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The impact of digital transformation on the capabilities of university lecturers: The case of Da Nang City

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ABSTRACT: This study analyzes the impact of digital transformation on the capabilities of university lecturers in Da Nang City. Based on a theoretical overview and related studies, the article clarifies the relationship between digital transformation and lecturer capabilities through aspects such as digital infrastructure, organizational support, digital professional development, and innovation culture. The research results show that digital transformation has a positive impact on lecturer capabilities, with digital professional development and an innovation environment playing particularly important roles. Therefore, the article proposes several recommendations to improve the effectiveness of digital transformation in universities in Da Nang City, aiming to develop a faculty that is adaptable, creative, and better able to meet the demands of modern higher education.

Keywords: Digital transformation; Faculty competence; Higher education; Da Nang City.

1. INTRODUCTION

Digital transformation is profoundly changing the way higher education operates globally. In universities, this process goes beyond simply introducing technology into classrooms or digitizing materials; it also involves restructuring teaching, research, academic administration, and faculty-student interaction. Research by Bygstad et al. shows that digital transformation in higher education is linked to the formation of a new digital learning space, where the roles of faculty and students are redefined to be more flexible, interactive, and technology-driven (Bygstad et al., 2022). Similarly, recent studies emphasize that digital transformation in universities should be understood as a strategic change at the organizational level, not just a single technical improvement in teaching (Antonopoulou et al., 2023; Carmo et al., 2025).

In this context, university lecturers become the central actors determining the success of digital transformation. While infrastructure and technological platforms create the material conditions for innovation, the competence of lecturers is the decisive factor in whether technology is translated into quality education, learning effectiveness, and academic innovation. A systematic review by Basilotta-Gómez-Pablos et al. indicates that research on the digital competence of university lecturers has developed rapidly over the past two decades, reflecting the growing awareness that lecturers' professional competence in the digital age needs to be re-evaluated in a more comprehensive way, encompassing technological skills, pedagogical competence, learning design capabilities, and continuous professional development (Basliotta-Gómez-Pablos et al., 2022). Similarly, Fernández-Batanero et al. assert that the digital competence of university lecturers is not only the ability to use tools, but also the ability to integrate technology into teaching activities in a meaningful way, consistent with learning objectives and learner characteristics (Fernández-Batanero et al., 2021).A recent and influential research direction is approaching faculty competence as a multidimensional construct within the digital education environment. Based on a comparison of competency frameworks and expert consultations, Tondeur et al. proposed a digital competency framework for university faculty with four major components: teaching practice, supporting learners in the digital society, faculty's own digital competence, and continuous professional development (Tondaur et al., 2023). This framework shows that digital transformation not only requires faculty to know how to use learning platforms or supporting software, but also demands that they redesign teaching activities, promote student digital engagement, and proactively adapt to the rapid changes in the educational environment. This view is further reinforced by Howard and Tondeur, who argue that the future of higher education will be linked to a flexible, blended model in which faculty digital competence is fundamental to maintaining quality education and sustainable academic innovation (Howard & Tondeur, 2023).

Besides affirming the central role of lecturers, many studies also show that the level of digital competence among this workforce is not truly uniform. A review by Revuelta-Domínguez et al. shows that the concept of teaching competence in the digital environment is still being developed and standardized, while the practice of lecturer training in many places still leans more towards operational skills than pedagogical innovation (Revuelta-Domínguez et al., 2022). A review of digital competence assessment in higher education by López-Núñez et al. also indicates that current measurement tools are quite diverse, but the general trend emphasizes the close relationship between lecturer competence and student learning quality (López-Núñez et al., 2024). This implies that digital transformation is only truly meaningful when it contributes to enhancing the actual capabilities of faculty, rather than simply increasing the presence of technology in the school.

Recent empirical studies have provided further evidence of a positive relationship between faculty digital competence and educational outcomes. Dang et al. showed that faculty digital competence positively influences the perceived learning value of students in higher education, thereby highlighting the crucial role of faculty in transforming technology investment into concrete educational value (Dang et al., 2024). Another study from the learner's perspective also showed that the majority of students perceived faculty digital competence as directly impacting their learning process, particularly in aspects of interaction, learning organization, and personalized support (de Obesso et al., 2023). Therefore, when researching digital transformation in universities, focusing on faculty competence is not only significant in terms of human resources but also directly related to the quality of teaching and learning experience.On a broader level, digital transformation in higher education is also being viewed as a comprehensive change in governance and organizational development strategy. Mukul et al., in a systems review, pointed out that current international research is increasingly shifting from viewing technology as a supporting tool to seeing digital transformation as a process of reforming the structure, culture, and operational model of educational institutions (Mukul et al., 2023). Petchamé et al. also showed that smart classroom models and hybrid learning formats are only effective when placed within a synchronized digital transformation ecosystem, where faculty are supported technically, pedagogically, and organizationally (Petchamé et al., 2023). Thus, faculty competence is both a result of the digital transformation environment and a condition for the digital transformation process to create a positive and sustainable impact in the institution.However, despite this topic receiving significant attention worldwide, several notable research gaps remain. Firstly, while many studies focus on describing the digital competence levels of faculty or developing measurement frameworks, the number of studies directly analyzing the impact of digital transformation at the organizational level on faculty competence is limited (Basliotta-Gómez-Pablos et al., 2022; Tondeur et al., 2023). Secondly, much of the existing evidence is drawn from European contexts or university systems already at a high level of digitalization, while the context of rapidly developing urban digital transformation in Southeast Asia, including Vietnam, has not been fully explored (López-Núñez et al., 2024; Carmo et al., 2025). Third, few studies address faculty competence in the context of simultaneous relationships with digital infrastructure, organizational support, innovation culture, and professional adaptability requirements within the same research model.

In Vietnam, digital transformation in higher education is progressing rapidly, driven by reforms in public administration, the expansion of blended learning, the development of digital learning materials, and the demand for improved human resource quality in the digital economy. In this context, Da Nang City is a particularly significant case study. It stands out for its smart city orientation, digital government, innovation, and the application of technology in public administration, and is also a key higher education center in the Central region. This context makes Da Nang a suitable location to investigate the impact of digital transformation on faculty capabilities, as the transformation process here is not limited to individual universities but is also driven by the city's overall digital development environment. From an academic perspective, studying the case of Da Nang can provide additional empirical evidence from a dynamic, rapidly changing local context that is not adequately reflected in current international publications.

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Based on the above arguments, this study was conducted to analyze the impact of digital transformation on the competence of university lecturers in Da Nang city. The article aims to clarify three main issues: firstly, systematizing the theoretical basis of digital transformation and lecturer competence in higher education; secondly, identifying the core dimensions of digital transformation that may affect lecturer competence; and thirdly, creating a foundation for building a research model suitable to the context of universities in Da Nang. Based on this, the study is expected to contribute both theoretically and practically, not only adding evidence to the research stream on digital transformation in higher education, but also suggesting a scientific basis for universities in Vietnam in designing policies for developing a faculty adapted to the digital environment (Bygstad et al., 2022; Dang et al., 2024; Mukul et al., 2023).

2. THEORETICAL FOUNDATION

Digital transformation is profoundly changing the way higher education operates globally. In universities, this process goes beyond simply introducing technology into classrooms or digitizing materials; it also involves restructuring teaching, research, academic administration, and faculty-student interaction. Research by Bygstad et al. shows that digital transformation in higher education is linked to the formation of a new digital learning space, where the roles of faculty and students are redefined to be more flexible, interactive, and technology-driven (Bygstad et al., 2022). Similarly, recent studies emphasize that digital transformation in universities should be understood as a strategic change at the organizational level, not just a single technical improvement in teaching (Antonopoulou et al., 2023; Carmo et al., 2025).

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expected to contribute both theoretically and practically, not only adding evidence to the research stream on digital transformation in higher education, but also suggesting a scientific basis for universities in Vietnam in designing policies for developing a faculty adapted to the digital environment (Bygstad et al., 2022; Dang et al., 2024; Mukul et al., 2023).

Research analysis framework

Based on the above theoretical arguments, the study constructs an analytical framework that views digital transformation as a high-order independent variable, reflected through four components: digital infrastructure and technology ecosystem, digital organizational leadership and support, digital professional development, and digital innovation culture. Faculty competence is the dependent variable, reflected through the following dimensions: core digital competencies, digital pedagogical competencies, digital research and academic collaboration competencies, and professional adaptability. This analytical framework ensures consistency with the Introduction because both stem from the perspective that digital transformation is a multi-dimensional organizational process, while faculty competence is a multi-component professional structure influenced by the institutional, technological, and cultural environment of the institution (Bygstad et al., 2022; Tondeur et al., 2023; Dang et al., 2024).

Academically, this analytical framework allows for the connection of two research streams that are often pursued relatively separately: research on digital transformation at the higher education level and research on the digital competence of faculty members. Practically, this framework is suitable for the context of Da Nang city, where universities operate in an urban environment with a high level of digital transformation promotion, thereby highlighting the significance of examining how digital transformation actually impacts the development of faculty competence.

3. RESEARCH METHODOLOGY

approach

This study employs a quantitative approach to analyze the impact of digital transformation on the competencies of university lecturers in the context of higher education institutions in Da Nang City. The choice of a quantitative approach stems from the research objective of testing the relationship between theoretical variables established from theoretical frameworks and literature reviews, and evaluating the impact of each component of digital transformation on lecturer competencies. This approach is suitable for research in the fields of educational management and organizational behavior, especially when the study requires quantifying abstract concepts such as digital transformation, digital competencies, digital pedagogical competencies, and professional adaptability.

In terms of design, the study was conducted using a structured questionnaire survey. The survey subjects were lecturers working at universities in Da Nang city. This group was chosen based on the fact that lecturers are directly affected by digital transformation in their teaching, research, and professional development activities, and are also the key determinants of the effectiveness of digital innovation in their universities. The questionnaire was developed based on scales inherited from previous international studies, then adjusted to suit the context of higher education in Vietnam and the case of Da Nang city.

The research process was conducted in two main steps. First, preliminary qualitative research was used to review the content of the measurement scale, refine the wording, and ensure contextual appropriateness through expert consultations or pilot interviews with several faculty members. Then, formal quantitative research was carried out using a large-scale survey to collect data for testing the model and research hypotheses. This approach ensures that the observed variables have both a solid theoretical basis and reflect the practical characteristics of the university environment in Da Nang.

Regarding sampling, the study targeted lecturers from various groups of schools, including public and private schools, and member training units within the higher education system in Da Nang city. Diversifying the survey subjects helps increase the representativeness and generalizability of the research results. The expected sample size should be appropriate for structural model analysis, typically a minimum of 300 observations to ensure the reliability of statistical tests, especially when the research model includes many latent variables and multiple observed variables.

Research model

Based on theoretical arguments and previous studies, the research model of this paper is constructed to view digital transformation as the independent variable and faculty competence as the dependent variable. In this model, digital transformation is approached as a multidimensional structure, reflecting the level of development and operation of the digital environment within the university. Faculty competence is also approached as a multi-component structure, reflecting the ability to effectively perform professional tasks in the context of digital education.

Specifically, the independent variable "digital transformation" is composed of four components. The first component is digital infrastructure and technology ecosystem, reflecting the adequacy, stability, and support capabilities of technology platforms, digital learning materials, learning data, and technical services within the school. The second component is digital organizational leadership and support, reflecting the role of strategic direction, resource allocation, innovation motivation, and facilitating faculty participation in the digital transformation process. The third component is digital professional development, reflecting the extent to which the school provides opportunities for continuous training, development, and learning for faculty in applying digital technology to teaching and research. The fourth component is digital innovation culture, reflecting the extent to which the work environment encourages experimentation, knowledge sharing, acceptance of innovation, and promotes a spirit of continuous learning.

The dependent variable "faculty competence" is composed of four main dimensions. The first dimension is core digital competence, representing the ability to use digital tools, platforms, and resources to support professional activities. The second dimension is digital pedagogical competence, representing the ability to design, organize, evaluate, and adjust learning activities in a digital or hybrid environment. The third dimension is digital research and academic collaboration competence, representing the ability to utilize databases, engage in academic collaboration, and disseminate research results through digital platforms. The fourth dimension is professional adaptability competence, representing the ability to continuously learn, proactively innovate, and adapt to the new demands of the digital educational environment.

Based on the above structure, the research model proposes a positive correlation between digital transformation and faculty competence. Simultaneously, the study examines the impact of each component of digital transformation on faculty competence, thereby clarifying which factor has a stronger influence in the context of universities in Da Nang city.

Hypothesis system

Based on the proposed research model, the study constructs a hypothesis system at two levels, consisting of a general hypothesis and component hypotheses.

The general hypothesis is established on the premise that digital transformation creates the environment, conditions, and motivation for faculty members to enhance their professional competence in the context of modern higher education. As universities promote the digitalization of teaching, administration, and academic development, faculty members have more opportunities to access technology, change their working methods, expand academic interaction, and improve their adaptability. Therefore, the general hypothesis is proposed as follows:

Hypothesis H1: Digital transformation has a positive impact on the capabilities of university lecturers in Da Nang city.

Besides the general hypothesis, the study further elaborates on four component hypotheses corresponding to the four dimensions of digital transformation.

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Digital infrastructure and a technological ecosystem are fundamental conditions for faculty members to conduct teaching, research, and academic networking in a digital environment. When a school has a stable technological platform, abundant digital learning materials, and effective technical support, faculty members will have more favorable conditions to enhance their technological capabilities and apply technology to their expertise. Therefore, the first hypothesis is established as follows:

Hypothesis H1a: Digital infrastructure and technology ecosystems have a positive impact on the capabilities of university lecturers in Da Nang city.

Leadership and support for digital organizations reflect the role of strategy, operational mechanisms, and the level of innovation incentives within the school. A clearly defined organization that provides adequate support and facilitation will encourage faculty to actively participate in the digital transformation process, thereby developing their professional capabilities in a more modern direction. Therefore, the following hypothesis is proposed:

Hypothesis H1b: Digital organizational leadership and support have a positive impact on the competence of university lecturers in Da Nang City.

Digital professional development is the component most directly linked to enhancing faculty capacity. Through training programs, workshops, experience sharing, and continuous learning, faculty can gradually improve their digital skills, digital pedagogical skills, and ability to adapt to new working methods. Therefore, the study proposes the hypothesis:

Hypothesis H1c: Digital professional development has a positive impact on the competence of university lecturers in Da Nang City.

A culture of digital innovation reflects the level of openness, encouragement of creativity, and a spirit of learning within an organization. A positive work environment that embraces experimentation and promotes sharing will increase faculty's motivation for innovation, thereby contributing to the enhancement of professional competence in the context of digital transformation. Therefore, the final hypothesis proposed is:

Hypothesis H1d: Digital innovation culture has a positive impact on the competence of university lecturers in Da Nang city.

Thus, the research's hypothesis framework ensures continuity with the theoretical foundation while providing a clear basis for empirically testing the relationship between digital transformation and faculty competence in the specific context of Da Nang city.

Data analysis methods

After collecting valid questionnaires, the data is cleaned, coded, and entered into statistical software for analysis. First, descriptive statistics are conducted to generalize the characteristics of the survey sample according to criteria such as gender, age, professional qualifications, years of service, teaching field, and type of university. This analysis helps to reflect the overall picture of the research subjects and provides a basis for interpreting the results in subsequent steps.

Next, the reliability of the scale is tested using Cronbach's Alpha coefficient. The purpose of this step is to assess the degree of internal consistency between the observed variables within each scale group. Variables that do not meet reliability standards will be considered for removal before further analysis.

Subsequently, exploratory factor analysis was used to examine the structure of the scales and determine the degree of convergence of the observed variables into the representative factors. The results of this analysis help assess whether the measured variables accurately reflect the proposed research concepts and serve as a basis for refining the formal research model.

After identifying the appropriate factors, the study conducts a correlation analysis to examine the degree and direction of the relationship between the variables in the model. This step helps to preliminarily identify the relationship between digital transformation and faculty competence, and also supports the testing of the regression model in the next step.

Finally, the study uses linear regression analysis to examine the impact of digital transformation on the competence of university lecturers in Da Nang city. Through the regression results, the study assesses the degree of influence of the independent variable on the dependent variable, and examines the statistical significance of the hypotheses formulated. Based on this, research conclusions and managerial implications are drawn that are consistent with the objectives of the paper.

4. RESEARCH RESULTS AND DISCUSSION

Description of the survey form

To ensure a solid foundation for subsequent verification steps, the study first conducted a descriptive statistical analysis of the survey sample. The sample consisted of 386 lecturers working at universities in Da Nang city. Describing the sample characteristics is important because it helps reflect the diversity of the survey subjects in terms of gender, age, professional qualifications, years of service, teaching field, and type of university. The summarized results are presented in Table 1.

Table 1. Characteristics of the survey sample

Variable group	Level	Quantity	Percentage (%)
Sex	Male	177	45.9
	Female	209	54.1
Age	Under 35	105	27.2
	35–44	150	38.9
	45–54	94	24.4
	From 55 years old and above	37	9.6
Professional qualifications	Master's degree	124	32.1
	Doctor	230	59.6
	Associate Professor/Professor	32	8.3
Years of service	Under 5 years	75	19.4
	5–10 years	101	26.2
	11–20 years	140	36.3
	Over 20 years	70	18.1
Teaching field	Economics - Management	90	23.3
	Engineering – Technology	83	21.5
	Social Sciences and Humanities	62	16.1
	Foreign Languages – Pedagogy	56	14.5
	Medicine and Health	43	11.1
	Other	52	13.5
Type of school	Public	278	72.0
	Private	108	28.0

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The results in Table 1 show that the survey sample has a relatively diverse structure, consistent with the research context at universities in Da Nang city. Regarding gender, female lecturers account for 54.1%, slightly higher than male lecturers at 45.9%. This structure indicates that the research sample is not strongly skewed by gender and may relatively reflect the balanced characteristics of the current higher education sector's workforce. The small difference between the two groups also facilitates the analysis of research variables without being overly affected by gender structural bias.

In terms of age, the 35-44 age group accounted for the highest percentage at 38.9%, followed by the under-35 age group at 27.2%, and the 45-54 age group at 24.4%. The group aged 55 and above accounted for only 9.6%. This structure indicates that the research sample mainly focuses on lecturers who are in a stable career development stage and have a relatively high level of professional involvement. This characteristic is consistent with the research topic, as middle-aged individuals often possess both teaching experience and are directly impacted by the demands for innovative methods, technology application, and adaptation to the digital education environment. Simultaneously, the relatively large presence of the under-35 age group reflects a trend towards younger lecturers, contributing to greater access to technology and innovation in professional activities.

In terms of professional qualifications, lecturers with doctoral degrees accounted for the highest percentage at 59.6%, while those with master's degrees accounted for 32.1%, and associate professors and professors accounted for 8.3%. This result shows that the research sample has a relatively good academic background, consistent with the characteristics of university lecturers. The predominance of doctoral degree holders is a positive sign because this group is often deeply involved in both teaching and research activities, and also has better access to and application of academic technology platforms. This increases the reliability of the data when evaluating the relationship between digital transformation and the professional competence of lecturers.

In terms of years of service, the group with 11 to 20 years of experience accounted for the highest percentage at 36.3%, followed by the group with 5 to 10 years at 26.2%, the group with less than 5 years at 19.4%, and the group with over 20 years at 18.1%. This structure shows that the survey sample covers many different levels of professional experience. The group of lecturers with 11 to 20 years of experience plays a prominent role, reflecting the core workforce of universities today. This group is more likely to have accumulated professional experience while also facing significant pressure to update technology, innovate teaching methods, and adapt to the demands of digital transformation. The relatively even distribution among the seniority groups also contributes to a more representative nature of the research results.

In terms of teaching fields, the Economics – Management group accounts for the largest proportion at 23.3%, followed by Engineering – Technology at 21.5%, Social Sciences – Humanities at 16.1%, Foreign Languages – Pedagogy at 14.5%, Medicine – Health at 11.1%, and other fields at 13.5%. This result shows that the research sample is not concentrated in a single major but has a relatively multidisciplinary distribution. This is an important point for research on digital transformation, as the level of technology application and the requirements for innovation in teaching methods can differ between fields. The wide distribution of the sample across many disciplines helps increase the comprehensiveness of the results and better reflect the diverse practices of the teaching staff in Da Nang city.

Regarding the type of institution, faculty members from public universities accounted for 72.0%, while those from private universities accounted for 28.0%. This proportion is reasonable in the context of higher education in Da Nang today, where the public sector still plays a dominant role in terms of size and number of faculty members. However, the participation of private universities, accounting for nearly one-third of the sample, is also a positive factor, as it helps the data reflect certain differences in governance, technology investment, and the level of flexibility in implementing digital transformation between the two types of higher education institutions.

Overall, the survey sample structure shows that the research data is diverse and suitable for the objective of analyzing the impact of digital transformation on the competence of university lecturers in Da Nang city. The sample is not overly concentrated on a single group of characteristics but has a relatively reasonable distribution across various demographic and occupational criteria. This is a favorable condition for further steps in testing the reliability of the measurement scale and conducting a deeper analysis of the relationships between research variables in the following sections.

Assessing the reliability of the scale

After characterizing the survey sample, the study proceeded to test the reliability of the scales using Cronbach's Alpha coefficient. The purpose of this analysis step was to assess the degree of internal consistency between the observed variables within the same scale, thereby determining whether these variables reflect the same research concept. In this study, the scales tested included four components of digital transformation and four components of faculty competence. The results of the analysis are presented in Table 2.

Table 2. Results of reliability testing of the scale.

Scale	Number of observed variables	Cronbach's Alpha	Smallest total item correlation coefficient	Conclude
Digital infrastructure and technology ecosystem	4	0.861	0.623	Meets requirements
Digital leadership and support	4	0.873	0.648	Meets requirements
Digital professional development	4	0.887	0.671	Meets requirements
Digital innovation culture	4	0.854	0.615	Meets requirements
Core digital competencies	3	0.842	0.632	Meets requirements
Digital pedagogical competence	4	0,891	0.684	Meets requirements
Digital research and academic collaboration capabilities	3	0.846	0.617	Meets requirements
Career adaptability	3	0.834	0.604	Meets requirements

The results in Table 2 show that all scales in the research model have Cronbach's Alpha coefficients greater than 0.8. This is a fairly high level, reflecting good internal consistency between the observed variables in each scale group. This indicates that the variables constructed in the questionnaire are closely linked and measure a relatively homogeneous conceptual content. With these results, it can be affirmed that the scale used in the study has the necessary reliability to proceed to the next steps of analysis.

For the digital transformation variables group, the digital professional development scale has the highest Cronbach's Alpha coefficient, reaching 0.887. This result reflects the strong correlation among the observed variables in this group, indicating that faculty members' perceptions of digital training, professional development, and learning support activities in the university are relatively consistent. Next is the digital leadership and organizational support scale with a coefficient of 0.873, showing that content related to strategy, direction, resource allocation, and support mechanisms in digital transformation is also fairly evenly rated by respondents. The digital infrastructure and technology ecosystem scale reached 0.861, while the digital innovation culture reached 0.854. Although slightly lower than the other two groups, these values are still at a good level, demonstrating that the observed variables fairly consistently reflect faculty members' perceptions of technological conditions and the innovation environment in universities in Da Nang city.

For the group of variables related to faculty competence, the digital pedagogical competence scale has the highest Cronbach's Alpha coefficient, reaching 0.891. This is a noteworthy result, indicating that the observed variables related to learning activity design, digital classroom

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organization, assessment, and adjustment of the learning process on a technology platform have high convergence. In other words, digital pedagogical competence is quite clearly and consistently reflected in the perceptions of the surveyed faculty. The digital research and academic collaboration competence scale reached 0.846, core digital competence reached 0.842, and professional adaptability competence reached 0.834. These values show that the remaining three competence groups also have good reliability and are suitable for use in factor analysis and regression.

Besides the Cronbach's Alpha coefficient, the smallest item-total correlation coefficient of all scales is greater than 0.6. This indicates that each observed variable within each scale has a relatively strong correlation with the overall scale it represents. No observed variable has an item-total correlation coefficient so low that it needs to be removed. This result demonstrates that the questionnaire was designed relatively appropriately, the measurement statements are clear in content, and accurately reflect the theoretical dimensions of the research model.

From the above results, it can be affirmed that the measurement system used in the study has good reliability. This is an important basis for continuing with exploratory factor analysis to examine the structure of the scales and the degree of convergence of the observed variables into the proposed research factors. The fact that all scales met the requirements right from the reliability testing stage also shows that the research model constructed has a relatively high degree of suitability to the actual survey context at universities in Da Nang city.

Exploratory Factor Analysis

After the scales were validated for reliability through Cronbach's Alpha coefficient, the study continued with exploratory factor analysis to examine the structure of the observed variables and assess the degree of convergence of the variables into the representative factors. This analysis step is crucial in determining whether the measured variables truly reflect the proposed theoretical concepts. Simultaneously, the results of exploratory factor analysis also serve as a basis for confirming the suitability of the research model before proceeding with correlation and regression analysis.

For the independent variable, digital transformation, exploratory factor analysis was performed on 16 observed variables belonging to four component groups: digital infrastructure and technology ecosystem, digital organizational leadership and support, digital professional development, and digital innovation culture. The results are presented in Table 3.

Table 3. Results of exploratory factor analysis for the independent variable.

Target	Value
KMO coefficient	0.912
Bartlett's Test	Sig. = 0.000
Total Variance Extraction	68.437%
Number of factors extracted	4
The smallest Eigenvalue	1,284

The results in Table 3 show that the KMO coefficient reached 0.912, greater than 0.5, indicating that the data is entirely suitable for exploratory factor analysis. Simultaneously, the Bartlett test has a significance level of Sig. = 0.000, showing that the observed variables have a linear correlation with each other overall, making factor analysis necessary. The total extracted variance reached 68.437%, exceeding the generally accepted threshold of 50%, demonstrating that the four extracted factors explain most of the variability in the dataset. Furthermore, the smallest Eigenvalue remains greater than 1, indicating that retaining the four factors is appropriate both statistically and theoretically.

This result shows that the 16 observed variables of digital transformation are grouped into four distinct factor groups, consistent with the theoretical structure proposed from the beginning of the study. This means that, in the context of the survey at universities in Da Nang city, lecturers perceive digital transformation not as a single concept but as a multi-dimensional structure, including technological conditions, organizational orientation and support, professional development opportunities, and the innovation environment within the university. This is an important result because it confirms that the theoretical model of digital transformation developed by the study is consistent with the survey's reality.

To further clarify the degree of convergence of each observed variable into the representative factors, the study continues to synthesize the factor loading coefficients of the independent variables as presented in Table 4.

Table 4. Factor rotation matrix of the independent variable

Observed variable	Factor 1	Factor 2	Factor 3	Factor 4
DT1	0.781	0.214	0.167	0.152
DT2	0.804	0.196	0.181	0.148
DT3	0.776	0.205	0.194	0.173
DT4	0.758	0.224	0.188	0.169
DT5	0.221	0.814	0.176	0.203
DT6	0.196	0.837	0.168	0.192
DT7	0.217	0.802	0.184	0.214
DT8	0.232	0.786	0.193	0.227
DT9	0.175	0.186	0.841	0.201
DT10	0.188	0.194	0.858	0.176
DT11	0.204	0.173	0.826	0.195
DT12	0.197	0.209	0.812	0.184
DT13	0.163	0.198	0.214	0.789
DT14	0.171	0.215	0.196	0.821
DT15	0.184	0.206	0.205	0.804
DT16	0.192	0.224	0.187	0.776

The results in Table 4 show that all observed variables have factor loadings greater than 0.7 on their respective representative factors, and there is no significant cross-loading. Specifically, variables DT1 to DT4 converge well on the first factor, reflecting digital infrastructure and technology ecosystem components. Variables DT5 to DT8 focus on the second factor, reflecting digital organizational leadership and support. Variables DT9 to DT12 converge clearly on the third factor, reflecting digital expertise development. Finally, variables DT13 to DT16 strongly load on the fourth factor, reflecting digital innovation culture. This result shows that the observed variables not only converge well but also have a fairly clear ability to distinguish between the component concepts of digital transformation.

For the dependent variable, faculty competence, exploratory factor analysis was performed on 13 observed variables belonging to four competence groups: core digital competencies, digital pedagogical competencies, digital research and academic collaboration competencies, and professional adaptability competencies. The results of the analysis are presented in Table 5.

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Table 5. Results of exploratory factor analysis for the dependent variable

Target	Value
KMO coefficient	0.895
Bartlett's Test	Sig. = 0.000
Total Variance Extraction	66.281%
Number of factors extracted	4
The smallest Eigenvalue	1,193

The results in Table 5 show that the KMO coefficient reached 0.895, reflecting the high suitability of the data for exploratory factor analysis. The Bartlett test continued to be statistically significant with Sig. = 0.000, indicating that the observed variables have a sufficiently strong relationship to form representative factors. The total variance extracted reached 66.281%, demonstrating that the four extracted factors explain most of the data's variability. The smallest Eigenvalue greater than 1 further confirms that retaining the four factors is reasonable.

This shows that the dependent variable "lecturer competence" also has a clear multidimensional structure in the actual survey data. This result is consistent with the previously presented theoretical basis, according to which lecturer competence in the context of digital transformation cannot be understood as a single competency, but must be viewed through multiple dimensions related to technology use, teaching organization, academic activities, and professional adaptability. This structure is consistent with the characteristics of university lecturers in the current digital innovation environment.The specific convergence levels of the observed variables belonging to the dependent variable are presented in Table 6.

Table 6. Factor rotation matrix of the dependent variable

Observed variable	Factor 1	Factor 2	Factor 3	Factor 4
FC1	0.812	0.184	0.171	0.152
FC2	0.837	0.176	0.165	0.163
FC3	0,794	0.198	0.183	0.176
FC4	0.201	0.846	0.187	0.169
FC5	0.186	0.861	0.174	0.158
FC6	0.193	0.834	0.188	0.171
FC7	0.214	0.808	0.196	0.165
FC8	0.175	0.188	0.821	0.184
FC9	0.181	0.176	0.844	0.191
FC10	0.194	0.185	0.803	0.203
FC11	0.163	0.172	0.198	0.786
FC12	0.176	0.184	0.205	0.819
FC13	0.187	0.191	0.176	0.801

Regression analysis and hypothesis testing

After the scales were validated for reliability and structural validity through Cronbach's Alpha test and exploratory factor analysis, the study continued using linear regression analysis to examine the impact of digital transformation on the competence of university lecturers in Da Nang city. This analysis was conducted in two steps. First, the study examined the impact of the composite independent variable, digital transformation, on the composite dependent variable, lecturer competence. Then, the study further examined the impact of each component of digital transformation on lecturer competence to clarify the degree of influence of each factor in the model.

The overall regression results between digital transformation and faculty competence are presented in Table 7.

Table 7. Regression results between digital transformation and faculty competence.

Independent variable	Unstandardized coefficient B	Standard error	Beta normalization coefficient	Value t	Sig.
Constant	1,487	0.214		6,949	0.000
Digital transformation	0.619	0.067	0.490	9,239	0.000
Model evaluation criteria	**Value**				
R	0.490				
R squared	0.240				
Corrected R-squared	0.238				
F	85,360				
Sig. F test	0.000				

The results in Table 7 show that the regression model is statistically significant with an F-value of 85.360 and a significance level of Sig. = 0.000. This demonstrates that the digital transformation variable is capable of explaining the variation in faculty competence in the research model. The adjusted R-squared coefficient is 0.238, indicating that digital transformation explains approximately 23.8% of the variation in university faculty competence in Da Nang city. This level of explanation is appropriate for studies in the social sciences and education fields, where human professional competence is often simultaneously influenced by many different groups of factors, not just the technological environment or organizational conditions.

The standardized regression coefficient Beta of the digital transformation variable reached 0.490 and was statistically significant at the 1% level. This result confirms that digital transformation has a positive impact on the competence of university lecturers. In other words, as the level of digital transformation in the university improves, the competence of lecturers also tends to increase accordingly. This result is entirely consistent with the theoretical basis presented in the previous sections, according to which digital transformation not only creates a new technological environment but also encourages lecturers to enhance their digital skills, innovate teaching methods, expand academic cooperation, and better adapt to new professional requirements.

From the unstandardized regression coefficients, the general regression equation of the model is determined as follows:

Faculty capacity = 1.487 + 0.619 × Digital transformation

This equation shows that, all other factors remaining constant, when the level of digital transformation increases by one unit, the lecturer's competence increases by an average of 0.619 units. The positive coefficient of the digital transformation variable further reinforces the assertion that the digital environment in the school plays a role in promoting the professional development of lecturers. This result allows us to accept hypothesis H1, that is, digital transformation has a positive impact on the competence of university lecturers in Da Nang city.

To further clarify the role of each component of digital transformation, the study continued with a multivariate regression analysis using four independent variables: digital infrastructure and technology ecosystem, digital organizational leadership and support, digital expertise development, and digital innovation culture. The results are presented in Table 8.

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Table 8. Results of multivariate regression between components of digital transformation and faculty competence.

Independent variable	Unstandardized coefficient B	Standard error	Beta normalization coefficient	Value t	Sig.	VIF
Constant	1,126	0.198		5,687	0.000	
Digital infrastructure and technology ecosystem	0.174	0.051	0.201	3,412	0.001	1,462
Digital leadership and support	0.156	0.049	0.182	3,184	0.002	1,517
Digital professional development	0.231	0.054	0.267	4,278	0.000	1,583
Digital innovation culture	0.198	0.052	0.224	3,808	0.000	1,471
Model evaluation criteria	**Value**					
R	0.566					
R squared	0.320					
Corrected R-squared	0.313					
F	44,786					
Sig. F test	0.000					

The results in Table 8 show that the multiple regression model is statistically significant with an F value of 44.786 and a Sig. value of 0.000. The adjusted R-squared coefficient is 0.313, meaning that the four components of digital transformation explain 31.3% of the variation in faculty competence. Compared to the general regression model, this level of explanation is higher, indicating that separating digital transformation into specific components helps to better reflect the nature of the impact of each factor on faculty competence. This is a valuable academic result, as it demonstrates that digital transformation does not affect faculty in a uniform way but through multiple channels of influence.

Considering each independent variable separately, all four components of digital transformation have positive regression coefficients and are statistically significant. This indicates that all component hypotheses in the model are accepted. Among them, digital professional development has the strongest impact on faculty competence, with a standardized Beta coefficient of 0.267 and a significance level of Sig. = 0.000. This result reflects that continuous training, experience sharing, and learning support activities play a particularly important role in enhancing faculty professional competence. This is a highly practical finding, as it shows that investing in technology alone is not enough; more importantly, the school must create mechanisms to help faculty learn how to use, integrate, and leverage technology in their professional activities.Coming in second in terms of impact is the culture of digital innovation, with a Beta coefficient of 0.224 and statistical significance at the 1% level. This result shows that a work environment that encourages innovation, is open to experimentation, and promotes academic sharing has a significant influence on faculty competency development. This implies that digital transformation in higher education is not just a technical or administrative issue, but also a matter of organizational culture. When faculty members feel encouraged to innovate and receive moral support from their work environment, they will adapt more easily to new technologies and be more proactive in improving their professional competence.

The digital infrastructure and technology ecosystem have a Beta coefficient of 0.201, which is statistically significant at the 1% level. This result confirms that technological conditions are a necessary foundation for faculty to enhance their capabilities in the digital environment. When the school has a stable learning platform, abundant digital learning materials, synchronized technical tools, and effective support mechanisms, faculty will have more advantages in using technology in teaching and research activities. However, the impact of this factor is lower than that of developing digital expertise and a culture of digital innovation, indicating that technological conditions are only truly effective when accompanied by learning support and a suitable organizational environment.

Organizational leadership and support have a Beta coefficient of 0.182 and are statistically significant at the 1% level. Although this factor has the lowest impact among the four components, the results still show the important role of strategic direction, leadership commitment, and organizational support mechanisms in enhancing faculty capacity. This can be explained by the fact that leadership roles are often indirect, impacting through facilitating, allocating resources, and shaping an innovation environment, rather than directly affecting specific faculty competency manifestations.Furthermore, the VIF of all independent variables is less than 2, indicating that the model does not exhibit significant multicollinearity. This demonstrates that the component variables of digital transformation, while related, still maintain the necessary distinctions to be included in the regression model. As a result, the obtained regression estimates can be considered stable and sufficiently reliable for interpretation.Based on the results of the multiple regression, the regression equation is determined as follows:

Faculty Competence = 1.126 + 0.174 × Digital Infrastructure and Technology Ecosystem + 0.156 × Digital Organizational Leadership and Support + 0.231 × Digital Professional Development + 0.198 × Digital Innovation Culture

This equation shows that all four components of digital transformation contribute positively to enhancing faculty capacity. Among them, digital professional development is the most influential factor, followed by a digital innovation culture, digital infrastructure and technology ecosystem, and finally, digital leadership and organizational support. This order reflects an important implication: in the context of universities in Da Nang city, the human element and learning environment play a more prominent role than purely technological factors in enhancing faculty capacity.

Based on the above results, the hypothesis testing is summarized in Table 9.

Table 9. Results of hypothesis testing.

Hypothesis	Content	Test results
H1	Digital transformation has a positive impact on the capabilities of university lecturers in Da Nang city.	Accept
H1a	Digital infrastructure and the technology ecosystem have a positive impact on the capabilities of university lecturers in Da Nang city.	Accept
H1b	Digital leadership and support have a positive impact on the capacity of university lecturers in Da Nang city.	Accept
H1c	Digital professional development has a positive impact on the capabilities of university lecturers in Da Nang city.	Accept
H1d	The digital innovation culture has a positive impact on the capabilities of university lecturers in Da Nang city.	Accept

In summary, the regression analysis results provided clear empirical evidence showing that digital transformation has a positive impact on the competence of university lecturers in Da Nang City. Not only did the overall digital transformation have a positive influence on lecturer competence, but each specific component of digital transformation also showed a statistically significant positive impact. This result is consistent with the theoretical direction of the study and closely reflects the current reality of higher education, where improving lecturer competence is inseparable from the context of the university's digital transformation.

Academically, this finding reinforces the view that digital transformation in higher education is a multidimensional process in which technology, organization, culture, and professional development interact to create change in faculty professional competence. Practically, the most striking finding of the study is that digital professional development and a digital innovation culture have a stronger impact than the other factors, implying that universities should not only focus on infrastructure investment but also pay more attention to faculty development and building a positive innovation environment within the institution.

5. CONCLUSION AND POLICY IMPLICATIONS

This study was conducted to analyze the impact of digital transformation on the competence of university lecturers in Da Nang City. Based on a synthesis of theories, the construction of a research model, and validation using survey data, the results show that digital transformation has a positive impact on lecturers' competence. This indicates that when universities promote digital transformation in a more synchronized manner, the professional competence of lecturers also has the opportunity to improve significantly. This result contributes to affirming that in current higher education, digital transformation is not only a process of technological or managerial innovation, but also an important driving force for the development of the teaching staff.

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The regression results show that digital transformation explains a significant portion of the variation in faculty competence. This demonstrates that the digital environment within the university has a substantial correlation with faculty members' ability to utilize technology, organize teaching and learning, conduct academic research, and adapt to their professional lives. When considering each component individually, all four factors—digital infrastructure and technology ecosystem, digital leadership and organizational support, digital professional development, and digital innovation culture—have a positive impact on faculty competence. Among these, digital professional development is the most influential factor, followed by digital innovation culture, digital infrastructure and technology ecosystem, and finally, digital leadership and organizational support. This order of impact suggests that, in the context of universities in Da Nang, enhancing faculty competence cannot rely solely on technology investment but must focus on continuous professional development, ongoing learning, and building an organizational environment that encourages innovation.From the research results, several important conclusions can be drawn. First, digital transformation is a multi-dimensional process in which technology, organization, expertise, and culture interact to influence faculty capabilities. Second, faculty capabilities in the current context need to be viewed as a comprehensive structure, encompassing not only core digital competencies but also digital pedagogical competencies, digital research and academic collaboration competencies, and professional adaptability. Third, the effectiveness of digital transformation in higher education depends significantly on the ability of the institution to transform technological conditions into genuine learning, development, and innovation opportunities for its faculty.Based on this, the study proposes several recommendations for universities in Da Nang city. First, universities need to continue investing in and improving their digital infrastructure in a way that is synchronized, stable, and easy to utilize in teaching and research. This investment should not be limited to equipment or management platforms, but should be linked to a digital learning resource ecosystem, academic databases, assessment support tools, and technical support services for lecturers. Only when the technology infrastructure operates efficiently and is user-friendly will lecturers have the conditions to sustainably develop their digital capabilities.

Furthermore, universities need to consider the development of digital expertise as a central focus of their digital transformation strategy. Training programs for faculty members should be designed to be practical, regular, and tailored to specific target groups, avoiding short-term, technically-oriented courses. Training content should concentrate on digital learning design, blended learning methods, digital assessment, data mining, technology application in research, and enhancing adaptability to new tools. Simultaneously, mechanisms should be created to enable faculty members to learn from each other through professional development activities, practice communities, and the sharing of innovative experiences within the university.Another important recommendation is that universities need to focus on building a culture of digital innovation within their organizations. An academic environment can only truly foster faculty capabilities when it encourages experimentation with new approaches, accepts the initial challenges of the innovation process, and celebrates effective initiatives. Universities need to establish mechanisms to recognize, encourage, and disseminate best practices in technology application, thereby making digital transformation an integral part of the professional culture rather than just an administrative requirement. This is especially important given that many faculty members are still hesitant to change or lack confidence in adopting new tools and working methods.

Furthermore, the role of leadership and organizational support needs to be strengthened in a clearer and more substantive way. University leaders need to develop digital transformation strategies linked to faculty development, ensuring consistency between the goals of technological innovation and the goals of improving teaching and research quality. Policies supporting faculty need to be implemented more concretely through appropriate resource allocation, reducing unnecessary administrative pressure, and providing time and opportunities for professional development. When leaders demonstrate clear commitment and build trust within the organization, faculty will be more motivated to participate in the digital transformation process.For education administrators and policymakers, the research implies that digital transformation in higher education needs to be approached from an ecosystem development perspective, not just focusing on equipment and technical platforms. Mechanisms are needed to support universities in building digital competency standards for lecturers, developing training programs with clear output standards, and enhancing experience sharing among higher education institutions. For a city like Da Nang, linking digital transformation in higher education with a smart city strategy, innovation, and the development of high-quality human resources will contribute to improved investment efficiency and create a greater ripple effect throughout the entire system.Despite its significant contributions, the study still has some limitations. Firstly, the research focuses primarily on universities in Da Nang City, thus limiting its generalizability to other localities. Secondly, the research model mainly examines the direct impact of digital transformation on faculty competence without deeply analyzing the mediating or regulating roles of factors such as innovation motivation, professional pressure, generational characteristics, or the governance environment of each institution. Furthermore, the research data was collected using a cross-sectional survey method, which does not accurately reflect changes in faculty competence over time.

From there, further studies could expand the scope of the survey to other localities to increase comparability and generalizability. Simultaneously, the research model could be developed to include mediating and moderating variables to further clarify the mechanisms of digital transformation's impact on faculty competence. Subsequent studies should also incorporate qualitative methods or time-series research to more deeply reflect the adaptation and development of faculty competence in the context of rapidly changing higher education.

Overall, the research results have shown that digital transformation is of significant importance for enhancing the capacity of university lecturers in Da Nang city. This confirms that in the current university development strategy, investment in digital transformation must go hand in hand with investment in human resources, especially developing a faculty that is adaptable, innovative, and possesses more comprehensive professional competencies. This will be a crucial foundation for universities to improve the quality of training, research capacity, and competitiveness in the context of increasingly digitized and deeply integrated higher education.

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