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Elements affecting primary school teachers' digital competency in Vietnam's northern mountainous areas

Chuyen Thi Hong Nguyen[1]
Huong Le Thi Thu[2]✉
Duong Lam Thuy[3]
Ha Nguyen Thi Thu[4]
Thai Doan Thi Minh[5]


(✉ Corresponding Author)

[1,2,3,4,5]*University of Education, Thai Nguyen University, Vietnam.*
[1]*Email: chuyennh@tnue.edu.vn*
[2]*Email: lethithuhuong@tnue.edu.vn*
[3]*Email: duonglt@tnue.edu.vn*
[4]*Email: hantt@tnue.edu.vn*
[5]*Email: thaidtm@tnue.edu.vn*

Abstract

This study aims to identify the elements that contribute to the digital competencies of primary school teachers working in the mountainous region of Northern Vietnam and assess the significance of these factors. The research sample consisted of 260 primary school teachers from this region. Exploratory factor analysis (EFA) and multivariate regression methods are used. The results of this research indicate that seven characteristics have a substantial impact on the digital abilities of teachers: ability to incorporate digital technology into teaching, conditions for digital transformation in teaching and learning activities are found to be influential, ability to create digital resources is highlighted as an important factor, ability to select teaching content with opportunities for technology usage, professional development needs of teachers, school policy and ability to select digital resources. These results offer education administrators a comprehensive understanding of the factors influencing primary teachers' digital competencies and enable them to implement strategic changes and prioritize each element. Moreover, this study provides a valuable reference for future researchers seeking to explore new research directions in this field and analyze the correlation between factors to propose solutions to develop digital competencies of primary school teachers suitable to specific contexts and conditions.

Keywords: Digital competence, EFA, Elements affecting, Northern mountainous region, Primary school, Teachers.

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Contents

Contribution of this paper to the literature

This article aims to determine the factors that influence the digital proficiency of primary school teachers in the mountainous regions of Northern Vietnam. Identifying the particular elements directly affecting primary school teachers' digital skills in this area is very important. This topic is unexplored and requires further investigation.

1. Introduction

The aim of this paper is to examine the factors that impact the digital proficiency of primary school educators in the mountainous area of Northern Vietnam. According to Durán (2019) perspectives, "digital competence" refers to the combination of knowledge, skills, attitudes, abilities, tactics and awareness that are necessary for making effective use of digital information and communication technologies (Durán, 2019). A number of activities are included in its scope, including problem-solving, communication, information management, collaboration, content production, knowledge-building, the development of critical and creative thinking, independent learning, flexible adaptation, ethical engagement and socialization (Ferrari, 2012). Digital competence is defined by the Council of the European Union as "the safe and responsible use of digital technologies for study, work and social engagement as well as the relevance of these technologies and how they interact with one another". The scope of this encompasses a range of skills and knowledge, including information and data literacy, effective communication and collaboration, media literacy, digital content creation (including programming), security (including digital well-being and cybersecurity skills), understanding intellectual property issues, problem-solving, and critical thinking (Council, 2018). Cabero-Almenara, Barroso-Osuna, Rodríguez, and Llorente-Cejudo (2020) emphasize that digital competence is one of the key competencies that individuals particularly teachers must master in a future-oriented society (Cabero-Almenara et al., 2020). The document contains pedagogical criteria that are necessary for the successful incorporation of information technology into educational practices and the appropriate deployment of this technology in either formal or informal classroom settings (Durán, 2019). According to Nguyen (2023) teachers are facing novel problems in their daily professional activities at school as a result of the accomplishments and breakthroughs of the digital transformation in education. Teachers play a crucial role in effectively applying and integrating information and communication technology (ICT) in the classroom. Teachers play a crucial role in facilitating educational transformation and improvement. They show effective digital skills and have knowledge of them which enables them to integrate and use technology effectively (Basilotta-Gómez-Pablos, Matarranz, Casado-Aranda, & Otto, 2022). Gámez and his colleagues argue that factors such as knowledge, age, gender and the usage of tools 2.0 and Moodle Modules have an impact on teachers' digital competencies (Guillén-Gámez, Mayorga-Fernández, Bravo-Agapito, & Escribano-Ortiz, 2021). These studies frequently examine the relationship between digital proficiency and individual variables such as age, gender, overall views towards technology and social environment. Multiple studies have found that teachers' personal traits such as their views, attitudes, motivations and self-efficacy judgments have a substantial impact on their digital competence (Backfisch, Scherer, Siddiq, Lachner, & Scheiter, 2021; Cheok & Wong, 2015; Lucas, Bem-Haja, Siddiq, Moreira, & Redecker, 2021) in conjunction with contextual factors (Lucas et al., 2021). Furthermore, Sailer et al.(2021) acknowledge the significance of the knowledge, abilities and attitudes that teachers possess in relation to their digital competencies (Sailer, Schultz-Pernice, & Fischer, 2021).

Researchers globally have studied the digital competency framework for teachers, exploring teachers' perceptions of digital competence, assessing teachers' proficiency in digital skills, and examining the relationship between influencing factors and the development of digital competence (Ally, 2019; Caena & Redecker, 2019; Koehler, Mishra, & Cain, 2013; Lameras & Moumoutzis, 2021; Marin 2022; Omar & Mohmad, 2023; Revuelta-Domínguez, Guerra-Antequera, González-Pérez, Pedrera-Rodríguez, & González-Fernández, 2022; Yang, Martínez-Abad, & García-Holgado, 2022; Zabolotska, Zhyliak, Hevchuk, Petrenko, & Alieko, 2021). Some authors study the relationship between teachers' competence and individual aspects like age, gender, general attitude towards technology and social milieu. Multiple studies have shown that teachers' personal traits such as their beliefs, attitudes, motivation and perceived self-efficacy have a notable impact on their digital skills along with contextual factors (Backfisch et al., 2021; Cheok & Wong, 2015; Lucas et al., 2021). In addition, Sailer et al. (2021) acknowledge the significance of teachers' knowledge, abilities and attitudes in relation to their digital competencies (Sailer et al., 2021). This research aims to examine the factors influencing the digital transformation capabilities of primary school educators in Vietnam. This research was limited to a specific province in Vietnam near the southern border. Trang and Phuong (2023) have pinpointed five key factors that influence digital transformation in education: (1) teachers' interest in digital transformation. (2) School policies. (3) Understanding of digital transformation's role in teaching. (4) Necessary conditions for implementing digital transformation and (5) teachers' requirements for using digital technology. Scientists are studying ways to enhance teachers' digital skills (Balyk, Vasylenko, Shmyger, Oleksiuk, & Skaskiv, 2019; Howard, Tondeur, Ma, & Yang, 2021; Zabolotska et al., 2021) and create a method to assess teachers' beliefs regarding their digital competency (Rubach & Lazarides, 2021). The authors did a literature analysis on teachers' digital competencies using the works of Fernández-Batanero, Montenegro-Rueda, Fernández-Cerero, and García-Martínez (2022); Ottestad, Kelentrić, and Guðmundsdóttir (2014); Pettersson (2018); Tsankov and Damyanov (2019) and Vásquez, Roig-Vila, and Peñafiel (2021). The study by Karakose, Polat, and Papadakis (2021) investigates the level of digital leadership displayed by principals, the digital teaching practices implemented by teachers and the particular aspects of principals' digital leadership that can forecast the degree of digital teaching practices used by teachers .

Although numerous studies have explored the factors influencing teachers' digital competence, most have been conducted in developed economies. Vietnam, as a developing country in Southeast Asia, lacks research articles on this particular issue. Vietnam is in the process of making a strong transformation in education (Anh, Phong, & Jan, 2023). One of the important solutions for successful implementation is to improve the digital capacity of K-12 school teachers, including primary school teachers. According to Oanh, Tuan, Duong, Triet, and Phuc (2023), one of the tasks to implement digital transformation in education in Vietnam is to carry out a more in-depth study on online teaching and teachers' capacity for it. The mountainous region of Northern Vietnam includes 14 provinces

with many difficult economic, cultural and social conditions. Therefore, it is crucial to identify the specific factors that directly impact their capability to improve the digital proficiency of primary school teachers in this area. This topic remains unexplored, although it is imperative to conduct a study on it. The objective of this paper is to identify the elements that impact the digital skills of primary school teachers in the mountainous areas of northern Vietnam. The results of this study have the potential to contribute to the recommendation of relevant policies, training programs and support efforts that are targeted at improving the digital capabilities of teachers and developing better learning environments for students attending primary schools in this particular geographical location.

Two questions were considered to conduct this research:

1) How many different factors go into determining the level of digital competence that primary school teachers in the hilly region of Northern Vietnam possess? What are those factors?

2) What is the extent of the influence that each factor has on the knowledge and abilities of primary school teachers in the mountainous region of Vietnam in relation to digital technology?

2. Research Methodology

2.1. Research Design

The study was conducted on primary school teachers from all provinces in the mountainous region of northern Vietnam, including Quang Ninh, Lang Son, Cao Bang, Bac Kan, Bac Giang, Thai Nguyen, Tuyen Quang, Yen Bai, Lao Cai, Son La, Hoa Binh, Ha Giang, Dien Bien and Lai Chau. Teachers in the provinces come from many different primary schools.

We designed questions and sent them to survey participants in these provinces through the social network Zalo. The survey was conducted in two weeks from August 15, 2023 to August 30, 2023. The number of survey participants is expected to be about 500. We received 391 responses of which we eliminated 39 cases (accounting for 7.4%) with similar answers to all questions. 92 cases (accounting for 25.6%) were also eliminated due to answers of almost agreement or absolute disagreement (only choose options 1,2 or 4.5). Finally, the data included in the analysis were 260 cases (accounting for 67%).

2.2. Participants

260 cases were selected to analyze the survey results. We examined and analyzed several factors including gender, training level, age and years of teaching experience. Table 1 provides an overview of the factors' distribution.

Table 1. Information on the participants' demographics (N = 260).

General information	Frequency	Percentage
Gender		
Female	223	85.8
Male	37	14.2
Level of education		
Vocational training	43	16.5
Undergraduate	212	81.5
Graduate	5	1.9
Age		
Under 30	85	32.7
31 – 40	61	23.5
41 – 50	100	38.5
Over 50	14	5.4
Experiences (years)		
Under 5	95	36.5
5 – 10	15	5.8
11 – 20	50	19.2
Over 20	100	38.5
Total	260	100%

In terms of gender, the study revealed that the percentage of female teachers was 85.8% while the percentage of male teachers was 14.2%. These findings indicate a higher representation of females in the surveyed group. In terms of qualifications, the majority of teachers held university degrees comprising 81.5% of the total participants. The next largest group possessed a college education, accounting for 16.5% of the sample followed by those with postgraduate education making up 1.9% of the participants. This distribution aligns with the Vietnam Education Law of 2019 which mandates a university level qualification for primary school teachers. Before this, the standard requirement was a college-level qualification. In terms of age, the age group between 41 and 50 years had the highest proportion representing nearly 40% of the total participants. Teachers under the age of 30 and those between the ages of 31 and 40 accounted for approximately 33% and 24% of the sample, respectively. The group over 50 years old had the lowest representation comprising only about 5% of the total participants. In terms of work experience, teachers with more than 20 years of experience constituted the largest proportion making up nearly 39% of the total participants. An additional major percentage which accounted for around 37% of the sample was comprised of individuals who had less than five years of experience. Approximately 19% of the participants were members of the group with 11 to 20 years of experience while the group with 5 to 10 years of experience had the lowest percentage accounting for only about 6% of the total participants overall.

2.3. Research Instruments

The survey questionnaire used in this study was bifurcated into two sections to gather the requisite data. The initial section of the questionnaire was specifically crafted to gather broad information while the subsequent section

was tailored to gather data on the factors influencing the digital abilities of primary school teachers in the northern mountainous region of Vietnam (Rungsinanont, 2020).

The first section of the questionnaire contained four general information items which included gender, degree of education, age and years of experience.

This second part consisted of a questionnaire that was prepared using a rating scale structure. 28 questions were used to identify factors affecting the digital competencies of primary school teachers in the northern mountainous region of Vietnam (see Table 2). Survey participants give their personal opinions by choosing their level of agreement on a Likert scale from 1 to 5 (1 =disagree , 2 = tend to disagree, 3 =neutral , 4 = tend to agree and 5 = completely agree).

The questionnaire was built with 28 specific questions as shown in Table 2.

Table 2. Survey questionnaires.

Variables	Observation variables
Q01	The school promulgates a plan to organize teaching to apply digital transformation.
Q02	The school promulgates regulations on teaching organizations applying digital transformation.
Q03	A content management system for online learning (LCMS) and online learning management system (LMS) are implemented by the institution.
Q04	The school has a specialist support person in digital technology.
Q05	I have a computer and personal internet data.
Q06	The school is equipped with projection equipment, auxiliary equipment for teaching-learning and Internet connection.
Q07	The school has a studio (Including computers, equipment to support the construction of digital learning materials and electronic lectures).
Q08	I urge students to get involved in the development of online educational materials.
Q09	I adapt and modify particular digital materials using pertinent criteria (Such as my learning objectives, the unique needs of my students and my teaching style).
Q10	I use digital materials such as mind maps, videos, quizzes and multimedia presentations to aid in my instruction
Q11	My colleagues and I work together to provide digital content.
Q12	I use the internet (Search engines, digital archives, webpages, specialist blogs, etc.) to identify and sort through different digital resources.
Q13	I use a variety of search techniques to locate online materials that support my objectives.
Q14	I assess the quality of digital resources using pertinent standards (Such as source authenticity, dependability, and quality, among others).
Q15	I can design lectures using PowerPoint.
Q16	I can analyze the program to select teaching content that can be applied digital resources.
Q17	I can select and evaluate the effectiveness of digital learning materials used in the teaching process.
Q18	I can use teaching methods and characteristics of learners when selecting and using learning materials.
Q19	When I teach, I make use of interactive digital resources and tools (Such as Mentimeter or Kahoot, as well as interactive tests like Quizlet and Quizzes).
Q20	I create cutting-edge teaching techniques that enhance learning using digital resources.
Q21	I use digital tools such as self-assessment questions, online diaries, electronic records and learning outcome documents into my instruction to assist students in organizing, monitoring, and reflecting on their own learning.
Q22	I make use of technology in order to strengthen the relationship that exists between the school and the parents.
Q23	I instruct students on how to co-build and generate resources, information and material through collaboration and teamwork methods using digital technology.
Q24	I use digital technology to design learning spaces that encourage or assist students in acquiring higher-order thinking and problem-solving abilities.
Q25	I help students create their own digital learning materials (Photography, video) during the learning process.
Q26	I work hard to improve my abilities to instruct using digital technology.
Q27	I use technology to take advantage of training options (e.g., massive open online courses, webinars, and online courses).
Q28	I take advantage of possibilities for instructional technology training but in a conventional manner (In -person classes).

Survey participants provide their personal opinions in the questionnaire and data is collected only once. Table 3 shows the number of links to question reliability determined by the alpha coefficient (Cronbach's alpha coefficient is 0.922) using SPSS software version 25.

Table 3. Cronbach's alpha coefficient for reliability.

Cronbach's alpha	N of items
0.922	28

This result is considered very good for a survey tool set based on the evaluation criteria listed in Table 4.

Table 4. Cronbach's alpha coefficient which measures the degree of internal consistency.

Cronbach's alpha	Internal consistency
$0.9 \leq \alpha$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Source: Cronbach's alpha coefficient for internal consistency (George & Mallery, 1999)

2.4. Data Analysis

Exploratory factor analysis (EFA) was employed to ascertain the factors that influence the digital competencies of primary school educators residing in the mountainous regions of northern Vietnam. EFA enables us to uncover and comprehend the underlying elements and structures inherent in this particular aspect of teachers and students.

EFA assists us in identifying significant factors that influence teachers' digital competencies by collecting data on potential variables associated with teachers' competence in fostering students' digital competencies (Hair, Black, Babin, & Anderson, 2009). We can propose teacher development and training programs that enhance teaching practices and ultimately create a more favorable learning environment for primary school students through the identification of key factors. The tool used to survey the factors affecting teachers' digital competencies draws references from various sources.

We employed the multivariate regression analysis method to assess the significance of each factor. We employed the multivariate regression analysis method for the purpose of determining the order of effect of independent variables on the dependent variable. This equation took into consideration the unit homogeneity and the standard deviation of the variables that were included in the regression model (Nimon & Oswald, 2013). The normalized regression equation can be represented as follows:

$$Y = \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_i X_i + \varepsilon$$

Where

Y is the dependent variable (teachers' digital competencies).

X_1, X_2, X_i are independent variables.

$\beta_1, \beta_2, \beta_i$ are normalized regression coefficients.

ε: is residual.

3. Results and Discussion

The exploratory factor analysis (EFA) method was employed using 28 survey questions with Varimax rotation. The eigenvalues of each factor were extracted from the data analysis performed using SPSS software. The Kaiser-Meyer-Olkin (KMO) index was applied, and the result was a value of 0.893 (see Table 5 for further information) regarding the appropriateness of the sample for analysis. This value surpasses the recommended thresholds proposed by Kaiser (1974) of 0.6 (Kaiser, 1974) and Kim and Mueller (1978) of 0.5 (Kim & Mueller, 1978) thereby affirming the suitability of the sampling for the factor analysis.

Table 5. KMO and Bartlett's test.

Kaiser-Meyer-Olkin measure of sampling adequacy		0.890
Bartlett's test of sphericity	Approx. chi-square	3714.566
	Df	378
	Sig.	0.000

The KMO measure of sampling adequacy is used to evaluate the appropriateness of a data sample for factor analysis. The KMO values range from 0 to 1 with higher values suggesting a higher level of appropriateness for factor analysis. In this case, the KMO value is determined to be 0.890 suggesting that the data sample exhibits a relatively high degree of relevance for conducting factor analysis. An acceptable KMO value is typically above 0.7, which permits the execution of factor analysis. On the other hand, Bartlett's test of sphericity tests the hypothesis regarding the sphericality of the correlation matrix.

In the event that the p (sig.) value is lower than a preset threshold which is often established at 0.05, there is sufficient evidence to reject the null hypothesis and move forward with aspect analysis. This particular occurrence has a p (sig .) value that is stated to be 0.000 which is lower than the threshold value of 0.05. This indicates that there is ample evidence to support the conduct of factor analysis.

It is appropriate to proceed with factor analysis using the provided data sample based on the results of both analyses. We performed that analysis and obtained results corresponding to the following 7 suggested factors (see Table 6).

Table 6. Eigenvalue and total variance elements that are explained.

Component	First eigenvalues			Squared loadings' extraction sums			Totals of squared loadings rotation
	Entire	Proportion of variance	Total percentage	Entire	Proportion of variance	Total percentage	Total
1	9.503	33.941	33.941	9.503	33.941	33.941	15.729
2	2.476	8.841	42.782	2.476	8.841	42.782	25.792
3	2.003	7.155	49.937	2.003	7.155	49.937	34.984
4	1.501	5.359	55.296	1.501	5.359	55.296	43.511
5	1.159	4.140	59.437	1.159	4.140	59.437	51.801
6	1.065	3.805	63.241	1.065	3.805	63.241	59.627
7	1.042	3.722	66.964	1.042	3.722	66.964	66.964
8	0.852	3.044	70.008	-	-	-	-

Table 6 presents the important elements that have an impact on the digital abilities of primary school teachers in the mountainous regions of northern Vietnam.

These factors were derived from 28 survey questions, each with an eigenvalue greater than 1. Collectively, these questions account for 66.964% of the variance in the factors affecting teachers' digital competencies while the remaining variance is attributed to other factors. The impact levels of the identified factors are as follows: factor 1 (33,941%), factor 2 (8.841%), factor 3 (7.155%), factor 4 (5.359%), factor 5 (4,140%), factor 6 (3.805%) and factor 7 (3.722%).

We define a rotation factor matrix resulting in the following findings providing further foundation for naming and identifying factors (see Table 7).

Table 7. Rotation factor matrix.

Variables	Factor						
	1	2	3	4	5	6	7
Q21	0.804						
Q23	0.787						
Q24	0.718						
Q22	0.676						
Q20	0.672						
Q25	0.659						
Q19	0.634						
Q16		0.736					
Q17		0.718					
Q18		0.678					
Q15		0.636					
Q05			0.762				
Q04			0.752				
Q06			0.685				
Q07			0.568				
Q26				0.708			
Q27				0.689			
Q28				0.673			
Q09					0.777		
Q10					0.682		
Q11					0.619		
Q08					0.582		
Q02						0.823	
Q01						0.778	
Q03						0.674	
Q12							0.746
Q13							0.732
Q14							0.635

Consequently, this discovery allowed us to identify the essential factors that impact the digital skills of primary school teachers in the mountainous areas of northern Vietnam. Each factor can be named based on the variables with the highest load factor (Hair et al., 2009). Specifically, we identified 7 factors with specific observed variables as follows (see Table 8).

Table 8. Naming the factors.

Variables	Observation variables	Loading
Component 1: The ability to integrate digital technology into teaching		
Q21	I use digital tools such as self-assessment questions, online diaries, electronic records and learning outcome documents into my instruction to assist students in organizing, monitoring and reflecting on their own learning.	0.804
Q23	I instruct students on how to co-build and generate resources, information and material through collaboration and teamwork methods using digital technology.	0.787
Q24	I use digital technology to design learning spaces that encourage or assist students in acquiring higher-order thinking and problem-solving abilities.	0.718
Q22	I make use of technology in order to strengthen the relationship that exists between the school and the parents.	0.676
Q20	I create cutting-edge teaching techniques that enhance learning using digital resources.	0.672
Q25	I help students create their own digital learning materials (Photography, video) during the learning process.	0.659
Q19	When I teach, I make use of interactive digital resources and tools (Such as mentimeters or Kahoot as well as interactive tests like Quizlet and Quizzes).	0.634
Component 2. The ability to choose teaching content that has the opportunity to use digital technology		
Q16	I can analyze the program to select teaching content that can be applied digital resources.	0.736
Q17	I can select and evaluate the effectiveness of digital learning materials used in the teaching process.	0.718
Q18	I can use teaching methods and the characteristics of learners when selecting and using learning materials.	0.678
Q15	I can design lectures using PowerPoint.	0.636
Component 3. Conditions for digital transformation in teaching and learning activities		
Q05	I have a computer and personal internet data.	0.762
Q04	The school has a specialist support person in digital technology.	0.752
Q06	The school is equipped with projection equipment, auxiliary equipment for teaching, learning and internet connection.	0.685
Q07	The school has a studio (Including computers, equipment to support the construction of digital learning materials and electronic lectures).	0.568
Component 4. Professional development needs of teachers		
Q26	I work hard to improve my abilities to instruct using digital technology.	0.708
Q27	I use technology to take advantage of training options (e.g., MOOCs, webinars and online courses).	0.689
Q28	I take advantage of possibilities for instructional technology training but in a conventional manner (In -person classes).	0.673
Component 5. Ability to create digital resources		
Q09	I adapt and modify particular digital materials using pertinent criteria (Such as my learning objectives, the unique needs of my students and my teaching style).	0.777
Q10	I use digital materials such as mind maps, videos, quizzes and multimedia presentations to aid in my instruction.	0.682

Variables	Observation variables	Loading
Q11	My colleagues and I work together to provide digital content.	0.619
Q08	I urge students to get involved in the development of online educational materials.	0.582
Component 6. School policy		
Q02	The school promulgates regulations on teaching organizations applying digital transformation.	0.823
Q01	The school promulgates a plan to organize teaching to apply digital transformation.	0.778
Q03	A content management system for online learning (LCMS) and online learning management system (LMS) are implemented by the institution.	0.674
Component 7. Ability to select digital resources		
Q12	I use the Internet (Search engines, digital archives, webpages, specialist blogs, etc.) to identify and sort through different digital resources.	0.746
Q13	I use a variety of search techniques to locate online materials that support my objectives.	0.732
Q14	I assess the quality of digital resources using pertinent standards (Such as source authenticity, dependability, and quality among others).	0.635

In addition, to confirm the reliability of the factors and observed variables identified, we studied the Cronbach's alpha system of each factor and obtained the following results (see Table 9).

Table 9. The Cronbach's alpha

Factors	The quantity of variables	Cronbach's alpha
The ability to integrate digital technology into teaching.	7	0.895
The ability to choose teaching content with the opportunity to use digital technology.	4	0.836
Conditions for digital transformation in teaching and learning activities.	4	0.760
Professional development needs of teachers.	3	0.756
Ability to create digital resources.	4	0.749
School policy	3	0.785
Ability to select digital resources.	3	0.734

According to the data presented in Table 9, all of the factors have Cronbach's alpha coefficients that are higher than 0.70.

The factors that affect the digital capacity of primary teachers in the hilly regions of northern Vietnam are reliable in terms of their size and influence. The findings from the model summary (see Table 10), Analysis of Variance (ANOVA test) (see Table 11), and coefficients (see Table 12) provide a foundation for determining the elements that influence teachers' digital abilities.

Table 10. Model summary[b].

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.999[a]	0.999	0.999	0.59715

Note: [a]: Predictors: (Constant).
[b]. Dependent variable: Total.

Table 11. ANOVA[a].

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	69999.290	7	9999.899	28043.183	0.000[b]
	Residual	89.860	252	0.357	-	-
	Total	70089.150	259	-	-	-

Note: [a]. Dependent variable: Total.
[b]. Predictors: (Constant).

Analysis of variance (ANOVA) results show that the significance level of 0.000 is lower than the conventional threshold of 0.05. This proves that the regression model is suitable for the observed data.

Table 12. Coefficients.

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	100.650	0.037	-	2717.793	0.000
	The ability to integrate digital technology in teaching.	8.983	0.037	0.546	242.105	0.000
	The ability to choose teaching content with the opportunity to use digital technology.	5.618	0.037	0.342	151.407	0.000
	Conditions for digital transformation in teaching and learning activities.	6.171	0.037	0.375	166.308	0.000
	Professional development needs of teachers	5.332	0.037	0.324	143.713	0.000
	Ability to create digital resources.	5.951	0.037	0.362	160.376	0.000
	School policy	5.473	0.037	0.333	147.506	0.000
	Ability to select digital resources	5.111	0.037	0.311	137.745	0.000

The standardized regression equation determining the numerical competencies of primary teachers in northern mountainous areas of Vietnam is based on the research results:

In Vietnam's northern hilly regions, primary school teachers' proficiency with digital technology (Y) = 0.546 * ability to integrate digital technology in teaching + 0.375*, conditions for digital transformation in teaching and

learning activities + 0.362 *, ability to create digital resources + 0.342 *, ability to choose teaching content with opportunities to use technology + 0.324*, professional development needs of teachers + 0.333 *, school policy + 0.311 * and ability to choose digital resources + ε.

The regression equation demonstrates that the digital capacity of primary teachers in the hilly regions of northern Vietnam is influenced by the following independent factors in descending order of impact: proficiency in incorporating digital technology into instructional practices, prerequisites for the digitalization of teaching and learning activities, the capacity to develop digital learning materials, the capability to select educational content with the potential for technology integration, teachers' professional development requirements, school policies and the capacity to choose digital materials.

4. Conclusion

The purpose of this study is to investigate the numerous elements that have an impact on the digital competencies of primary school teachers in the hilly regions of northern Vietnam. Some of the most important aspects that have been found are the capacity to incorporate digital technology, the selection of appropriate material, the existence of favorable conditions for digital transformation, the requirements for professional development, the production of digital resources and the policies of the school. Teachers must possess professional knowledge and skills in using digital technology in order to enhance their digital competencies. The integration of digital technology into the teaching process fosters an interactive learning environment and promotes the development of arithmetic skills. The selection of teaching content that aligns with digital technology is crucial for ensuring optimal learning outcomes. The provision of suitable conditions for implementing digital transformation as well as support from schools is of paramount importance. Adequate information technology and telecommunications infrastructure are necessary to facilitate the integration of digital technology. Training programs and professional support assist teachers in adopting digital technology with flexibility. The creativity exhibited by teachers in the creation of digital resources plays a significant role in the learning process. Developing digital resources that are suitable for the content being taught and the age of the students enhances interest and interaction within the classroom. Lastly, school policies should establish a supportive environment and encourage the utilization of digital technology. This includes providing training opportunities, resources and recognizing the efforts of teachers in driving digital transformation forward.

5. Recommendations

Digital competence has become a crucial skill that individuals must possess to thrive in the 21st-century digital world (Romero-García, Buzón-García, & De Paz-Lugo, 2020). In the context of the 4.0 revolution, teachers cannot afford to lack digital competence.

According to Ayanwale (2022) teachers are willing to incorporate technology into their respective classrooms (Ayanwale, Sanusi, Adelana, Aruleba, & Oyelere, 2022). School administrators play a vital role in providing a clear digital transformation strategy to guide schools in effectively integrating technology and aligning teachers' efforts towards a common goal (Kakavas & Ugolini, 2019). The capability of incorporating digital technology into the classroom is widely regarded as an essential component for teachers. It is necessary for teachers to have Content Knowledge (CK), Pedagogical Knowledge (PK) and Technology Knowledge (TK) in order for integration to be successful (Mishra & Koehler, 2006). Furthermore, teachers must actively embrace the use of technology (Davis, 1989). There are a variety of advantages that come with integrating technology into the classroom. Some of these advantages include the enhancement of interaction between teachers and students, the encouragement of creative thinking and the development of mathematical skills. Nevertheless, it is required to have flexibility, interaction and accessibility on the individual, group and societal levels in order for the implementation to be successful (Lawrence & Tar, 2018).

Secondly, it is imperative to establish conducive conditions for digital transformation in teaching and learning activities. They must be provided with appropriate technology infrastructure, software and digital learning materials to enable teachers to effectively implement digital transformation. Lawrence and Tar (2018) have identified several barriers that hinder the development of teachers' digital competencies, including limitations in infrastructure, a lack of training, inadequate access and insufficient technical support (Lawrence & Tar, 2018). Therefore, local authorities and schools must invest in the construction and development of infrastructure while also focusing on training teachers, adjusting curricula and continuously evaluating progress (Nguyen, 2023). These efforts are essential to ensure the comprehensive development of teachers' digital competencies (Chen, Wang, Kirschner, & Tsai, 2018). Badia, Meneses, Sigalés, and Fàbregues (2014) argue that the cognitive effectiveness of digital technology, the presence of educational information technology curricula and robust technological infrastructure (including internet access within and outside schools) significantly contribute to teachers' digital competencies (Badia et al., 2014).

Thirdly, it is essential to foster the creative utilization of digital resources by teachers, including videos, online lectures, educational software and mobile apps in order to foster engaging and interactive learning environments. The effectiveness of digital content platforms such as YouTube relies on the creativity exhibited by individual content creators, as well as the efficiency of content distribution (Qian & Jain, 2022). Encouraging teachers to actively engage in the creation of digital content will also contribute to the effective utilization of technology in teaching (Ivers & Barron, 2014). Moreover, it is crucial to create opportunities for teachers to select teaching content that incorporates the use of technology. Schools should provide an enabling environment for teachers to participate in the selection process of teaching content, specifically content that integrates technology, thereby allowing them to incorporate technology into their instructional practices. This approach empowers teachers to embrace technology as a means to enhance the teaching and learning experience.

Fourthly, schools should make it a priority to invest in technology-related training and professional development opportunities for teachers in order to improve their ability to make effective use of technology. It is necessary for school leaders and policymakers to have a distinct understanding of the ways in which technology can be utilized in order to effectively support and raise learning outcomes. The ability to drive digital

transformation, define goals and cultivate an environment that is supportive and favorable to change is something that they should display as strong leadership abilities. Among the key reasons why teachers do not routinely include computers in their classroom activities, one of the most important is that they do not have sufficient preparation for the utilization of technology. Therefore, it is crucial for teachers to participate in professional development programmes in order to obtain the necessary skills and knowledge to successfully use and integrate technology in order to improve the learning outcomes of theirstudents . Teachers should be equipped with the ability to properly use technology into their teaching techniques through the training that is being provided.

Fifthly, it is vital to make adjustments to the methods and regulations of the school in order to motivate and encourage teachers to include technology in the process of teaching and learning. Institutional-level barriers such as limitations in infrastructure, insufficient training, limited access and inadequate technical support often impede the development of teachers' digital competencies (Lawrence & Tar, 2018). Consequently, schools should conduct thorough reviews and make necessary adjustments to their mechanisms and policies. This includes providing support, guidance and resources to assist teachers in selecting and using appropriate digital resources that align with their specific teaching needs. By doing so, schools can facilitate the effective integration of technology into the educational landscape.

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