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Factors Affecting Learning Outcomes in Digital Economics Education: Evidence from Economics Universities in Vietnam

Than Thi Hanh
Foreign Trade University
Hanoi, VietNam

Hoang Xuan Binh
Foreign Trade University
Hanoi, VietNam

Duong Thi Thu Phuong
Academy of Finance
Hanoi, VietNam

Nguyen Nghi Thanh
National Academy of Public Administration
Hanoi, VietNam

Abstract. This study article examines key factors affecting learning in the field of digital economics education at Vietnamese universities. The research study makes a significant contribution to the academic literature on the topic of digital learning environments. The main purpose of the study was to investigate collectively the impact of technological infrastructure, digital content quality, instructional design, learner digital literacy, educator competence, teaching styles, and student motivation and engagement on learning outcomes. The research highlighted that technological infrastructure, digital content quality, instructional design, educator competence, and teaching styles influence student motivation and engagement, which are important contributors to learning outcomes. Conversely, learner digital literacy had little impact on motivation and engagement, highlighting an additional point for future research. The results suggested the importance of investing in technologies and educational resources to provide an engaging digital learning environment. Overall, the study highlights the implications for educators and policymakers who should take advantage of the findings explore the critical areas for improving digital learning outcomes strategically. Although the paper focused on the context of economics universities in Vietnam, it offers important contributions that can be applied to similar

areas and provides some direction for future research to consider different educational contexts or disciplines.

Keywords: digital education; learning outcomes; technology infrastructure; student engagement; SEM analysis; Vietnam

1. Introduction

The introduction of digital technology into education marked the beginning of a time of immense change, significantly transforming educational practices worldwide, particularly in niche areas such as economics (Quy et al., 2023). This shift is especially evident in Vietnam where recent rapid economic growth has increased technological sophistication, facilitating better education (Pham, 2023). This development propelled the investigation into the multiple and cumulative factors that determine learning outcomes in digital economics education in Vietnam's universities (Hung, 2023). The study is placed at the critical intersection of innovation in information technology and education and aims to leverage digital learning technologies and platforms for optimal learning gains.

The global shift to digital learning also highlights the pressing need for research in this area, a need accelerated by the situational and unprecedented nature of the COVID-19 pandemic (Ngo & Phan, 2023). Therefore, the current study provides a valuable context for examining digital education within a unique economic and educational landscape while simultaneously offering insights that are both locally valuable and globally applicable).

To address a significant gap in the literature, this research systematically examined a wide range of influences on outcomes in digital learning, encompassing technology infrastructure and curriculum design, socio-economic background, and social class. The overall aim of the research was to contribute to the understanding of the key catalysts that bring effective digital education through nuanced teaching and learning in economics. This would represent a meaningful contribution to the broader engagement in and research into digital education in economics for educators, administrators, and policymakers who are seeking to extend and promote digital education in education at higher levels of educational research.

Importantly, this research shows and draws attention to the possibility for digital technology to develop and transform economics education and illustrates how various determinants can contribute to increased student engagement and improved learning outcomes. This allows for the development of new teaching methods in economics education and supports more comprehensive, meaningful, and effective pedagogical views of engagement in a mode of delivery—digital education—heralding a new era in enhanced education paradigms in the digital age.

2. Literature Review

2.1 Technological Infrastructure

The association between technological infrastructure and student engagement in teaching digital economics is widely documented (Bond & Bedenlier, 2019) and extensively discussed in the literature. The research suggests a strong correlation between technological resources, learning motivation, and learners' prior experiences with technology in education. Potts (2019) further highlights that a lack of technology negatively affects learning motivation, regardless of learners' prior knowledge. Essential elements such as high-speed internet service, digital devices of sophistication, or content-rich e-learning websites are foundational for developing engaging digital learning (Ahmed & Sidiq, 2023). Henrie et al. (2015) claim that a technological-rich environment enhances students' motivation to learn and report increased motivation when technology is used regularly. Therefore, a robust digital infrastructure is necessary for a functional digital learning environment.

The implications and/or impact of digital tools on the motivational dynamics of teaching and learning in digital economics education becomes more evident when considering the interactions within e-learning platforms. These interactions play an important role in sustaining student motivation and engagement in learning economics, as they stimulate a deeper level of immersion and interaction. This effect is enhanced by incorporating gaming elements that align appropriately with educational contexts, particularly in synchronous e-learning environments. Such environments rely on interactive processes that facilitate the understanding of economics concepts, emphasizing the necessity of mastering foundational theories. These theories serve as prerequisites for conceptual understanding, which often occurs outside the structured learning interventions provided by economists in real-time settings. Hence, the application of economic theories must take into account the role of interaction as a motivator for learning economics, particularly when facilitated by peer-level technologies.

Moreover, the quality of technological infrastructure represents the most conspicuous factor affecting the emergence of student engagement. Recent studies have documented that high-quality digital devices and seamless connectivity to the internet enable continuous and interactive learning experiences. Such conditions have been shown to enhance student engagement significantly within e-learning contexts (Sato et al., 2023). In digital economics education, students must effectively navigate the processes mediated by their digital devices while engaging in the narrative-driven learning process (Singh et al., 2024).

Usability and functionality of e-learning platforms can provide an additional vital avenue for engagement. It has been documented that user-friendly and intuitive e-learning systems reduce cognitive load, allowing students to focus on learning activities without undue stress (Ferrer, 2022). Consequently, the design serves as the primary means of engagement in digital economics education.

The examples demonstrate that quality technological infrastructure is key to enhancing learner motivation. All considerations regarding motivational features and positive engagement in e-learning experiences were addressed and identified in this context. Therefore, the following hypothesis is proposed:

Hypothesis 1 (H1): Technological infrastructure has a positive and significant effect on motivation and engagement in digital economics education**2.2 Digital Content Quality and Instructional Design**

The elaborate engagement between quality, instructional design, and student engagement in digital economics education has drawn a significant degree of scholarly attention (Snijders et al., 2020). This field of research acknowledges that the improvement of digital learning is not solely dependent on software or hardware infrastructure but is also significantly influenced by instructional design, which in turn, relies on quality of content (Trolian & Parker, 2023). Quality digital content may fundamentally be defined as quality deemed to be related, clear, and aligned with the objectives of content assessment. Such high-quality content is a pivotal aspect in generating students' interest, engagement, and deep learning outcomes (Walters et al., 2017). With appropriate content, instructional design—often referred to as learning design—further encompasses strategies for engaging knowledge and personalizing content (Kay & Pasarica, 2019).

An engaging learning experience positions student engagement as central to improvement. Bertheussen and Myrland (2016) suggest that academically rigorous and related content significantly influences students' ability to construct knowledge through enhanced motivation. They recommend integrating video and simulation-based content to deliver engaging learning experiences. Such methods enable students to connect abstract concepts with practical applications, thereby improving their comprehension of economic theories (Conceição & Howles, 2023).

The significance of instructional design in developing engaged learners is paramount (Collins, 2014). There are instructional design approaches such as active learning and multimedia learning theory that have the potential to enhance participation and active interactions in the learning environment (Clark & Mayer, 2023). As Nortvig et al. (2018) denote, courses that are purposefully designed to incorporate diverse resources catering to varying learning preferences create an engaging and supportive environment. This approach enhances students' interest and comprehension while aiding the retention of complex economic concepts.

In addition, ensuring that the quality of digital content matches the quality of the instructional design is essential for achieving educational impact.. The quality of the instructional strategy and the quality of the content will work together; this is an impact. The intersection of high-quality instructional strategies and content offers significant potential for improved motivation and engagement. Nortvig et al. (2018) underscore the importance of aligning the benefits of digital learning materials with meaningful experiences that remain engaging and worthwhile for learners.

Based on these considerations, the following hypothesis is proposed:

Hypothesis 2 (H2): Quality of digital content and instructional design positively and meaningfully affects motivation and engagement in digital economics education.

2.3 Digital Literacy and Skills

Research in digital economics education highlights the critical role of students' digital literacy and skills in driving motivation and engagement. Spante et al. (2018), for instance, emphasize that a student's ability to navigate, comprehend, and use digital technologies facilitates access to learning and enhances learning experiences, significantly influencing motivation and engagement (see also Mills, 2010; Murtadho et al., 2023).. Moreover, digital literacy extends beyond basic technological proficiency. Wahyuni et al. (2023) contend that digital literacy refers to a set of interconnected skills that include evaluating information, creating digital products, and engaging in effective communication in digital environments. Higher levels of digital literacy correlate with greater student engagement, as technologically adept students can efficiently access online resources, participate in discussions via digital platforms, and complete assessments as an integral part of their learning journey (Arzeen et al., 2023). This means that digital literacy allows students to immerse themselves in online learning spaces that provide them with the means to learn in a space where they are provided with opportunities to engage more actively in their learning experience, resulting in enhanced motivation and engagement (Villa et al., 2023).

Similarly, the development and use of digital literacy skills has been shown to influence students' confidence and independence in their learning. For example, Katsarou (2021) states, 'students who have the ability to use digital tools and platforms, display more self-efficacy, and therefore have a higher readiness to engage with digital learning materials with motivation'. This correlates with a greater willingness to engage in complex economic reasoning, and ultimately, it fosters commitment to digital learning participation (Li & Zhang, 2024).

The value of embedding literacy development as part of a digital-enabled whole economics education is clear. A curriculum that integrates digital literacy development enhances students' learning by preparing them to take advantage of technological opportunities for educational engagement in digital learning environments (Blau et al., 2020). In this sense, it enables educators to leverage digital tools, ensuring that digital learning with its vast potential becomes accessible and effective (Ukwoma et al., 2016).

Based on the extensive evidence that supports the link between digital literacy, engagement, and motivation, embedding or simulating these skills emerges as a necessity for optimizing student experiences in digital economics education (Reichert-Schlax et al., 2023). Students' ability to use available technologies effectively appears to improve students' learning experiences, fostering deeper engagement with educational content and the digital economy's framework.

Therefore, the following research hypothesis is proposed:

Hypothesis 3 (H3): Learner digital literacy and skills positively and meaningfully affect motivation and engagement in digital economics education.

2.4 Teaching Methods and Educator Competence

Investigating the intersection of pedagogy, educator competence and student motivation, interest, and engagement is a critical research area that aims to deepen the understanding of what it means to be an educator in the digital learning environment (Zharmukhanbetov & Singh, 2023). In the context of digital education, it is often situational and reliant on the educator's abilities and competence to facilitate effective pedagogy and foster student involvement (Aldhaen, 2024). This particular literature suggests that an educator's teaching competence and pedagogical skills in the classroom, competence with technology, and content knowledge are key precursors to maintaining student engagement and motivation.

New pedagogies—blended learning, flipped classrooms, and gamification of learning—have shown notable promise in enhancing student engagement and motivation in a digital learning environment (Thongmak, 2019). Caulfield (2023) elaborates on how these practices, when seamlessly executed, can revolutionize and personalize student learning, making it more interactive and effective. Trust, behavioral standards, and student-centered learning models collectively foster active critical thinking and comprehension of complex challenges, especially in teaching economic concepts and theories (Dogani, 2023). Additionally, the apparent attributes of superior digital educator ability influence the pursuit of learner-centered learning experiences (Amhag et al., 2019). Educators succeed by embracing innovative opportunities across digital and traditional domains and guiding learners toward clearly defined outcomes (Howard et al., 2016). Educators who demonstrate competence in digital education pedagogy create improved engagement—school transition can be an exciting phase (Falloon, 2020).

The synergy between pedagogy and educators' competence is a product of more than the transference of knowledge. It involves creating an environment that provides students with an engaging, challenging, and supportive opportunity, an engagement of subject mastery merged with the capacity to build online learning ecologies that are interactive and dynamic (Prostova et al., 2020). In this context, Blau et al. (2020) argue that continuing professional development (CPD) is essential, serving as an ongoing process of building educators' digital pedagogical capabilities—an indispensable step toward fostering student motivation and engagement in digital education.

In conclusion, achieving student engagement and motivation in digital economics education necessitates the bold integration of pedagogy and educator competencies. By combining opportunity and inquiry through engaging pedagogical approaches, educators can create an empowering and compelling field of inquiry for students in digital learning, marked by significant potential and impact, particularly in contexts where student needs are greatest (Moore, 2008).

Therefore, the following research hypothesis is proposed:

Hypothesis 4 (H4): Teaching methods and educator competence positively and meaningfully affect motivation and engagement in digital economics education.

2.5 Student Motivation and Engagement

The relationship between student motivation and their engagement in digital economics education and the associated learning outcomes has received substantial academic interest and represents an important aspect of educational success (Bouchrika et al., 2021; Dellatola et al., 2020). This area of research expands on the idea that students' tendency to become motivated to participate in and engage with digital learning environments has an impact on the success of their learning process (Muhammad et al., 2023). Motivation and engagement are not peripheral to learning but are central to the process of acquiring knowledge and competencies, particularly within digital environments (Nortvig et al., 2018).

Relating to this line of inquiry, evidence suggests that students with higher levels of motivation and engagement in digital economics achieve more positive learning outcomes than those with lower levels of motivation and engagement (Hidayat et al., 2022). For example, the research by Nepal and Rogerson (2020) demonstrates the positive impact of engagement on students' understanding and application of economic theories and concepts with engagement. This level of engagement is made possible through the interactive and experiential nature of digital learning environments, which encourages deeper cognitive processing and retention of multifaceted information (Parong et al., 2020).

In this study context, motivation is defined as a disposition of individual interest, possessing value and environmental support that shapes students' engagement with a sustained level of effort in their learning activities (Hart, 2012). For instance, Gan et al. (2015) found that motivated students engaged more deeply in learning by completing short quizzes and simulations, in addition to participating in discussion board posts, which positively impacted their understanding of economics. Equally important, for developing significant student engagement and motivation, significant educational achievement in digital economics education relates to the use of engaging pedagogies in digital economics courses that promote active learning and that, in turn, improve learning outcomes (Bean & Melzer, 2021). Learning contexts that emphasize interaction, collaboration, and practical applications of economic principles often create the engagement and motivation that lead to successful learning experiences (Barkley & Major, 2020).

Additionally, the feedback loops inherent in digital learning platforms collectively represent the mediating work between engagement and learning outcomes (Wang et al., 2022). The feedback loops of digital learning platforms provide timely and functional feedback on learning experiences, awarding recognition and validating students' efforts through feedback, both of which reinforce the learners' motivation to learn (Sogunro, 2015). Arguably, this student engagement and motivation and the learning environment that emerges from the interplay of all these factors may reveal the contingent veracity of engagement

and motivation for achieving learning objectives in digital learning environments (Papaioannou et al., 2023).

From the existing literature base, which indicates a relationship between student engagement and motivation in the context of digital economics education and learning outcomes, it is evident that these factors serve as antecedents to the effectiveness of digital learning (Yu et al., 2021). Establishing an environment that cultivates engaged and motivated students not only enriches the educational experience but also provides opportunities for deeper engagement, enhanced performance, and the demonstration of a nuanced understanding of economic complexities.

Therefore, the following research hypothesis is proposed:

Hypothesis 5 (H5): Student motivation and engagement in digital economics education positively and significantly influence learning outcomes in digital economics..

Based on the research hypotheses, the following research model (Figure 1) is proposed:

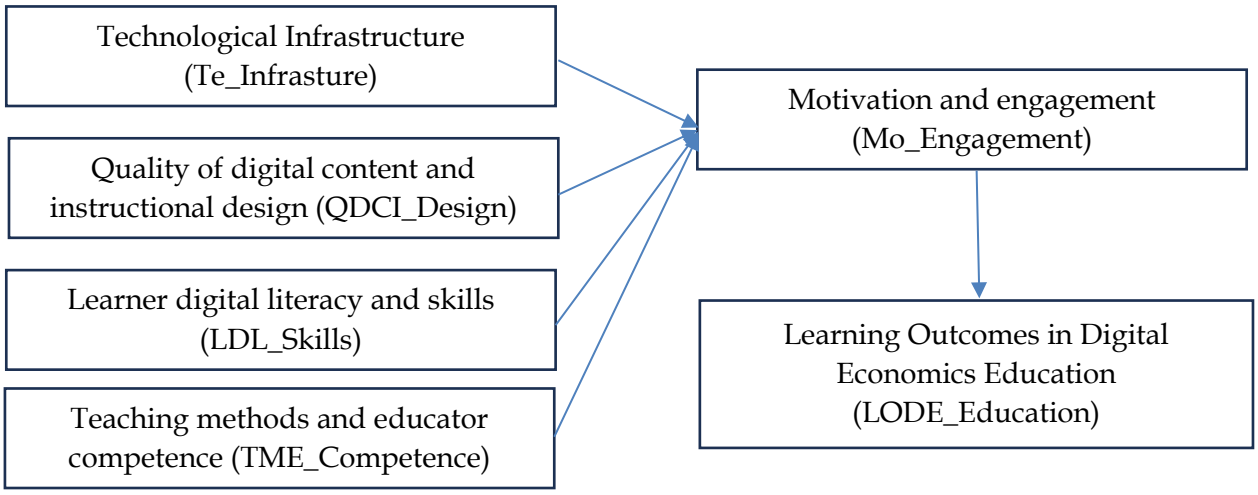

Figure 1: Proposed research model

3. Methodology

3.1 Instrument Development and Pilot Testing

The instrument for this study was a structured questionnaire that was meticulously designed through a full examination of the literature that was relevant to this study, with revisions through discussions being held with two educational experts (Oosterveld, 1996). The questionnaire consisted of two sections: the first gathered demographic data from the respondents (see Appendix), while the second collected data related to each research question (Martin, 2006). For the assessment of the instrument, the instrument underwent a two-phase evaluation process. The first phase involved the administering of a pilot survey to 40 respondents, which served to identify areas for refinement and ensure the relevance and suitability of the questionnaire for the study sample

(Granquist, 1995). The information and the experts' feedback from the pilot study were used to finalize the questionnaire for the main study (Mitchell et al., 2021).

3.2 Respondent Selection and Data Collection

The research addressed a targeted group of respondents, namely students in economics majors from top universities in Vietnam. This sample was used for the purpose of aligning the study with its aims. Accordingly, a sample of 200 respondents was established as acceptable to perform linear multivariate computational analyses (Kyriazos, 2018). The random sampling technique was employed to obtain a diverse and representative respondent group (Etikan & Bala, 2017). The research team distributed questionnaires in person, a process that engaged respondents with the questionnaire through a hands-on approach. This direct engagement facilitated the timely collection of thorough responses and ensured a 100% validity rate (Table 1).

3.3 Ethical Considerations

Stringent ethical standards were upheld throughout the research process. All respondents received comprehensive information about the study's purpose and their involvement, ensuring informed consent was obtained prior to participation (Shrader-Frechette, 1994). Confidentiality was prioritized, with all personal and sensitive data securely managed and anonymized in presenting the research findings. Adherence to these ethical practices was paramount in upholding the integrity and ethical standards of the research and in guaranteeing the protection and respect of all respondents (Shrader-Frechette, 1994).

Table 1: Demographic characteristics of survey respondents

		Major					
		Data Science and Economics		E-Commerce		Financial Technology	
		Count	Row N %	Count	Row N %	Count	Row N %
Age	Over 22 years old	3	11.5%	9	34.6%	14	53.8%
	19 years old	8	24.2%	12	36.4%	13	39.4%
	20 years old	11	17.7%	18	29.0%	33	53.2%
	21 years old	9	17.3%	28	53.8%	15	28.8%
	22 years old	4	14.8%	14	51.9%	9	33.3%
Sex	Female	16	17.2%	34	36.6%	43	46.2%
	Male	19	17.8%	47	43.9%	41	38.3%
University	Foreign trade university	6	14.3%	14	33.3%	22	52.4%
	Ho Chi Minh City University of Economics	7	14.3%	20	40.8%	22	44.9%
	National Economics University	11	25.0%	19	43.2%	14	31.8%

	The University of Danang/ University of Economics	2	12.5%	8	50.0%	6	37.5%
	Thuong Mai University	5	19.2%	14	53.8%	7	26.9%
	University of Economics/ Hue University	4	17.4%	6	26.1%	13	56.5%

4. Results

4.1 Reliability Analysis

Cronbach's alpha and Composite Reliability (CR) were used to evaluate the internal consistency and reliability of the survey and its constructs (Vaske et al., 2017; Peterson & Kim, 2013). The measurement tool was deemed reliable when the Cronbach's alpha of all items met or exceeded the social science threshold of 0.7, suggesting all items measured the constructs with a high degree of consistency (Vaske et al., 2017). Similarly, the study used CR to assess the consistency of the latent variables, maintaining the same 0.7 minimum threshold. This ensured a high degree of internal consistency among the latent variables, which provided confidence that the findings of the study were robust (Peterson & Kim, 2013). In summary, the data collection tool underwent rigorous testing for quality and methodologically drivable interpretation—a hallmark of rigorous research.

Average Variance Extracted measures were also applied to assess the convergent validity of the constructs. The Average Variance Extracted scores were measured conventionally at the standard minimum of .50, indicating that the construct captured at least half of the variance in the indicators (Dos Santos & Cirillo, 2023). Although AVE scores are allowed to dip slightly below the .50 coefficient, it is often acceptable for them to be near or above the equivalent .40 if supported by substantial reliability measured using CR (de Oña, 2022). Such nuanced consideration of the appropriateness of the study's constructs clearly exhibits statistically valid consideration of circumstances for abstraction constructs in research and again, contributes to the methodological rigor of this study.

Table 2: Summary of reliability

Scales	Number of variables observed	Reliability coefficients (Cronbach's Alpha)	Composite Reliability (CR)	Average variance extracted (AVE)
LODE_Education	4	0.726	0.726	0.399
LDL_Skills	4	0.789	0.789	0.483
QDCI_Design	4	0.775	0.778	0.467
Te_Infrasture	4	0.782	0.782	0.474
TME_Competence	4	0.741	0.741	0.418
Mo_Engagement	3	0.750	0.750	0.500

Table 2 summarizes the results regarding the reliability and validity measures for the research questionnaire. All items had a Cronbach's alpha exceeding the threshold of .70, indicating sufficient internal consistency and reliability of the questionnaire. The CR of the five to eight item measure resulted in coefficients that officially met the minimum .70 threshold. Furthermore, all items demonstrated a factor loading greater than .70, reflecting strong convergent validity. The approximate AVE of all the items was approximately .50, which met the minimum acceptable AVE threshold and justified the subsequent analysis in the multivariate analysis plan that guided the inquiry. These outlined statistical and methodologically driven results suggest that the survey items demonstrated sufficient reliability and validity for analyzing the proposed research model..

4.2 Factor Analysis

Eid and Diener (2004) used Exploratory Factor Analysis (EFA) in their study to identify latent structures within observed variables, thereby informing the dimensionality of latent constructs (Fabrigar & Wegener, 2001). In this research, EFA identified the number and the nature of the factors that best accounted for the observed correlations, which subsequently informed the construct validity of this research (Cudeck, 2000). Factors were extracted based on the Kaiser eigenvalue criterion, which considers factors statistically significant if their eigenvalues exceed 1.0 and if the factor loadings are at least 0.4 (Braeken & Van Assen, 2017). The reliance on these standards ensured that only the variables that were presumed to be advantageous in characterizing the underlying constructs' dimensionality were derived as factors. Applying EFA emphasized the systematic methodology that was in place in this study to define and understand the constructs of interest.

Table 3: Results of the factor analysis

	Rotated Component Matrix					
	Component					
	1	2	3	4	5	6
LDL_Skills4	.752					
LDL_Skills1	.730					
LDL_Skills3	.725					
LDL_Skills2	.698					
QDCI_Design1		.742				
QDCI_Design4		.734				
QDCI_Design3		.690				
QDCI_Design2		.676				
Te_Infrastructure1			.782			
Te_Infrastructure4			.752			
Te_Infrastructure3			.672			
Te_Infrastructure2			.638			
TME_Competence1				.750		

TME_Competence3	.685		
TME_Competence2	.670		
TME_Competence4	.668		
LODE_Education3		.745	
LODE_Education4		.704	
LODE_Education1		.641	
LODE_Education2		.637	
Mo_Engagement1			.747
Mo_Engagement3			.740
Mo_Engagement2			.690

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 6 iterations.
b. Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) = 0.883
c. Bartlett's Test of Sphericity (Chi-Square = 1550.258; *df* = 253; sig.= 0.000)
d. Extraction Sums of Squared Loadings = 61.207; Initial Eigenvalues = 1.108

The factor analysis results supporting the validation of the research questionnaire are displayed in Table 3. Bartlett's test of sphericity was statistically significant (sig. = 0.000), yet KMO = 0.883 (> 0.5). This suggested that the observed variables are correlated in the respective population and are, therefore, appropriate for factor analysis. The extracted variable loadings for all variables ≥ 0.5 are, therefore, validated. The total squared extract loadings for the six factors = 61.207 (>50%), suggesting that the six extracted factors could account for considerable variance in the data. The initial eigenvalue of the six factors = 1.128 (> 1.00), suggesting that the six extracted factors have initial eigenvalues greater than one and are, therefore, valid. These results demonstrate the efficacy and appropriateness of EFA in validating the constructs and supporting the proposed research model.

4.3 Structural Equation Modeling

This study used structural equation modeling (SEM) to effectively test each proposed hypothesis and to determine the validity of the theoretical model (Bowen & Guo, 2011).. Structural equation modeling is a statistical technique that simultaneously examines the relationship between observed and latent variable(s). This method enabled a comprehensive evaluation of the model's validity, including the determination of both convergent and discriminant validity (Harlow, 2014). Validity criteria established in the SEM literature emphasize model fit, reflecting how well the model aligns with the collected data. Acceptable fit statistics can include the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). Values for the CFI and TLI are assessed in relation to a cutoff of > 0.90, while values for RMSEA are assessed against a cutoff of < 0.08 to convey good model fit (Sahoo, 2019). By employing SEM, this study yielded a substantial

analytic paradigm for testing the hypotheses and validating the constructs of the theoretical model, thus demonstrating that the study followed appropriate statistical principles.

Table 4: Regression weights

			Estimate	SE	CR	*p*	
Mo_Engagement	<---	QDCI_Design	.239	.103	2.333	.020	accepted
Mo_Engagement	<---	LDL_Skills	.169	.105	1.617	.106	not accepted
Mo_Engagement	<---	Te_Infrasture	.234	.111	2.104	.035	accepted
Mo_Engagement	<---	TME_Competence	.284	.130	2.188	.029	accepted
LODE_Education	<---	Mo_Engagement	.681	.111	6.109	***	accepted

The analysis results, as shown in Figure 2, indicated that the SEM model met the standard requirements. The Chi-square statistic was 226.588 with 219 degrees of freedom (p-value = 0.000, < 0.05), Chi-square/df ratio of 1.035, GIF = 0.868 (approximately equal to 0.9), TLI = 0.944, and RMSEA = 0.013. The results of the SEM analysis are presented in Table 4, which shows the relationship between the variables. Overall, the results suggested that the SEM model fit well with the data and effectively represented the proposed research model.

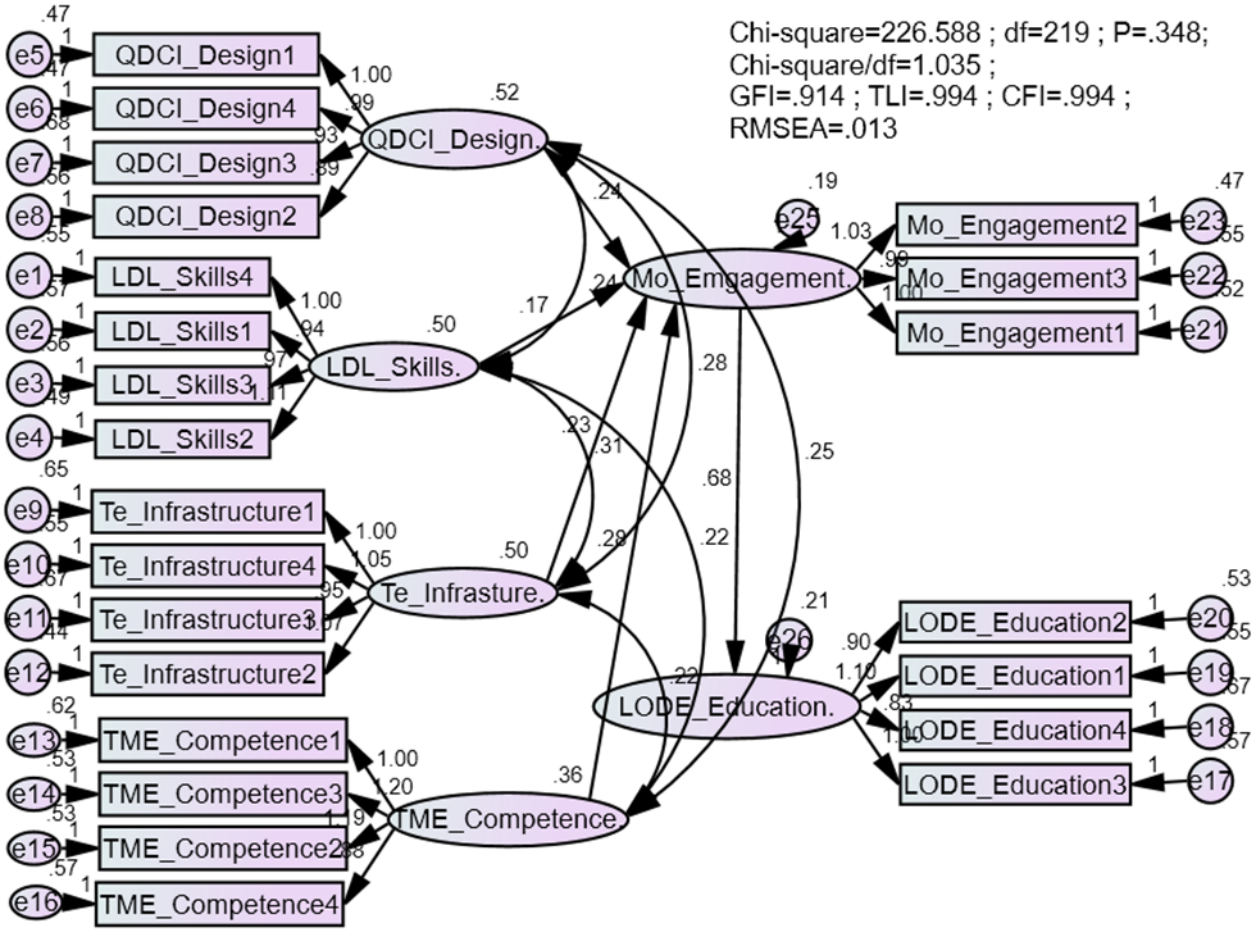

Figure 2: SEM analysis results

4.4 Hypothesis Test

A detailed interpretation of the relationships involving motivation, engagement, and other pedagogical factors with respect to digital economy educational delivery is provided in Table 4. The analysis revealed a positive direct effect of technology moderated by student motivation and engagement, represented by β =.234 with a significance level of p < .035. This value falls within the 95% confidence interval cutoff, providing support for H1 and validating the hypothesized relationships specified in the Pedagogical Engagement in Digital learning model. Similarly, the quality of digital content and instructional design significantly and positively affects motivation and engagement, with a regression weight (β) of 0.239 and a p-value of 0.020, also within the 95% confidence interval, thus supporting H2.

However, the impact of learner digital literacy and skills on motivation and engagement returned no statistically significant evidence in support of the positive effect. The regression weight (β) was 0.169 with a p-value of 0.106, which does not fall within the desired confidence interval of 95%, and as a result, H3 was not accepted.

The investigation of the influence of instructional strategies and teacher effectiveness on students' motivation and engagement revealed a significant positive effect on the relationship between the variables, as evidenced by the regression weight (β) value of 0.284 and a *p*-value of 0.029 in the 95% confidence interval. These findings validate and support H4 in this study.

In addition, student motivation and engagement were shown to have a significant positive correlation with a meaningful learning outcome in digital economics education. This is evidenced by the regression weight (β) value of 0.681 and the *p*-value of 0.000 in the 95% confidence interval. This compelling result led to the acceptance of H5, underscoring the critical role of student motivation and engagement in achieving a meaningful learning outcome.

5. Discussion

This research investigated the complex factors influencing learning outcomes for students in digital economics education at Vietnamese economics universities. The research offers valuable implications for understanding the factors that are necessary to improve the experience of learning online (Pham, 2023). The research identified several significant factors affecting student engagement and motivation in learning online, including technological infrastructure, the quality of digital content, teaching and learning design, and teacher competence and professionalism (Vu et al., 2022). Interestingly, contrary to expectations, the study found that learner digital literacy did not significantly affect motivation and engagement. As a notable contribution to the research literature in economics, this study confirmed the critical link between motivation, engagement, and learning outcomes in digital economics education.

The findings illustrate the value and importance of high-quality digital learning infrastructure and the design of the educational experience in aiding and developing an engaging learning experience. This suggests the need for investments in technology and the professional development of educators, as they will assist in enhancing learning outcomes for online digital economics courses (McKnight et al., 2016). The unexpected findings related to digital literacy suggest that complexities exist regarding motivation and engagement and that the role of possessing skills and literacy would only support learning outcomes if students were engaged in a well-designed and configured experience of learning (Jatmoko et al., 2023). The clear connection between motivation, engagement, and learning outcomes emphasizes the need for educational interventions that methodically enhance students' motivation and engagement (Martin & Dowson, 2009). This is particularly relevant for educators and policymakers aiming to enhance the effectiveness of digital learning by designing engaging and motivating experiences for students.

While this study focused on economics universities in Vietnam, thus limiting the transferability of the findings to other educational contexts and fields, the data would need to be carefully considered before generalizing the results beyond the scope of this study. Moreover, the research design does not allow causality or change over time to be inferred and, therefore, future research could extend the

frameworks to include longitudinal studies that detect the development of motivation and engagement over the course of the study and the longer-term impact on learning outcomes. Examples highly worthy of follow-up studies could explore the role of culture and context in mediating the association of digital literacy with learning outcomes as elucidated in this study, as there may be some unique factors in the local context that are associated with the observed factors. Expanding the research framework to include qualitative methodologies might also yield deeper insights into the student and educator experience within specific digital learning environments, enriching our understanding of the factors that contribute to successful digital education.

6. Conclusion

This research article investigated the main factors influencing learning outcomes in digital economics education with a specific focus on Vietnamese economics universities (Ly, 2023). The specificity of the context motivated this study to address concerns arising from the limited research on the multiple factors influencing educational outcomes in digital learning environments. Specifically, the study focused on technological infrastructure, the quality of digital content, instructional design, learner digital literacy, educator and facilitator competence, teaching strategies, and student motivation and engagement (Pham, 2023)

The research aims were deliberately crafted to address the concerns outlined in the literature and to propose a research framework with SEM as the primary methodological choice. This statistical testing technique afforded the opportunity to provide a comprehensive assessment of the relationships between the stated personal and contextual factors related to learning in addition to a robust statistical basis in support of the study findings.

The findings of the SEM analysis provided a tremendous amount of valuable information. This included the finding that significant implications are evident for technological infrastructure, the quality of digital content, instructional design, teaching effectiveness, educator effectiveness, and educator competency, all of which have a significant positive impact on student motivation and engagement. However, no significant impact of learner digital literacy and skills was found within this specific research context (Mohammadyari & Singh, 2015). More importantly, the results provided valuable insights into the roles of motivation and engagement in enhancing learning outcomes in digital economics education.

This study makes an important contribution to the field of digital education by offering actionable, evidence-based insights aimed at improving learning outcomes in the digital space. It emphasizes the importance of investing in technological infrastructure; high-quality digital content, instructional design, and teaching; and educator effectiveness/content knowledge, as collectively, they enhance student engagement and motivation (Sarva et al., 2023).

However, the study's limitations must be acknowledged. In particular, the study concentrated on economics universities in the context of Vietnam, which may restrict the ability to apply the thinking to different contexts or disciplines.

Because of the cross-sectional design of the research, one cannot assess causality or witness changes over time (Shrout, 2011).

Possible future research could address these limitations by exploring diverse educational contexts and disciplines to improve the generalizability of the findings. Longitudinal studies could also illuminate the dynamic nature of the outcomes of digitally based learning and further specify the relevance of engagement and motivation over time. Finally, qualitative research methods could provide nuanced insights into the underlying factors behind the statistical relationships found in this research, enriching the understanding of the challenges and opportunities regarding digital education.

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Appendix

QUESTIONNAIRE

Your profile: Please select ONE answer from each statement that best describes you

1. Age:…….

2. Gender: ☐ female ☐ male

3. University:……..

4. Major:……..

This survey aims to identify the factors affecting learning outcomes in digital economics education. There is no correct or incorrect response on this scale. Please read each statement carefully and indicate your level of agreement using a 5-point Likert scale where 1 corresponds to "Strongly Disagree" and 5 corresponds to "Strongly Agree."

LODE_ Education	Learning Outcomes in Digital Economics Education:					
LODE_ Education1	My understanding of economics concepts has significantly improved through digital learning.	1	2	3	4	5
LODE_ Education2	I can apply the knowledge gained from digital economics courses in practical scenarios.	1	2	3	4	5
LODE_ Education3	Digital economics courses have enhanced my analytical and critical thinking skills.	1	2	3	4	5
LODE_ Education4	I am satisfied with my overall learning outcomes from digital economics education.	1	2	3	4	5
Te_Infrastructure	Technological Infrastructure:					
Te_Infrastructure1	My course's digital devices and software are high quality and reliable.	1	2	3	4	5
Te_Infrastructure2	I have consistent and high-speed internet access for my digital economics courses.	1	2	3	4	5
Te_Infrastructure3	The e-learning platforms used are user-friendly and easy to navigate.	1	2	3	4	5
Te_Infrastructure4	Technical support is readily available and helpful in solving issues related to digital learning.	1	2	3	4	5
QDCI_Design	Quality of Digital Content and Instructional Design:					
QDCI_Design1	The digital content in my economics courses is relevant and up to date.	1	2	3	4	5
QDCI_Design2	The instructional design of the digital courses facilitates easy understanding of complex concepts.	1	2	3	4	5
QDCI_Design3	Interactive elements (such as quizzes and simulations) are effectively integrated into the digital content.	1	2	3	4	5
QDCI_Design4	The digital courses are well-structured and organized.	1	2	3	4	5
LDL_ Skills	Learner Digital Literacy and Skills:					
LDL_ Skills1	I am confident in using the digital tools required for my economics courses.	1	2	3	4	5
LDL_ Skills2	I can easily navigate and find resources on digital platforms for my economics courses.	1	2	3	4	5
LDL_ Skills3	I have the necessary digital skills to participate effectively in online economics classes.	1	2	3	4	5
LDL_ Skills4	I regularly update my digital skills to keep up with the requirements of my economics courses.	1	2	3	4	5
TME_Competence	Teaching Methods and Educational Competence:					

TME_Competence1	My instructors effectively use digital tools to enhance teaching and learning.	1	2	3	4	5
TME_Competence2	The teaching methods used in my digital economics courses are engaging and innovative.	1	2	3	4	5
TME_Competence3	My instructors are competent in delivering digital content clearly and effectively.	1	2	3	4	5
TME_Competence4	The teaching methods have a good balance of theoretical and practical elements.	1	2	3	4	5
Mo_Engagement	Motivation and Engagement:					
Mo_Engagement1	I am highly motivated to learn and participate in my digital economics courses.	1	2	3	4	5
Mo_Engagement2	I actively engage with the course content and participate in online discussions and activities.	1	2	3	4	5
Mo_Engagement3	The digital learning environment stimulates my interest and curiosity in economics.	1	2	3	4	5
Mo_Engagement4	I feel a sense of accomplishment and engagement in completing digital economics coursework.	1	2	3	4	5

Thanks for participating!