sig. (2-tailed)	.000		.000	.000	.000	.000
	Pearson correlation	.474**	.389**	1	.237**	.430**	.297**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
f_NL	Pearson correlation	.583**	.336**	.237**	1	.322**	.520**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
f_CSVC	Pearson correlation	.537**	.491**	.430**	.322**	1	.383**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
f_CP	Pearson correlation	.559**	.453**	.297**	.520**	.383**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	**. Significance level p < 0.01						

Source: Results of data processing using SPSS 20.0

3.5. Testing the Level of Influence of Each Independent Variable on the Dependent Variable

Through the multiple regression analysis (Table 8), the results are as follows:

Table 8. *ANOVA*[a].

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61.325	6	10.221	115.390	.000[b]
	Residual	30.825	348	.089		
	Total	92.150	354			

a. Dependent Variable: f_VCF

b. Predictors: (Constant), f_CN, f_CSVC, f_CP, f_NL, f_SS

Source: Results of data processing using SPSS 20.0

Firstly, assessing the significance of the regression model through the F test (or ANOVA test) yields F = 115.390, with a significance level of 0.000 < 0.05. This implies that the R^2 of the overall model is different from 0. Therefore, the linear regression model is significant, indicating that it can be extended and applied to the population.

Secondly, the validation of multicollinearity in the multiple regression model shows that all VIF values of independent variables ranging from 1.426 to 1.675 are less than 10, indicating that no multicollinearity phenomenon occurs in this model.

Thirdly, examining the influence of independent variables on the dependent variable with the adjusted R^2 value of 0.660 indicates a relatively high degree of model fit. The independent variables included in the regression account for 66.0% of the variation in the dependent variable, or in other words, 66% of the variance in the dependent variable is explained by the five independent variables.

Fourthly, testing the relationship and impact between independent and dependent variables in the research model (Table 6) through the forecast results of the multiple regression model reveals that the model has a statistically significant level of p < 0.001, with an F value of 95.865 and a significance level of F = 0.000. This indicates that the constructed regression model rejects the null hypothesis of nonlinear relationship and is suitable for evaluating factors affecting digital transformation in the higher education sector in Vietnam within the market context and conditions. The standardized regression coefficients of the 5 independent variables are as follows: 0.254 (CSVC), 0.236 (NL), 0.198 (CN), 0.186 (CP), and 0.174 (SS), with a significance level of p < 0.001, indicating that all 05 independent variables are significant and good predictors for the dependent variable. Thus, the standardized regression model takes the form:

$$DTE = 0.254*CSVC + 0.236*NL + 198*CN + 0.186*CP + 0.174*SS + e \quad (1)$$

4. Conclusion and Recommendation

From model (1), it can be observed that the 5 component factors are ranked in the following order of importance: firstly, infrastructure factor; secondly, human resources factor; thirdly, IT and internet factor; fourthly, level of readiness for digital transformation; and fifthly, government factor. This level of impact provides an important guideline for governing agencies, policymakers, and educational administrators to prioritize focusing on the most crucial factors to achieve high outcomes in digital transformation in the higher education sector in Vietnam in the near future.

Thus, the findings of the research model "Factors Influencing Digital Transformation in the Higher Education Sector in Vietnam" ensure convergence and differentiation requirements, exhibit a linear relationship between independent variables and the dependent variable, and demonstrate no multicollinearity among the independent variables. These findings are aligned with the current development context and conditions of higher education in Vietnam.

The research results indicate that the CP (Government) factor has a positive impact on digital transformation in the higher education sector in Vietnam. Therefore, including this factor in the model is both appropriate and significant. This finding represents a difference from previous research models concerning factors influencing digital transformation in the education sector, particularly in higher education.

Based on the standardized regression correlation model, to accelerate the digital transformation process in the higher education sector in Vietnam, it is necessary to prioritize the following solutions:

Firstly, enhancing the provision of modern infrastructure for higher education institutions. For the digital transformation process in education to occur quickly and successfully, modern infrastructure and equipment are crucial prerequisites. Higher education institutions in Vietnam are currently developing unevenly, with many still lacking adequate infrastructure. This is a weakness in Vietnam's education system. In the coming period, to further promote the digital transformation process in higher education, institutions need to focus on enhancing both physical infrastructure and teaching equipment, including improving learning spaces and instructional technology infrastructure. Regarding learning spaces and classrooms: there is a need to invest in constructing schools and classrooms that meet standards in remote and disadvantaged areas, providing conditions for students to access education, especially concerning digital transformation in education. The government should pay attention to localities to develop policies regarding the construction of learning spaces. Regarding instructional technology infrastructure: there is a need to invest in purchasing digital technology equipment to support teaching and learning, allowing learners to access digital transformation, and helping create equal learning opportunities among different regions. Completing telecommunications and information technology infrastructure to meet the demand for digital transformation, such as ensuring wifi network coverage in all classrooms, improving the quality of the Internet to serve the learning process.

Secondly, invest in enhancing the quality of human resources for digital transformation. Human resources are the driving force for digital transformation in education, so it is necessary to promote awareness and determination to implement the digital transformation process. Additionally, this should include campaigns targeted at specific locality, schools, and institutions. There is a need to organize training and development programs to equip teachers, lecturers, and students with knowledge and skills in technology to promote the digital transformation process. In the era of Industry 4.0, actively engaging with new knowledge and skills, especially for students, is relatively easy and fast due to the advancements in technology. Therefore, accessing new learning methods is not overly difficult. The role of educators is evolving from simply imparting knowledge to becoming guides and companions. Hence, teachers and lecturers need to enhance their skills and adopt new teaching methods, integrating them with the use of new technologies. Schools should create opportunities and encourage active innovation among students, lecturers, and teachers to drive the digital transformation process forward.

Thirdly, enhance the adoption of new IT applications and modern software in teaching activities. Boosting the application of modern technologies such as AI, IoT, Blockchain, etc., in learning and management activities of educational institutions is crucial. Utilizing technology during the pandemic period has made activities more easily connectable and adaptable to any time and space. Additionally, there is a need to establish a comprehensive database across the education sector to facilitate rapid information collection. Continuously updating advanced software applications that are suitable for different user groups and learning devices is essential. Implementing simple and effective online learning software enables learners to access knowledge efficiently even without physically attending school.

Fourthly: The government needs to establish supportive policy mechanisms and create the best conditions for higher education institutions to implement digital transformation. The government serves as the captain steering the ship of educational digital transformation. Therefore, it is crucial for the government to encourage, facilitate, and closely monitor all digital transformation initiatives in this critically important sector. First and foremost, government agencies need to review and adjust regulations that are not conducive to digital transformation, such as regulations concerning land area for building schools, the number of teachers/students, etc. The government should consider increasing the budget and providing support to individuals and organizations facing difficulties in accessing digital transformation in education to ensure that "no one is left behind." The government should

also consider establishing mechanisms to support pioneering schools, especially non-public educational institutions, towards financial autonomy. With autonomous mechanisms, these schools can adapt quickly, and their success will serve as a model to drive nationwide digital transformation in education. It is recommended that researches are carried out so as to allow some pioneering schools in digital transformation to experiment with new breakthrough training models, integrating digital transformation into education such as blended learning, combining online and offline learning, reducing time while ensuring educational content and meeting learning outcomes. The Ministry of Education and Training provides support regarding financial mechanisms and general guidelines for the digital transformation process, such as digitizing learning materials, developing digital libraries, curating useful resources, and limiting the appearance of websites providing misinformation.

Fifthly: Enhance the level of readiness for digital transformation among participating entities. For successful digital transformation, high readiness is required from all participating entities. On the part of the Government: It's a necessity to lead by example in digital transformation by aggressively investing in technology infrastructure; learn from and leverage the technological and financial assistance experiences of advanced countries worldwide; invest in training and encouraging the workforce to acquire skills and knowledge in IT and the Internet. On the part of educational institutions: Continue to promote an education model centered around the learner, invest in developing infrastructure, equip classrooms with advanced teaching tools, and establish partnerships with technology companies in training. Enhance training on digital literacy relating to digital information and provide authoritative materials for both faculty and students. On the part of educators: Enhance self-learning and self-improvement in IT and Internet-related knowledge and skills, promote the use of software for digitizing lectures, and support learners in utilizing open educational resources. On the part of learners: Actively and proactively enhance knowledge and skills in IT and the Internet, engage in digital transformation. Actively participate in online training projects and other digital transformation initiatives.

Conflicts of Interest

The authors declare no conflicts of interest.

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