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Determinant Factors Affecting the Development of Digital Competencies of Primary School Students

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ABSTRACT: The global trend of Industry 4.0 has significantly accelerated the digital transformation process. In the field of education, digital transformation is bringing substantial changes to the educational policies and orientations of many countries, especially developing nations. This necessitates equipping students with comprehensive knowledge, skills, and digital competencies to enhance teaching quality and meet future societal demands, even starting from primary education. Although the development of digital competence is expected to yield positive outcomes, it also poses considerable challenges for educators in terms of thorough preparation and policy formulation. The purpose of this study is to explore the factors influencing the development of digital competence in primary school students. The validity and reliability of the measurement tools were assessed using SPSS analysis to perform exploratory factor analysis (EFA), determine reliability, and extract prominent factors. Factor analysis using Varimax rotation retained 16 items in the questionnaire. Analysis of the results from 86 survey samples revealed three factors influencing the development of digital competence, with a KMO measure of sampling adequacy of 0.903; Bartlett's test indicated a Chi-Square significance level of 0.000 < 0.05. These findings provide direction for teachers in identifying priorities to form and develop digital competence in primary school students.

KEYWORDS: Digital competence, Education, Primary students; EFA; Determinants

I. INTRODUCTION

The digital scientific and technological revolution is increasingly exerting profound impacts on all aspects of economic and social life, including work, education, entertainment, and social relations. Education is not exempt from this trend; it is one of the fields that any government prioritizes, directs, and develops. During the digital transformation phase, education, despite being presented with numerous opportunities, also faces the risk of losing these opportunities if both teachers and students do not keep pace with changes related to the use of digital resources and strategies to adapt to the fluctuations in the digital society [1]. Therefore, the formation and development of digital competence for future citizens/students from their early education years is an urgent requirement and should be an integral part of educational policy [2].

Digital competence can be defined as the ability to use technology effectively to optimize our daily lives [3,4,5]. On this basis, future generations of digital citizens will be fully equipped with the knowledge, skills, and competences necessary to participate in a digital society that is expected to involve a diverse range of high technology, modern science and technology integrating many smart features, and requiring the ability to interact with multimedia on technological platforms. Currently, the development of digital competence in the field of education is being actively pursued by researchers with the aim of fulfilling the demand for high-quality human resources in society. Accordingly, the digital competence of primary school students needs to be formed and developed to adapt to technological advancements and the modernization of education. However, the collaboration of the entire society, including teachers, students, families, communities, and the government, to contribute to the development of primary school students' digital competence is not yet high and lacks uniformity. In fact, there have been studies related to proposing digital competence frameworks and teaching methods to develop digital competence. Among these, the European Framework for Digital Competence for Citizens - DigComp is quite popular and is utilized for assessment with 22 competences distributed across five areas: Information and Data Literacy; Communication and Collaboration; Digital Content Creation; Safety; and Problem Solving [6]. Additionally, UNESCO's digital competence framework is also one of the most comprehensive frameworks. It categorizes competences into seven groups, each divided into specific sub-competences: Device and Software Operation; Information and Data Literacy; Communication and Collaboration; Digital Content Creation; Safety; Problem Solving; and Career-related Competences [7]. A study in Ireland on the experiences of primary school students using Minecraft Education (ME) also demonstrated how digital competence has been enhanced, particularly in terms of their improved use of digital devices

during project implementation [8]. The extensive research on digital competence has highlighted its significant role and impact across various fields of social life. Nonetheless, there is still a lack of research related to the formation and development of digital competence for primary school students. This situation prevents educators from identifying and establishing policies, orientations, and priorities in teaching to create a generation of digital citizens capable of effectively adapting to the numerous changes in the digital society.

This paper aims to investigate the factors influencing the formation and development of digital competence in primary school students using the exploratory factor analysis method. This approach seeks to identify the key groups of factors that play a decisive role in shaping this ability in learners, based on survey responses collected from primary school teachers teaching various classes. These findings will serve as a foundation for teachers to identify priorities in their interactions with students to foster and develop digital competence throughout the teaching and educational activities organized in schools. Additionally, it will provide a basis for experts to conduct further in-depth research in this field in the future.

II. MATERIALS AND METHODS

A. Participants

Primary data was collected through a questionnaire. The information about the survey respondents included gender, age, professional qualifications, grade levels being taught, years of service, frequency of information technology usage, and duration of each usage session. The survey was created on Google Forms and distributed via a link to teachers in primary schools in urban areas of Central Vietnam through social networks (such as Zalo, Facebook, etc.) from January 3, 2024, to February 29, 2024. The estimated number of teachers surveyed was 140, with 122 responses, yielding a response rate of 87.1%. After data collection, the research team excluded 36 invalid samples due to incomplete questionnaires or identical responses to all questions. The final number of samples used for analysis was 86 (70.5%).

Table 1 summarizes the data from the online survey. The proportion of male respondents was 8.14%, while female respondents accounted for 91.86%. The professional qualifications of the respondents were as follows: college (6.98%), university (89.53%), and postgraduate (3.49%). The average age of the respondents was primarily between 35 and 44 years old (40.70%), followed by over 45 years old (34.89%), 26 to 34 years old (18.60%), and 22 to 25 years old (5.81%). The respondents were teaching grade 4 (23.26%), grade 2 (20.93%), grade 5 (19.77%), grade 3 (18.60%), and grade 1 (17.44%), with the majority having more than 15 years of experience (63.95%), 2 years of experience (9.30%), and 3 to 5 years of experience (3.49%). The frequency of information technology usage during the survey period was primarily daily (89.54%), followed by more than 12 times per month (5.81%), 7 to 12 times per month (2.33%), 3 to 6 times per month (1.16%), and 1 to 2 times per month (1.16%). The duration of each information technology usage session was most commonly 1 to 2 hours (40.70%), followed by more than 4 hours (32.55%), 3 to 4 hours (17.77%), and the least common was under 1 hour (6.98%).

Table 1. Demographic Information of Participants (N = 86)

Variable		***Frequency***	***Percentage***
Gender	Male	7	8.14
	Female	79	91.86
Age	22 - 25 years old	5	5.81
	26 - 34 years old	16	18.60
	35 - 44 years old	35	40.70
	Over 45 years old	30	34.89
Professional qualification	University	77	89.53
	Postgraduate	3	3.49
	College	6	6.98
Teaching class	Grade 1	15	17.44
	Grade 2	18	20.93
	Grade 3	16	18.60
	Grade 4	20	23.26
	Grade 5	17	19.77
Seniority	2 years experience	8	9.30
	3 - 5 years experience	3	3.49
	6 - 10 years experience	0	0.00
	11 - 15 years experience	20	23.26
	Over 15 years experience	46	63.95
Frequency of using the information technology	1-2 times/month	1	1.16
	3-6 times/month	1	1.16
	7-12 times/month	2	2.33
	More than 12 times/month	5	5.81
	Daily	77	89.54
Total time for each participation	Less than an hour	6	6.98
	1-2 hours	35	40.70

	3-4 hours	17	17.77
	More than 4 hours	28	32.55
Total		86	100%

B. Survey Instruments

The questionnaire used in the survey comprised 16 questions, selected and proposed by the authors based on the characteristics of teachers' awareness, skills, and external factors that could influence the formation and development of digital competence in primary school students (Table 2).

Table 2. Questionair (N = 16)

Q1	The technological capability of teachers affects students' awareness of technology use.
Q2	Teachers' ability to use technology can inspire the development of students' technological skills.
Q3	Teachers' ability to use technology helps form students' technological proficiency.
Q4	Interaction through technological environments during learning between teachers and students will help students develop digital competence.
Q5	The use of technology by classmates affects students' desire to access and use technology.
Q6	Trends in technology and digital use within schools influence students' demand for technology use.
Q7	Teachers' encouragement affects students' desire to use these technologies.
Q8	Teachers' awareness of the role of developing technological skills in students positively impacts the formation of their digital competence.
Q9	Teachers' understanding of the digital transformation context in education influences the orientation of digital competence development in students.
Q10	Teachers' awareness of the benefits of developing digital competence for students' future lives positively contributes to the cultivation of this competence in the classroom environment.
Q11	Policies promoting the role of technology and digital tools in the educational environment guide the development of digital competence in students.
Q12	School orientations toward digital transformation create an environment conducive to the development of digital competence in students.
Q13	The use of technology, technological applications, and proficiency in using digital tools by school leaders and department heads guide the movement to enhance digital competence for both teachers and students.
Q14	The school's provision of technological infrastructure (wired and wireless internet, projectors, screens, etc.) positively impacts the formation of digital competence in students.
Q15	The provision of interactive platforms in the online environment (software for school management, free educational software for teachers, online professional communities, etc.) positively impacts the formation of digital competence in students.
Q16	Technical training and support for technology use in schools positively impact the formation of digital competence in students.

A five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree) was used for each question.

C. Data Analysis

The exploratory factor analysis (EFA) method was used in the analysis of the collected data. This is a statistical analysis method used to reduce a set of many interdependent observed variables into a smaller set of variables (called factors) that are more meaningful but still contain most of the information content of the original set of variables [9]. The research team relied on EFA to identify the underlying structure of a group of related variables. It is assumed that each indicator in the set of indicators is a linear function of one or more common factors and a unique factor. The common factors are latent variables that cannot be observed and have an impact on more than one indicator in the set of indicators. The unique factor is a latent variable that is considered to affect only one indicator from a group of indicators and does not account for the correlation of the indicator [10].

The suitability of the measure for the 16 survey items was assessed using descriptive statistics before conducting EFA. In the descriptive statistics table, the research team calculated the mean value of all responses and the standard deviation (SD) for each question. Responses with mean values close to 1 or 5 were removed from the table as they could reduce the correlation standard among the remaining items [11]. After this step, normality in the distribution was checked using Skewness and Kurtosis tests. Once normality of the distribution was confirmed, exploratory factor analysis was performed using SPSS 26 (Statistical Package for the Social Sciences).

III. RESULTS AND DISCUSSION

The exploratory factor analysis process begins by collecting the characteristic values for each factor. Then, the Kaiser-Meyer-Olkin (KMO) measure is used to assess the adequacy of the data for factor analysis [12]. The KMO ranges from 0 to 1, with values greater than 0.5 being considered adequate for EFA [13]. Bartlett's test of sphericity is employed to determine whether the

correlations between the questions are strong enough for meaningful factor analysis [9]. Further analysis is only conducted if Bartlett's test is statistically significant (sig. < 0.05).
Initially, 16 questions were proposed. After conducting several verification procedures, all questions were deemed eligible and retained for the exploratory factor analysis.

Table 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.903
Bartlett's Test of Sphericity	Approx. Chi-Square	938.088
	df	120
	Sig.	.000

EFA was conducted on 16 questions using Varimax rotation. The results from the SPSS software allowed the research team to extract characteristic values for each factor. The Kaiser-Meyer-Olkin measure confirmed the sampling adequacy for the analysis with a value of 0.903 (see Table 3), which is higher than the 0.6 recommended by Kaiser [14] and 0.5 by Kim [13].

Bartlett's test of sphericity yielded $\chi 2\ (120) = 938.088$, $\rho < 0.000$, indicating that the correlations between the question items are sufficiently large for conducting exploratory factor analysis.

A. Exploratory Factor Analysis

The data in Table 4 indicates that three principal factors were formed from the 16 questions with eigenvalues greater than 1. In other words, these 16 questions account for 67.251% of the significance of the factors affecting the development of digital competence in primary school students, with the remaining variance attributed to other factors. The percentage of variance explained by each factor is as follows: factor 1 (54.240%), factor 2 (6.751%), and factor 3 (6.260%).

Table 4 Eigenvalue, Total Variance Explained of Factors

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.678	54.240	54.240	8.678	54.240	54.240	4.747	29.671	29.671
2	1.080	6.751	60.991	1.080	6.751	60.991	3.065	19.154	48.825
3	1.002	6.260	67.251	1.002	6.260	67.251	2.948	18.425	67.251
4	.923	5.766	73.017						
5	.707	4.417	77.434						
6	.650	4.060	81.494						

Extraction Method: Principal Component Analysis.

Table 5 shows the loadings for each item associated with a factor. Factor loadings provide a description of each factor and the structure within the set of variables. For interpretative purposes, factor loadings of .30 or higher are considered significant with a sample size of 86 [9]. Using this loading threshold, we can observe that all loadings are significant. Furthermore, Table 6 reports that each variable has a significant loading on only one factor. Factor 1 comprises 10 variables, Factor 2 includes 3 variables, and Factor 3 contains 3 variables.

Table 5. Rotated Component Matrix[a]

	Component		
	1	2	3
VAR00004	.782		
VAR00002	.779		
VAR00003	.729		
VAR00001	.711		
VAR00007	.647		
VAR00008	.642		
VAR00009	.630		
VAR00010	.534		
VAR00012	.527		
VAR00013	.489		
VAR00005		.843	
VAR00006		.621	

VAR00011		.605	
VAR00016			.868
VAR00014			.751
VAR00015			.554

Based on the general content of the variables, each factor can be named as shown in Table 6.

Table 6. Naming the Factors

Component 1: Teacher's knowledge, skills and attitude		***Loading***
Q4	Interaction through technological environments during learning between teachers and students will help students develop digital competence.	.782
Q2	Teachers' ability to use technology can inspire the development of students' technological skills.	.779
Q3	Teachers' ability to use technology helps form students' technological proficiency.	.729
Q1	The technological capability of teachers affects students' awareness of technology use.	.711
Q7	Teachers' encouragement affects students' desire to use these technologies.	.647
Q8	Teachers' ability to use technology helps form students' technological proficiency.	.642
Q9	Teachers' understanding of the digital transformation context in education influences the orientation of digital competence development in students.	.630
Q10	Teachers' awareness of the benefits of developing digital competence for students' future lives positively contributes to the cultivation of this competence in the classroom environment.	.534
Q12	School orientations toward digital transformation create an environment conducive to the development of digital competence in students.	.527
Q13	The use of technology, technological applications, and proficiency in using digital tools by school leaders and department heads guide the movement to enhance digital competence for both teachers and students.	.489
Component 2: Social influence		
Q5	The use of technology by classmates affects students' desire to access and use technology.	.843
Q6	Trends in technology and digital use within schools influence students' demand for technology use.	.621
Q11	Policies promoting the role of technology and digital tools in the educational environment guide the development of digital competence in students.	.605
Component 3: Facilitate condition		
Q14	The school's provision of technological infrastructure (wired and wireless internet, projectors, screens, etc.) positively impacts the formation of digital competence in students.	.868
Q15	The provision of interactive platforms in the online environment (software for school management, free educational software for teachers, online professional communities, etc.) positively impacts the formation of digital competence in students.	.751
Q16	Technical training and support for technology use in schools positively impact the formation of digital competence in students.	.554

B. Discussion and Limitations

Researching the factors influencing the development of digital competence in primary school students not only helps educators set important directions for forming and developing digital competence in students but also aids in developing educational strategies, thereby enhancing the quality of education during the digital transformation period. Three factors have been identified: knowledge, technological skills, attitudes of teachers and the school; the influence of the social environment; and favorable conditions. Based on this result, teachers can develop teaching methods, increase student engagement, and improve academic performance. From the analyzed factors, several suggestions are proposed as follows:

First, human factors in general, and teachers and schools in particular, are crucial in forming student competence. The collaboration between teachers' knowledge, skills, attitudes, and school leaders' orientations in using technology significantly impacts the formation and development of students' digital competence. Teachers and school leaders who are well-equipped with awareness, technological capabilities, and proficiency in using digital tools will positively contribute to developing this competence in the classroom environment.

Second, students' digital competence is also influenced by trends and policies in the social environment. This is where students develop the need to access and use technology through their peers, which then directs their development through educational policies.

Third, the study indicates that objective factors such as infrastructure, interactive online platforms, and technical training and support within schools positively impact the formation and development of digital competence in students. These factors motivate students to access, explore, and use technology, as they receive support in resolving technical issues encountered in the digital environment.

However, this study has some limitations. First, there is a limitation in sampling. Sampling teachers from primary schools in urban areas of Central Vietnam significantly affects the generalizability of the research results. Second, there is a limitation in the analytical method. Exploratory Factor Analysis (EFA) is a statistical method used to examine the structural validity and psychometric properties of a set of scales. However, EFA is not robust enough to test theoretical foundations; therefore, Confirmatory Factor Analysis (CFA) should be used in subsequent studies to validate the measurement model we proposed (three factors). Third, several other factors were not considered or analyzed in this study. There may be many factors directly affecting the development of digital competence in primary school students that were not observed and measured. These limitations will guide our future expanded research

IV. CONCLUSIONS

Educating students in digital competence is crucial for creating a generation of digital citizens capable of adapting to all fluctuations of the digital society in the future. The study proposed 16 question variables and distributed them to participants through social networks. Based on the analysis of 86 valid collected samples, the exploratory factor analysis results revealed three main factors influencing the development of digital competence in students: Teacher's knowledge, skills, and attitude; Social influence; and Facilitate condition. These findings can serve as a reference for other research or pose questions for subsequent studies by scholars interested in developing digital competence. Educators can utilize these findings to establish effective educational strategies for the future of higher education in Vietnam to form and develop digital competence in primary school students.

REFERENCES

1) Dias-Trindade, S., Moreira, J. A., & Ferreira, A. G. 2021. Evaluation of the teachers' digital competences in primary and secondary education in Portugal with DigCompEdu CheckIn in pandemic times. Acta Scientiarum-Technology, 43, e56383.
2) Stofkova, J., Poliakova, A., Stofkova, K. R., Malega, P., Krejnus, M., Binasova, V., & Daneshjo, N. 2022. Digital skills as a significant factor of human resources development. Sustainability, 14(20), 13117.
3) Rodríguez-García, A.; Raso Sánchez, F.; Ruiz-Palmero, J. 2019. Digital competence, higher education and teacher training: A meta-analysis study on the web of science. Pixel-Bit. Rev. Medios Educ. 54, 65–82.
4) Ferrari, A. DIGCOMP 2013. A Framework for Developing and Understanding Digital Competence in Europe; Publications Office of the European Union: Luxembourg.
5) INTEF. 2017. Common Framework of teaching digital competence V 2.0; Ministry of Education, Culture and Sports: Madrid, Spain.
6) Vuorikari Rina, R., Kluzer, S., & Punie, Y. 2022. DigComp 2.2: The Digital Competence Framework for Citizens-With new examples of knowledge, skills and attitudes (No. JRC128415). Joint Research Centre (Seville site).
7) Law, N. W. Y., Woo, D. J., De la Torre, J., & Wong, K. W. G. 2018. A global framework of reference on digital literacy skills for indicator 4.4. 2.
8) Slattery, E. J., Butler, D., O'Leary, M., & Marshall, K. 2023. Primary school students' experiences using Minecraft Education during a national project-based initiative: An Irish study. TechTrends, 1-13.
9) Hair, J.F., 2009. Multivariate data analysis.
10) Fabrigar, L.R. and D.T. Wegener, 2011. Exploratory factor analysis: Oxford University Press.
11) Kim, J., 2011. Developing an instrument to measure social presence in distance higher education. British Journal of Educational Technology, **42**(5): p. 763-777.
12) Tabachnick, B.G., L.S. Fidell, and J.B. Ullman, 2007. Using multivariate statistics. Vol. 5: Pearson Boston, MA.
13) Kim, J.-O. and C.W. Mueller, 1978. Factor analysis: Statistical methods and practical issues. Vol. 14: sage.
14) Kaiser, H.F. 1974. An index of factorial simplicity psychometrika. **39**(1): p. 31-36.