

# Factors affecting to digital skills and adaptability of students in the context of digital transformation at the Ho Chi Minh city University of Technology and Education

*Fatores que afetam as habilidades digitais e a adaptabilidade dos estudantes no contexto da transformação digital na Universidade de Tecnologia e Educação da cidade de Ho Chi Minh*

Nguyen Thi Nhu Thuy\*  
Nguyen Thi Tuyet Nga\*\*  
Phung The Anh\*\*\*  
Tran Ngoc Chung\*\*\*\*

## Abstract

The article focuses on analyzing the factors affecting students' digital skills and adaptability in the context of digital transformation. The study identified influencing factors: Environment, Behavior, Individuals, Teachers, Time of use, and access. However, the results of an online survey of 1.282 students of the Ho Chi Minh City University of Technology and Education (HCMUTE) with Cronbach's Alpha test method, EFA analysis, correlations, and regression analysis, showed that there are 3/5 factors identified in the hypothesis that affect digital skills and adaptability of HCMUTE students in the context of digital transformation, specifically: behavior (Beta = 0.177, Sig. = 0.000); individuals (Beta = 0.181, Sig. = 0.027); teacher (Beta = 0.547, Sig. = 0.000). Besides, the environment does not affect digital skills and adaptability (KNSKNTU) due to Beta = 0.017 and Sig.=0.384>0.05. Sig does not involve usage and access time factors. >0.05 in the table Correlations not be further analyzed in the regression model. The research results are expected to help provide a more objective view of the reality of digital adoption and student adaptability in the digital transformation context at HCMUTE.

**Keywords:** digital skills; digital transformation; factors affecting.

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\* PhD. Ho Chi Minh City University of Technology and Education (HCMC), Vietnam; <https://orcid.org/0000-0002-6529-9651>; [ntnthuy@hcmute.edu.vn](mailto:ntnthuy@hcmute.edu.vn)

\*\* Ho Chi Minh City University of Technology and Education; Email: [nga.nguyen@hcmute.edu.vn](mailto:nga.nguyen@hcmute.edu.vn); <https://orcid.org/0000-0002-6540-5549>

\*\*\* PhD. Ho Chi Minh City University of Technology and Education (HCMC), Ho Chi Minh, Vietnam; <https://orcid.org/0000-0002-0906-5666>; Email: [anhpt@hcmute.edu.vn](mailto:anhpt@hcmute.edu.vn)

\*\*\*\* Masters, Ho Chi Minh City University of Technology and Education (HCMC), Ho Chi Minh, Vietnam; Email: [chungtn@hcmute.edu.vn](mailto:chungtn@hcmute.edu.vn); <https://orcid.org/0000-0002-4349-9548>

## Resumo

O artigo enfoca a análise dos fatores que afetam as habilidades digitais dos estudantes e a adaptabilidade no contexto da transformação digital. O estudo identificou os fatores que influenciam: Ambiente, Comportamento, Indivíduos, Professores, Tempo de uso e acesso. Entretanto, os resultados de uma pesquisa online com 1.282 alunos da Universidade de Tecnologia e Educação da cidade de Ho Chi Minh (HCMUTE) com o método de teste Alfa de Cronbach, análise EFA, correlações e análise de regressão, mostraram que existem 3/5 fatores identificados nas hipóteses que afetam as habilidades digitais e a adaptabilidade dos alunos do HCMUTE no contexto da transformação digital, especificamente: comportamento (Beta = 0,177, Sig. = 0,000); indivíduos (Beta = 0,181, Sig. = 0,027); professor (Beta = 0,547, Sig. = 0,000). Além disso, o ambiente não afeta as habilidades digitais e a adaptabilidade (KNSKNTU) devido a Beta = 0,017 e Sig.=0,384>0,05. O Sig não envolve fatores de uso e tempo de acesso. >0,05 na tabela Correlações não são mais analisadas no modelo de regressão. Espera-se que os resultados da pesquisa ajudem a fornecer uma visão mais objetiva da realidade da adoção digital e da adaptabilidade do estudante no contexto da transformação digital no HCMUTE.

**Palavras-chave:** habilidades digitais; transformação digital; fatores que afetam.

## Introduction

The strong development of science and technology, especially information technology, plays an extremely important role in the socio-economic of every country in the world. This requires every individual to use information technology to respond to the new situation. Katz (2007) believed that digital literacy was as important as reading and writing in the last century, Killen (2018) asserted that digital literacy was considered a vital factor to achieve success in learning, research and the future career development. The World Bank's "the Changing Nature of work" report affirms that digital skills are a prominent feature in the skills frameworks of the 21st century and are at the core of future-ready education concepts. The 21st Century Skills Framework identifies "digital skills" as one of three core skill areas.

There are many studies that give different terms to define human attributes related to the use of information technology such as: digital literacy, digital skills hay digital competency. The first, Digital literacy, introduced by Gilster (1998) is considered as the ability to understand and use information from a variety of digital sources. Digital literacy is not limited to understanding technical functions, not just using digital resources effectively. Eshet-Alkalai (2004) said that digital literacy was not only the ability to use software and operate digital devices, but also emphasized social and emotional cognitive skills to perform tasks and solve problems in the digital environment. Ameen & Gorman (2009) argued that digital skill was not simply the ability to understand technological functions, but also the ability to search and select digital information, apply necessary knowledge for people to become "important consumers". In many of their research papers, Van Deursen and Van Dijk (2010) have proposed a series of digital skills concepts that take into account the technical, media, and basic content aspects (skills related to operation, the formal, information, communication, content creation and strategy). In 2018, UNESCO defined digital literacy as the ability to safely and appropriately access, manage, understand, integrate, communicate, evaluate and create information through digital technologies to serve jobs from the simple to the complex as well as start-ups. Digital literacy is a combination of computer usage, information technology, information and

communication capabilities". A recent World Bank study (Melhem & Jacobsen, 2021) has taken a different approach and used the concept of "digital literacy" to refer to an organization's ability to utilize its employees to achieve its goals. Digital literacy includes not only digital skills but also digital capabilities in leadership and digital culture, all of which are necessary for successful execution of a digital transformation strategy. Although there are different approaches to the terminology of digital literacy, there are differences in the contents and methods to determine the level of digital literacy; the above studies have clarified the nature, role and basic content of digital skills. The above studies are an important basis for individuals and organizations to research on how digital has supported teaching, learning, and research on how to improve digital skills for learners to meet new conditions. For example, Bartlett-Bragg (2017) and Varga-Atkins (2018) both argued that student's learning was greatly influenced by technology-related factors such as the integration of technology in course design, interaction between students, and between students and teachers through technology applications and digital resources. In addition, researchers who are interested in individual characteristics in relation to digital literacy Ng (2012) proposed a three-factor framework based on perception (i.e. choice of technology, information search, and critical evaluation of information), technique (i.e., technical awareness of technology) and society (i.e., support through online communities and protect yourself from harm in the areas of the digital environment). Therefore, the article will analyze the factors affecting students' digital skills and adaptability in digital transformation on several aspects such as Environment, Behavior, Individuals, Teacher, Time of use, and access. Solutions are proposed to improve students' digital skills and adaptability in the digital context.

## Methods

The main methods used in the article are qualitative research and quantitative research in the sociological approach. In qualitative research, we analyze the secondary documents and the qualitative data from the studies of the previous authors. This method not only suggests ideas but also helps to provide relevant qualitative information to selectively inherit the theoretical basis, content, and methods of the research, and at the same time, points out the gaps in information in documents, theoretical tools, and methods to identify new research tools and methods.

In the quantitative research, the author uses the survey method by online questionnaire, and the data processing by SPSS statistical method.

*Descriptive statistics method:* The survey results are conducted with 1.282 HCMUTE students. In which, there are 24.6% female (n=315) and 75.4% male (n=967); first-year students accounted for 79.5% (n=1.019); sophomore students accounted for 14.7% (n=189); third-year students accounted for 5.4% (n=69), fourth-year students accounted for 0.2% (n=3), after-fourth-year students accounted for 0.2% (n=2); students from 28 to 25 years old accounted for 99.9% (n= 1.281), students aged 26 and older accounted for 0.1% (n=1); students from the high-quality training system accounted for 67.5% (n=865), students from the mass system accounted for 28.5% (n=365), students from the international association system accounted for 4.1% (n=52).

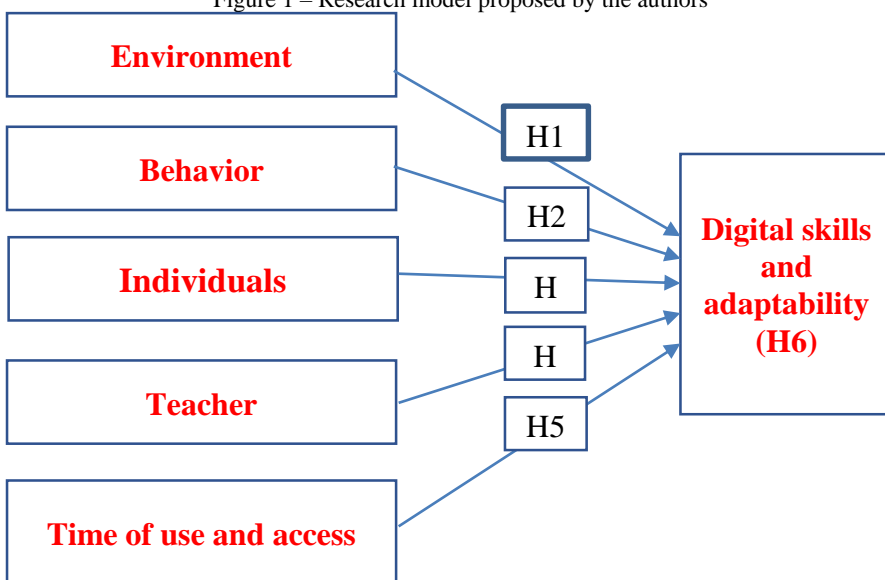
*Analytical method to assess the reliability of Cronbach's Alpha scale:* Cronbach's Alpha coefficient is a statistical test of how closely the items in the scale correlate with each other. Cronbach's Alpha coefficient value level From 0.8 to close to 1: the scale is perfect from 0.7 to close to 0.8: good usability scale; From 0.6 and above: qualifying scale (Hoang Trong, Chu Nguyen Mong Ngoc, 2008).

*Exploratory factor analysis method EFA:* Exploratory factor analysis, referred to as EFA, is used to reduce a set of K variables into a set of F (with  $F < k$ ) of more significant factors.

*Building a regression model in the study:* After the scale of the survey factors has been tested, it will be processed to run linear regression by the sum of least squares (OLS) method by the Enter method. According to Nguyen Dinh Tho (2011), the Enter method is more suitable for testing studies.

Research models

Figure 1 – Research model proposed by the authors



## Results and discussion

### Actual situation of using digital skills and adaptability of students in the context of digital transformation at HCMUTE

In the “Digital Jobs for Youth: Young Women in the Digital Economy” report, the authors mention that digital skills are mainly based on skills related to the use of technology.

Digital skills are divided into three basic, intermediate, and advanced groups as divided by UNESCO (2017), Basic digital skills are

“entry level functional skills required to make rudimentary use of digital devices and applications.” With basic digital skills, users are typically able to operate devices such as computers and smartphones, access and store information from online resources, and set up online accounts and profiles. In it, the internet connection system is one of the core issues and determines the ability to apply digital. In our research, the devices used to connect to the internet include fiber optic internet (accounting for 51.5%), 4G network (accounting for 39.5%), 3G network (accounting for 61%), and 5G network (accounting for 2.8%) (Source: Rendered from SPSS, 2022).

And devices used to access and store online resources are mainly laptops (63.1%), followed by Smartphones (30.9%), Desktop (PC) (4.0%), and Ipad (1.9%) (Source: Rendered from SPSS, 2022).

The digital skills and adaptability of students in the context of digital transformation at HCMUTE in this study show the ability to understand and use information from various digital sources. In which the digital resources and the ability to exploit resources at HCMUTE are mainly UTExlms (accounting for 37.7%) and FHQxlms (accounting for 59.1%); besides, other digital sources such as Angel, Blackboard Learn, and Pearson Education account for a negligible percentage (Source: Rendered from SPSS, 2022). Moreover, to learn and find resources, HCMUTE students also use other platforms and tools such as zoom (21%), Google meet (27.3%), Microsoft Teams (9.6%), Jitsi Meet (0.7%), Zalo (17.9%), Face book (16.4%) and some other platforms (7.1%)

According to our research results, the Covid-19 epidemic has had an impact (accounting for 51%) on students' digital skills and adaptability in the context of digital transformation at HCMUTE (Source: Rendered from SPSS, 2022). Therefore, to adapt, HCMUTE students not only have the ability to understand technology, digital platforms, and tools but switch to the ability to manage, search, select, create and manage information to service learning. Specifically, the use of digital skills and adaptability are shown in the following aspects: Independent learning (accounting for 20.6%); Searching and managing digital information (accounting for 16.6%); Their participation in information/data management (accounting for 15.0%); Creating the digital documents and digital learning independently (accounting for 12.3%); Digital creative activities (e.g.: blogs, electronic portfolios, wikis) (accounting for 10.2%); Management of digital data/information (accounting for 10.0%); Digital identity (accounting for 5.5%). The results of this study show that there is a concordance between digital skills and adaptability with previous research results "intermediate Digital Skills enable individuals to use digital tools for more significant task-oriented purposes. Intermediate skills are "the skills that enable an individual to make substantive and beneficial use of online applications and services,". Advanced Digital Skills allow people to use technology in transformative ways. UNESCO defines these as "the group of skills that form the basis of specialist [information and communication technology] occupations and professions." (UNESCO, 2017).

A remarkable research result from the JISC Organization (2015) described digital skills as the digital capabilities individuals need to live, learn and work in a digital society. This organization introduced a framework called the JISC Digital Capability Framework which

consists of 6 components: (1) ICT qualification - involves fundamental digital skills in adopting, adapting and using digital devices, applications and services; (2) Information, data and media literacy - involves the ability to find, evaluate, manage and share digital information and data, critically read in a variety of digital media; (3) Digital creativity, problem solving and innovation - involves the process of creating, innovating and solving problems by using technology and/or developing new practices with digital technology; (4) Digital Communication and Collaboration - involves the ability to communicate and collaborate effectively in a variety of digital media for different purposes and audiences; (5) Digital Learning and Development - involves the ability to identify/participate in digital learning opportunities; and (6) Digital Identity and Wellbeing - relates to the ability to maintain a positive digital identity across platforms and take care of one's work-life balance.

To explore the digital capabilities that individuals need to live, study and work in a digital society at HCMUTE, a survey is conducted to capture the basic digital skills of application, adaptation, and use of digital devices, applications, and services in learning. The results show that the main software applications used are (24.2%), website (22.9%), word processing software (14.7%), image processing software (11.7%), Video sharing application (10.8%), statistical software (6.3%), virtual learning environment (6.1%) ... (Source: Rendered from SPSS, 2022).

Eshet-Alkalai (2004) argued that digital literacy was not only the ability to use software and operate digital devices but also emphasized social and emotional cognitive skills to perform tasks and solve problems in the digital environment. In our research, the social and emotional cognitive skills of HCMUTE students are demonstrated through positive adaptability, good time management ability, high academic persistence, performance in the context of online learning, improving their online learning skills, and online learning experience adaptability. On the other hand, more or less significant differences are found in cognitive aspects of technology use, which seem to be related to students' ability and cognitive effort to think critically in the search, evaluation, management, and sharing of digital information.

Table 1 – Student's adaptability in the context of digital transformation

Training system	Positive adaptability	Good time management ability	High academic persistence	Performance in the context of online learning	Enhancing online learning skills	Online learning experience	Adaptability
High Quality	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Mass	3.00	3.00	3.00	3.00	3.00	3.00	3.00
International association	3.00	3.00	3.00	3.00	3.50	4.00	4.00
Total	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Source: Survey results, 2022

With level 1 - the lowest and level 4 - the highest, Table 3.1 show that the digital skills and adaptability of HCMUTE students in the digital context are all at level 3 or higher. In there is a new finding that the online learning experience and adaptability (both scores at level 4) of students of the international association system are higher than that of the high-quality system and the mass system (both of them are at level 3). Differences between training systems in the use of students' digital skills and adaptability may be linked to the curriculum structure or student's learning behavior or personal characteristics and family structure which are beyond the scope of this study... However, we recognize that the needs of students at any training system also provide digital platforms to provide the necessary support in developing strategies of effective information management.

## Analysis of factors affecting students' digital skills and adaptability in the context of digital transformation at HCMUTE

### *Tested the reliability of the scales*

The study has determined and tested the reliability of the scales: Environment (MT); Behavior (HV); Individual (CN); Instructor (ND); Time of use and access (TGTC); Digital skills and adaptability (KNS&KNTU) by confidence factor Cronbach's Alpha.

Cronbach's Alpha see helps to delete the unacceptable observed variables with an item-total correlation less than 0.3. The criterion for the scale is accepted when Cronbach's Alpha is more significant than 0.6 or more (Nguyen Dinh Tho & Nguyen Thi Mai Trang, 2004). The researchers agree that when the value of Cronbach's Alpha is above 0.8 to close to 1, this scale is good; if the value of Cronbach's Alpha is within the range of 0.7 to 0.8, it means that the value of Cronbach's Alpha is acceptable. Some researchers believe that the value of Cronbach's Alpha at 0.6 or greater can be used in a case where the concept of the scale is new or the scale is unique to respondents in the research (Hoang Trong - Chu Nguyen Mong Ngoc, 2008).

#### Environment

The results of running the reliability analysis of the "environmental" factor's scale show that the reliability is 0.849, ranging from 0.795 to 1, this is a good scale, and all variables correlate with a large sum. More than 0.3 satisfactory.

Table 2 – The results of the reliability analysis of the scale for environmental factors

Item-Total Statistics				
Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha: 0.849				
MT1	13.44	12.263	.745	.795
MT2	13.41	12.258	.725	.800
MT3	14.03	12.958	.577	.840
MT4	14.09	12.901	.608	.831
MT5	13.53	12.649	.644	.821

Source: Survey results, 2022

## *Behavior*

The results of running the reliability analysis of the "behavior" factor scale show that the reliability of 0.932 is more significant than 0.6, satisfactory, and all correlated variables with a sum greater than 0.3 are satisfactory.

Table 3 – The results of the reliability analysis of the scale for behavioral factors

Item-Total Statistics				
Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha: 0.932				
HV1	12.77	15.645	.783	.923
HV2	12.75	15.242	.850	.910
HV3	12.81	15.116	.863	.907
HV4	12.75	15.452	.819	.916
HV5	12.80	16.014	.778	.923

Source: Survey results, 2022

## *Individual*

The reliability analysis of the "individual" factor's scale results show that the reliability of 0.957 is more significant than 0.6 satisfactory, and all correlation variables with a sum greater than 0.3 are satisfactory.



Table 4 – The results of the reliability analysis of the scale for individual factors

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha: 0.957				
CN1	19.43	32.711	.820	.952
CN2	19.41	32.358	.852	.950
CN3	19.38	32.458	.854	.950
CN4	19.33	32.752	.843	.950
CN5	19.38	32.250	.865	.949
CN6	19.39	32.232	.848	.950
CN7	19.37	31.988	.865	.949

Source: Survey results, 2022

## *Teacher*

The results of running the reliability analysis of the "teacher" factor scale show that the reliability of 0.953 is greater than 0.6, satisfactory, and all correlated variables with a sum greater than 0.3 are satisfactory.

Table 5 – The results of the analysis of the reliability of the scale for the teacher factor

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha: 0.953				
ND1	9.84	9.283	.870	.943
ND2	9.82	9.288	.902	.933
ND3	9.83	9.317	.895	.935
ND4	9.83	9.352	.875	.941

Source: Survey results, 2022

## *Time of use and access*

The results of running the reliability analysis of the scale of the factor "Time of use and access" show that the reliability is 0.790, more significant than 0.6, and all correlated variables with a sum greater than 0.3 are satisfactory.

Table 6 – The results of the reliability analysis of the scale for the factors of Time of use and access

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha: 0.790				
TGSDTC1	6.47	3.700	.725	.608
TGSDTC2	6.44	3.992	.687	.656
TGSDTC3	6.39	4.525	.495	.855

Source: Survey results, 2022

### *Digital skills and adaptability*

The results of running the reliability analysis of the scale of the factor “Digital skills and adaptability” shows that the reliability of 0.953 is more significant than 0.6 satisfactory, and all correlation variables with a sum greater than 0.3 meet the requirements.

Table 7 – The results of the reliability analysis of the scale for the factor of Digital skills and adaptability

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cronbach's Alpha: 0.953				
KNS&KNTU 1	13.21	15.748	.849	.945
KNS&KNTU 2	13.19	15.500	.872	.941
KNS&KNTU 3	13.19	15.444	.893	.938
KNS&KNTU 4	13.15	15.546	.858	.944
KNS&KNTU 5	13.17	15.503	.873	.941

Source: Survey results, 2022

### Exploratory factor analysis

#### *Exploratory factor analysis with (EFA) independent variables*

The standard of the factor analysis method is that the KMO index must be greater than 0.5 (Garson, 2003), and Barlett's test has a significance level of  $\text{sig} < 0.05$  to show that the data used for factor analysis is appropriate and between the variables. They are correlated with each other. Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value=0.951.

The factor analysis results show that the KMO index is  $0.951 > 0.5$ , which proves that the data used for factor analysis is entirely appropriate. Bartlett's test result is 28131,357, with a Sig significance level. =  $0.000 < 0.05$ , this time was rejecting hypothesis H0: observed variables are not correlated with each other in the population. Thus, the hypothesis that the correlation matrix between variables is homogenous is rejected; the variables are associated with each other and satisfy the factor analysis conditions. (Source: Survey results, 2022). Perform factor analysis according to Principal components with Varimax rotation. The results show that the 24 observed variables are initially grouped into five groups.

The total value of variance extracted =  $76.605\% > 50\%$ : satisfactory; it can be said that these five factors explain 76.605% of the variation in the data. The Eigenvalues of the factors are all high ( $>1$ ), and the 5th factor has the lowest Eigenvalues of  $1,131 > 1$ . Factor matrix with Varimax rotation method:

Table 8 – Results of the first independent variable EFA analysis

Rotated Component Matrixa					
	Component				
	1	2	3	4	5
CN3	.800				
CN2	.794				
CN5	.784				
CN4	.783				
CN7	.773				
CN6	.763				
CN1	.733				
HV3		.763			
HV2		.746			
HV4		.738			
HV5		.712			
HV1		.702			
ND2			.811		
ND3			.799		
ND4			.781		
ND1			.774		
MT2				.858	
MT1				.853	
MT5				.667	

MT4				.612	
MT3					
TGSDTC1					.901
TGSDTC2					.882
TGSDTC3					.729
Eigen - value	12.290	2.137	1.651	1.176	1.131
Phuong sai trích(%)	51.207	60.113	66.990	71.891	76.605

a. Rotation converged in 6 iterations.

Source: Survey results, 2022

The factor loading factors are all greater than 0.5, but there are cases where MT3 has no load value. Therefore, the elements do not guarantee convergence and discriminant values when analyzing EFA. Consequently, it is necessary to remove MT3 and treat EFA a second time.

The second-factor analysis results show that the KMO index is  $0.949 > 0.5$ , which proves that the data used for factor analysis is entirely appropriate. Barlett's test result is 27311.315 with a Sig significance level =  $0.000 < 0.05$ , this time was rejecting hypothesis H0: observed variables are not correlated with each other in the population. Thus, the hypothesis that the correlation matrix between variables is a homogenous matrix is rejected; that is, the variables are correlated with each other and satisfy the factor analysis conditions. (Source: Survey results, 2022). Perform factor analysis according to Principal components with Varimax rotation. The results showed that 23 observed variables were initially grouped into five groups.

The total value of variance extracted =  $77.934\% > 50\%$ : satisfactory; then it can be said that these five factors explain 77.934% of the variability of the data. The Eigenvalues of the factors are all high ( $>1$ ), and the fifth factor has the lowest Eigenvalue of  $1.130 > 1$ . Factor matrix with Varimax rotation method:

Table 9 – The results of the second independent variable EFA analysis

Rotated Component Matrixa					
	Component				
	1	2	3	4	5
CN3	.801				
CN2	.796				
CN5	.787				
CN4	.784				
CN7	.777				

CN6	.768				
CN1	.737				
HV3		.766			
HV2		.749			
HV4		.741			
HV5		.719			
HV1		.708			
ND2			.813		
ND3			.801		
ND4			.783		
ND1			.777		
MT2				.866	
MT1				.861	
MT5				.671	
MT4				.581	
TGSDTC1					.901
TGSDTC2					.883
TGSDTC3					.730
Eigen - value	11.884	2.131	1.603	1.176	1.130
Phuong sai trích(%)	51.671	60.935	67.905	73.019	77.934

Source: Survey results, 2022

The factor loading factors are all greater than 0.5, and there is no case where the variable loads both factors simultaneously with the load factors close to each other. Therefore, the factors ensure convergent and discriminant validity when analyzing EFA; there is no disturbance of factors, that is, the question of one factor is not confused with the question of the other factor. Therefore, these independent factors are kept unchanged after factor analysis, not increased or decreased by factors.

Exploratory factor analysis with (EFA) dependent variables

EFA results on the dependent variable (satisfaction) by Principal components extraction method and varimax rotation showed: KMO coefficient = 0.896 (>0.5), Barlett's test result is 6673.393, and Sig significance level. = 0.000 (<0.05), so exploratory factor analysis (EFA) is appropriate (Source: extracted from SPSS, 2022). 05 variables measuring satisfaction are extracted into the same factor at Eigenvalues = 4.207 (>1), and the extracted variance is 84.145%. Therefore, the EFA results can be used for regression analysis in the next step.

Table 10 – Total Variance Explained

Component	Total Variance Explained			Extraction Sums of Squared Loadings		
	Initial Eigenvalues			Total	% of	Cumulative
	Total	% of	Cumulative	Total	% of	Cumulative
		Variance	%		Variance	%
1	4.207	84.145	84.145	4.207	84.145	84.145
2	.305	6.107	90.252			
3	.186	3.715	93.967			
4	.160	3.195	97.162			
5	.142	2.838	100.000			

Extraction Method: Principal Component Analysis.

Source: Survey results, 2022

Table 11 – Grouping of factors after performing exploratory factor analysis

Factors	Symbol	Measure variable
Environment (H1)	MT	MT1, MT2, MT4, MT5
Behavior (H2)	HV	HV1, HV2, HV3, HV4, HV5
Individuals (H3)	CN	CN1, CN2, CN3, CN4, CN5, CN6, CN7
Teachers (H4)	ND	ND1, ND2, ND3, ND4
Time of use and access (H5)	TGSDTC	TGSDTC1, TGSDTC2, TGSDTC 3
Digital skills and adaptability (H6)	KNS&KNTU	KNS&KNTU1, KNS&KNTU2, KNS&KNTU3, KNS&KNTU 4, KNS&KNTU5

Source: Survey results, 2022

## Correlation coefficient matrix analysis

Correlation coefficient matrix analysis is a crucial analytical step before performing regression analysis to consider whether groups of independent and dependent variables are eligible for regression analysis.

Correlation analysis represents a linear correlation relationship between the pairs of variables being analyzed. The correlation coefficients will range from -1 to 1 and measure the degree of linear correlation between the variables. The Prob value represents the level of

statistical significance for the estimated correlation coefficients. The author conducts correlation analysis among the variables in the model.

Table 12 – Correlations

Correlations		MT	HV	CN	ND	TGSDTC	KNSKNTU
MT	Pearson Correlation	1	.593**	.559**	.516**	.026	.506**
	Sig. (2-tailed)		.000	.000	.000	.353	.000
	N	1282	1282	1282	1282	1282	1282
HV	Pearson Correlation	.593**	1	.749**	.685**	.041	.698**
	Sig. (2-tailed)	.000		.000	.000	.142	.000
	N	1282	1282	1282	1282	1282	1282
CN	Pearson Correlation	.559**	.749**	1	.727**	.047	.721**
	Sig. (2-tailed)	.000	.000		.000	.091	.000
	N	1282	1282	1282	1282	1282	1282
ND	Pearson Correlation	.516**	.685**	.727**	1	.039	.809**
	Sig. (2-tailed)	.000	.000	.000		.164	.000
	N	1282	1282	1282	1282	1282	1282
TGSDTC	Pearson Correlation	.026	.041	.047	.039	1	.043
	Sig. (2-tailed)	.353	.142	.091	.164		.127
	N	1282	1282	1282	1282	1282	1282
KNSKNTU	Pearson Correlation	.506**	.698**	.721**	.809**	.043	1
	Sig. (2-tailed)	.000	.000	.000	.000	.127	
	N	1282	1282	1282	1282	1282	1282

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Survey results, 2022

For the correlation between the independent variables, the study is mainly interested in the relationship between the variables with a correlation coefficient of 0.8 and above (relatively close correlation) and statistically significant at 10. % because this relationship can cause the regression model to be biased due to the phenomenon of multicollinearity between the independent variables. The analysis results of Table 3.11 show that the correlation between the independent variables in the model is relatively strong (correlation coefficients are all less than 0.6, relatively much more significant than 0.7). For the correlation between the independent variables and the dependent variable, the satisfaction variable has a non-zero correlation coefficient for the independent variables MT, HV, CN, and ND at the significance level of 10%. For time use and access variables (TGSDTC), there is no correlation (affect) on digital skills and adaptability (KNSKNTU) because of sig. >0.05.

Thus, with the results of the analysis of the correlation coefficient matrix between the variables in the model, the independent variables and the dependent variables are eligible to perform the next step of regression analysis. The regression model has the form:

$$KNSKNTU = \beta_0 + \beta_1*MT + \beta_2*HV + \beta_3*CN + \beta_4*ND$$

## Regression analysis

After conducting exploratory factor analysis, and grouping variables according to each factor, the study continued to conduct regression analysis. The regression model that the study applies is a multivariable regression model to examine the relationship between the dependent variables and the independent variables. When analyzing regression, the results will show the factors affecting customer satisfaction. Also, indicate the level of impact of the factors and their level of explanation. Specifically, regression analysis was performed with 04 independent variables: Environment (MT), Behavior (HV), Individual (CN), and Teacher (ND); and the dependent variable was Digital skills and adaptability (KNSKNTU). One-pass input method (Enter method) was used for regression analysis. The values of the factors used to run the regression are the mean values of the observed variables. The model is written as follows:  $KNSKNTU = \beta_0 + \beta_1*MT + \beta_2*HV + \beta_3*CN + \beta_4*ND + e_i$  ( $\beta_i$ : Regression coefficients ( $i > 0$ );  $\beta_0$ : Constant;  $e_i$ : error ).

Evaluate model fit:

Adjusted R2 = 0.704 means that the independent variables in the model include: Environment (MT), Behavior (HV), Individual (CN), Instructor (ND) for Digital Skills and Abilities adaptation (KNSKNTU) of students at the University of Technology and Education of Ho Chi Minh City. Explains 70.4% of the variation in Digital Skills and Adaptability (KNSKNTU), and the rest is variation in Digital Skills and Adaptability that is not explained by independent variables in the model. Model, or in other words, due to factors outside the model.

Table 13 – Model Summary b

Model Summary b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.840a	.705	.704	.53306	1.925
a. Predictors: (Constant), ND, MT, HV, CN					
b. Dependent Variable: KNSKNTU					

Source: Survey results, 2022

In addition, testing from the ANOVA table of variance, F value = 763.194 Sig value. = 0.000 is very small ( $< 0.05$ ); from this result, there exists at least one statistically significant independent variable explaining the change of the dependent variable.



Table 14 – ANOVA

ANOVAa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	867.452	4	216.863	763.194	.000b
	Residual	362.862	1277	.284		
	Total	1230.314	1281			
a. Dependent Variable: KNSKNTU						
b. Predictors: (Constant), ND, MT, HV, CN						

Source: Survey results, 2022

## The results of regression analysis and the level of impact of each factor

The results of the regression model are shown in Table 3.14 specifically as follows:

Table 15 – Coefficientsa

Coefficientsa Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.316	.065		4.884	.000		
MT	.018	.021	.017	.871	.384	.611	1.636
HV	.178	.025	.177	7.048	.000	.366	2.729
CN	.187	.027	.181	6.980	.000	.344	2.904
ND	.532	.023	.547	23.378	.000	.421	2.373
a. Dependent Variable: KNSKNTU							

Source: Survey results, 2022

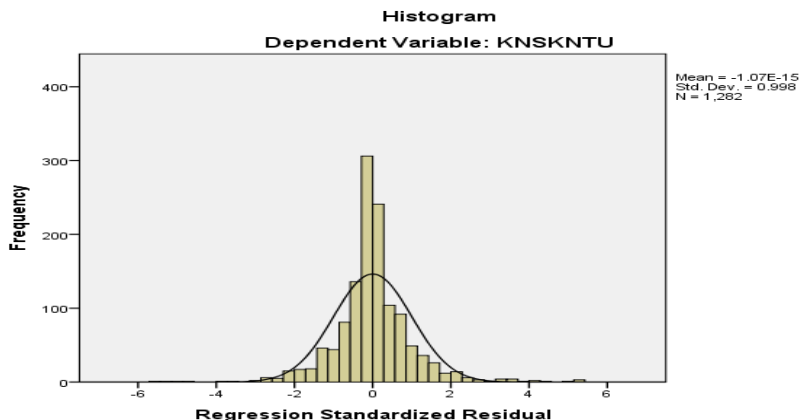
## Check the statistical significance of the estimated coefficients

Based on the results in Table 3.14, statistically significant variables include Behavior (HV), Individual (CN), and Instructor (ND) that affect Digital Skills and Adaptability (KNSKNTU) of students from the Ho Chi Minh City University of Technology and Education. Because all significance levels (Sig. coefficients) are  $< 0.05$ . The normalized regression model on digital skills and adaptability of students at Ho Chi Minh City University of Technology and Education in the context of digital transformation is defined as follows:

$$\text{KNSKNTU} = \beta_0 + 0.177 \cdot \text{HV} + 0.181 \cdot \text{CN} + 0.547 \cdot \text{ND}$$

Histogram: Assumption of a normal distribution of the residuals

Figure 2 – Histogram

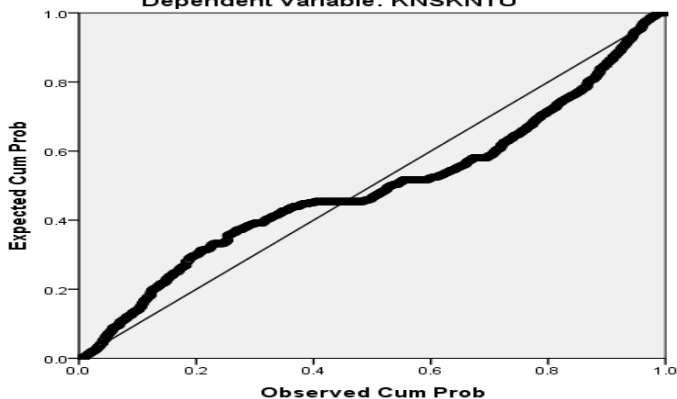


Source: Survey results, 2022

Looking here, we see that the normalized residuals are distributed according to the shape of the normal distribution. There is a bell curve in the figure, which is a normal distribution; we see the histogram frequency corresponding to that bell curve. Furthermore, the mean value of  $-1.07E-15$  is approximately  $=0$ , and the standard deviation of  $0.998$  is approximately  $=1$ , further confirming that the normalized residuals are normally distributed.

Figure 3 – Normal P-P Plot of Regression Standardized Residual

**Normal P-P Plot of Regression Standardized Residual**  
Dependent Variable: KNSKNTU

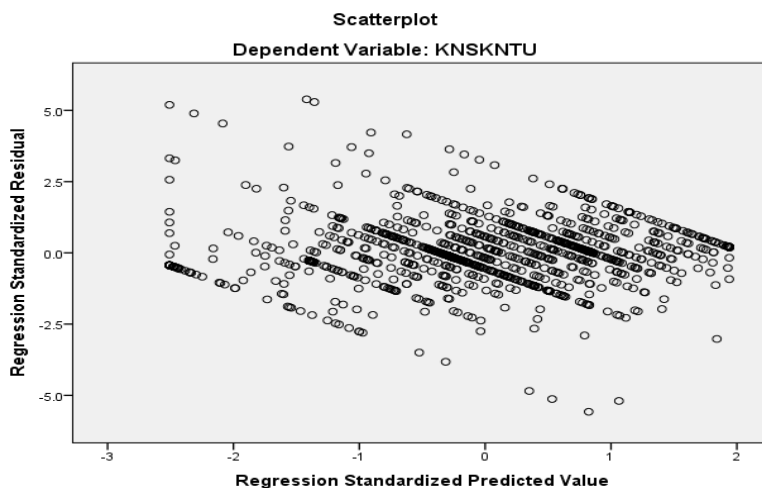


Source: Survey results, 2022

See the Normal P-P Plot of Regression Standardized Residual, the observed and expected values are all close to the diagonal indicating that the normalized residuals are normally distributed. Test by P-P Plot plot showing the values of the percentiles of the

distribution of the variable according to the percentiles of the distribution standard distribution. Observing the level of actual points, centered close to the expected line, shows that the research data set is relatively good, the normalized residuals have a distribution close to the normal distribution.

Figure 4 – Scatterplot Dependent Variable



Source: Survey results, 2022

Regarding the assumption of linear relationship, the method used is the Scatterplot Dependent Variable. Looking at the graph, we see that the Regression Standardized Residual has no insignificant change in a certain order for the Regression Standardized Predicted Value. Hence the assumption of linear relationship is not violated. This means that the normalized prediction value is the normalized value of the dependent variable, and the normalized residual is the normalized value of the residual. We see that the dependent variable has no relationship with the residual.

## Discussion

Results of regression analysis of factors affecting digital skills and adaptability of students at Ho Chi Minh City University of Technology and Education in the context of digital transformation showed that there are 04 factors identified that affect students' digital skills and adaptability (KNSKNTU), namely Environment (MT), Behavior (HV), Individual (CN), Instructor (ND) have an influence on Digital Skills and Adaptability (KNSKNTU) of students at Ho Chi Minh City University of Technology and Education. The results of the regression analysis also show that only 3/5 of the initial hypotheses H2, H3, H4 are accepted, and H1 is

not accepted (H5 due to sig.>0.05 (does not affect skill). number and adaptability of students) in the correlation table run step, should be excluded from the regression model).

Table 16 – S . Statistical hypothesis testing

Statistical hypothesis	Estimated coefficient	Result
H1: The environment affects digital skills and adaptability (KNSKNTU)	0.017 (Sig.=0.384)	Does not accept
H2: Behavior affects digital skills and adaptability (KNSKNTU)	0.177 (Sig. = 0,000)	Accept
H3: Individuals influence digital skills and adaptability (KNSKNTU)	0.181 (Sig. = 0,027)	Accept
H4: Teachers influence digital skills and adaptability (KNSKNTU)	0.547 (Sig. = 0,000)	Accept

Source: Survey results, 2022

The regression analysis results show that behavioral factors influence digital skills and adaptability (KNSKNTU). The behavior is shown through time; although the internet is high-speed, the ability to interact and work directly on the Laptop, the ability to access information, documents, and digital learning equipment to fully meet the needs of users. Request access to behavior information about personal life on social networking sites. Behavior is a factor that accounts for a high proportion of students' selection, refinement, and learning of digital skills and adaptability. Obviously, people who can use information technology, the internet, fast operation, and quick search access can be seen as having the ability to adapt to digital transformation and digital skills quickly.

Personal factors influence digital skills and adaptability (KNSKNTU). Individuals with abilities such as active adaptation, good time management, high academic persistence, work performance, learning and accessing information in the context of online learning, improving skills Online learning, learning, accumulating online learning experiences, and adaptability is qualities and attribute that contribute to perfecting students' digital skills and adaptability in the context of digital transformation. ....

The teacher factor affects digital skills and adaptability (KNSKNTU). Teachers have an important role in contributing to the formation of digital skills and adaptability for students. Therefore, the variables observed by teachers in this study include: Innovation and technology readiness; teaching content is counted as a success factor for switching teaching modes, and Methodology Preaching is counted as a success factor for transforming teaching modes and organizational forms and implementing online exercises and tests. For students of Ho Chi Minh City University of Technology and Education, the role of the teacher as a guide and leader directly affects the assessment of students' digital skills and adaptability. Members in the context of digital transformation.

According to the analysis results from the survey, environmental factors (including observed variables: pandemic disruption, social isolation, studying at home should be

convenient, easy to arrange, and not able to arrange a time. Appropriate time because of having to help with household chores, lack of face-to-face meetings, and interactions between lecturers and students, students and students have no effect on digital skills and adaptability (KNSKNTU).

## Solutions to increase students' digital skills and adaptability in digital transformation

Firstly, to complete and upgrade the LMS and FHQLMS systems, lecturers must supplement, update and provide sufficient documents and detailed and easy-to-understand lectures. Video lectures on LMS and FHQLM systems are pretty diverse and rich.

The second is support means and tools for students to participate in online classes to improve the quality of training, learning, and accessing resources for learning.

Third, one of the factors affecting students' digital skills and adaptability today is the internet and students' access skills. In implementing online learning, an indispensable factor is the internet connection. Research results show that fiber optic internet system plays a key role, besides 4G network, 3G network, and 5G network. However, the transmission line and internet connection are unstable, making it difficult to access and serve the purpose of learning and research, so upgrading the wifi system, 4G, and 5G applications need to be focused.

Fourth, learning on the digital platform and students' ability to adapt in the context of digital transformation will quickly lead to psychological fatigue and stress, which more or less affects digital skills and students' adaptability in active learning and research. Therefore, it is necessary to facilitate and encourage students to adapt actively, manage their time well, persevere with high academics, work performance, study, and access information in the context of online learning. Enhancing online learning skills, learning, accumulating online learning experiences, and adaptability are qualities and attributes that contribute to perfecting students' digital skills and adaptability in the digital transformation scene.

## Conclusion

In summary, this study has contributed to analyzing factors affecting digital skills and adaptability in the context of digital transformation in student learning at Ho Chi Minh City University of Technology and Education. The analysis results have shown that three influential factors are the individual (CN), the behavior (HV), and the teacher (ND). The regression analysis results also proved that environmental factors do not affect students' digital skills and adaptability in the context of digital transformation.

Although there are different approaches to the terminology related to digital skills, there are differences in the contents and methods to determine the level of digital competence. Still, the above studies have made it clear. Understand the nature, role, and essential range of digital skills. The above studies are an indispensable basis for individuals and organizations to research how digital has supported teaching and learning and how to improve digital skills for learners to meet future needs-new conditions.

The authors have proposed four solutions to improving students' digital skills and adaptability in the digital context:

Trainers must improve, upgrade, and supplement resources on LMS and FNQLMS systems.

Support means and tools for students to participate in online classes to improve the quality of training, learning, and accessing resources for learning.

Upgrading wifi systems, 4G, and 5G applications need to be focused on.

To avoid psychological fatigue and stress in students, students need to actively study and research. Facilitate and encourage students to actively adapt, manage their time well, persevere with high academics, work performance, study and access information in the context of online learning, improve skills online learning, learning, accumulating online learning experiences and student adaptability in the context of digital transformation....

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