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Student Competence of Blended Learning Involvement in Tertiary Education: Evidence in a University of Education in Vietnam

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Abstract

Digital transformation in tertiary education requires the systematic integration of student digital competence into training curricula, particularly withing teacher education institutions. As the first-ranking university in Vietnam in the field of teacher training, Hanoi National University of Education (HNUE) plays a pivotal role in shaping future teachers' readiness for blended and technology-enhanced learning environments. This study examines the role of student digital competence within the tertiary curriculum framework, emphasizing its contribution to sustainable blended learning implementation. A structured questionnaire using a 5-point Likert scale was administered to 340 students, and in-depth interviews with 22 students across three disciplinary groups. The measurement model comprised three domains: (i) adaptability to technological devices in blended learning, (ii) individualized blended learning planning, and (iii) problem-solving in blended learning contexts. The results indicate that students demonstrated relatively high levels of technological adaptability ($M=3.89$), the moderate levels of individualized planning ($M=3.68$) and problem-solving competence ($M=3.64$). Strong positive correlations were identified among the three domains ($r > .70$, $p < .001$), confirming the independence of digital competence dimensions. However, qualitative findings revealed limitations in proactive learning planning and deeper critical problem-solving engagement. The study recommends embedding structured digital competence development explicitly into tertiary curricula, particularly through guided self-regulated learning modules and integrated LMS-based pedagogical practices.

Keywords: Blended learning, Blended learning involvement, Teacher training, Tertiary education, Vietnam

1. Introduction

Blended learning has emerged as a transformative force in tertiary education, driven by the need to adapt to the rapid advancements in technology and the challenges posed by the COVID-19 pandemic. This educational approach combines traditional face-to-face instruction with online learning, creating a dynamic and flexible learning environment that caters to the diverse needs of 21st-century students [1], [2]. The integration of various instructional methods enhances student engagement, fosters self-directed learning, and promotes the effective application of acquired knowledge in practice [3], [4]. The concept of blended learning is not new, but its adoption has accelerated in recent years, particularly in renowned universities that recognize its potential to revolutionize education. Research by Angawi et al. (2024) highlights the increasing prevalence of blended learning in these institutions, where it is regarded as an innovative teaching and learning strategy that integrates technology seamlessly [5]. Similarly, Moraes (2023) asserts that "Blended learning has gained popularity as it has been proven to be an effective approach to accommodating an increasingly diverse student body while adding value to the learning environment through the integration of online teaching resources" [2]. One of the critical factors influencing the success of blended learning is student competence. De Bruijn-Smolters et al. (2024) emphasize the importance of students' learning competence in optimizing the effectiveness of blended learning [6]. They argue that students must develop self-directed learning skills and perseverance to address complex academic challenges within a blended learning environment. This view is supported by the Community College Research Center in 2024; they demonstrate that students with strong learning competencies are better equipped to apply the knowledge they acquire in practical settings [7], [5]. In the context of Vietnam, the government has implemented various policies to promote a more comprehensive and progressive educational system. These policies lay the foundation for accelerating the integration of information technology into education, paving the way for the development of innovative learning models. These legislative documents [8], especially the Law of Higher Education (2025) facilitate flexible and effective access to knowledge for learners, while improving teaching and learning quality in the context of globalization [9]. Critically, article 10 about application of technology in tertiary education mentions "higher education institutions shall proactively adopt digital

technologies, artificial intelligence, and other advanced technologies in a controlled manner in the management and organization of higher education activities". The applications of technology in higher education shall meet the requirements of ensuring equal access for learners to infrastructure, platforms and digital resources, enhancing digital competencies and the capacity to apply artificial intelligence for lecturers, administrators and learners. Article 22 of Standards of training programs tells to permit the application of flexible modes of training delivery, facilitating lifelong learning opportunities. Accumulated learning outcomes of learners shall be recognized and transferable across different levels, forms and modes of education, the validity period of such learning outcomes shall be determined in accordance with regulations promulgated by the Ministry of Education and Training. In terms of assessment and evaluation, certification, Article 26 mentions the modes of training delivery including a) face-to-face (in person) instruction, b) Distance learning, and c) A combination of face-to-face and distance learning, namely blended learning. Through these analyses, it calls essentially the importance of developing the framework of student competence in blended learning involvement, in which students possess the necessary digital literacy, self-regulation, and motivation to thrive in technologically enriched learning environments. By aligning with legislative requirements, institutions can foster effective participation, enhance learning outcomes, and support the ongoing digital transformation in higher education. Establishing clear competencies not only prepares students for academic success but also equips them with essential skills for future professional roles, thereby sustaining educational quality and innovation.

One of the earliest forms of blended learning to emerge in Vietnam is the "flipped classroom" model, also referred to as Flipped Learning (FL). This model leverages the advantages of information technology to address the limitations of traditional teaching methods by fundamentally "reversing" the conventional instructional process. The "reversal" in this context refers to a pedagogical shift in the organization and implementation of instructional content, learning objectives, and teaching activities, differing significantly from traditional approaches used by both educators and learners [10]. In a flipped classroom model, the traditional approach of "learning in class and completing assignments at home" is transformed into a self-directed learning process at home through recorded lecture videos, online learning, and lesson research via the Internet. When students attend class, they engage in exercises, discussions, and collaborative problem-solving activities based on scenarios presented by the instructor. Students are required to engage with course materials beforehand by reading, summarizing, and listening to lectures via multimedia resources such as video clips, slide presentations, and supplementary documents [11], [12]. The instructor's lecture is provided in advance, serving as preparatory material that students must review before attending class. Consequently, the entirety of in-class time is dedicated to instructor-led activities, student presentations, discussions, and peer exchanges regarding their preparatory work, culminating in the instructor's consolidation and formalization of the lesson content [13].

Literature review

The rapid digital transformation of higher education has reshaped the ways teaching and learning are organized worldwide, particularly through the expansion of online and blended learning modes. Blended learning, which integrates face-to-face instruction with online components, is widely recognized as a pedagogical approach that enhances flexibility, learner autonomy, and engagement in the digital era [11], [12]. In Vietnam, the Covid-19 pandemic accelerated the adoption of online and blended learning across universities, aligning with the national policy of "suspending in-person schooling without stopping learning". However, despite the increasing prevalence of blended learning, concerns remain regarding students' competence to participate effectively in such learning environments, especially in teacher education institutions. Previous studies in Vietnam have documented multiple barriers affecting students' online learning experiences, including economic constraints, limited interaction, psychological challenges, and learning environments issues [14]. For instance, a study at Hue University identified four main groups of barriers, including economic, interactional, psychological challenges, and learning environmental, that significantly impeded students' online learning outcomes [15], [11].

Hanoi National University of Education is among the institutions that have benefited from the Higher Education Project, which has invested significantly in IT infrastructure and service software. Since the latter half of the previous decade, the university has implemented learning management systems (LMS), ranging from IBM Lotus to open-source LMS platforms such as Moodle and Ilias. Several faculty members have integrated LMS into their teaching to facilitate blended learning and have achieved promising results. As blended learning continues to evolve, it is essential to recognize the critical role of student competence and the impact of supportive legislation in shaping the future of education. The integration of information technology and innovative learning models holds great promise for enhancing the quality of education and meeting the diverse needs of students in a rapidly changing world. These findings indicate that students' participation in digital learning is strongly conditioned by their readiness and competence rather than merely the availability of technological infrastructure [11]. Beyond barriers,

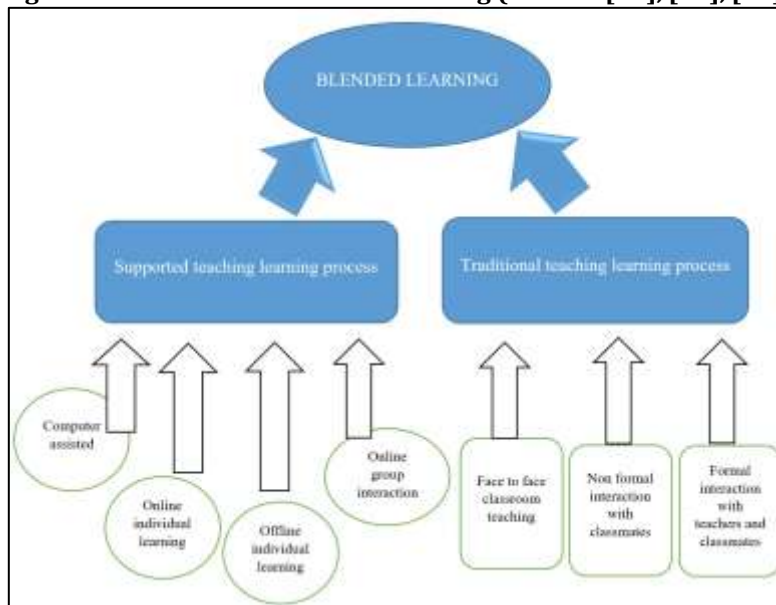
recent Vietnamese studies have explored determinants of students' motivation, readiness, satisfaction, and engagement in online learning. Pham et al. (2022) found that students' online learning motivation was influenced by perceived benefits, learning experience, environmental factors, and technological challenges [15]. Likewise, Trinh et al. (2023) demonstrated that online learning readiness was significantly predicted by information technology skills and time-management competence. At the engagement level [16], Nguyen, D. H. (2025) showed that applying a flipped-classroom model in blended learning environments improved students' motivation, self-study skills, and problem-solving abilities, suggesting that pedagogical design interacts with students' competencies in shaping learning outcomes [17]. Despite these growing bodies of evidence, most existing studies in Vietnam focus on general universities or business or business-related disciplines, while research on student competence of blended learning involvement in teacher education universities remains limited. Teacher education institutions play a crucial role in preparing future teachers to operate in digitally enriched classrooms. Thus, understanding the competencies that enable students to engage effectively in blended learning, such as digital literacy, self-regulation, motivation, and interactive skills, is essential for ensuring the sustainability of digital transformation in higher education. International literature emphasizes that students' competence in blended learning is multi-dimensional, encompassing technical skills, self-directed learning capacity, cognitive engagement, and emotional-behavioral involvement [6], [7], [18]. However, these dimensions are under-examined within the Vietnamese context, particularly in universities of education where students are both learners and future educators. This gap limits the capacity of institutions to design evidence-based interventions for strengthening blended learning quality. Therefore, this study aims to examine the competence of students in their involvement in blended learning at a university of education in Vietnam, providing empirical evidence on the factors shaping their participation and engagement. By doing so, the study seeks to contribute to the emerging literature on blended learning in Vietnam and offer practical implications for teacher education programs undergoing digital transformation.

THE COMPREHENSIVE THEORETICAL BASIS

1.1. Definition of Blended learning

Blended learning would be analyzed with Figure 1 as below.

Figure 1: Definition of blended learning (Source: [19], [20], [21])



Blended learning is a pedagogical concept that involves the structured integration of direct instruction and technology-enhanced teaching facilitated by information and communication technology (ICT) [22]. This approach encompasses various instructional modalities, including face-to-face teaching, online instruction, hybrid learning, and personalized computer-assisted learning [20], [21].

According to Ingabire, H. (2024), blended learning can be defined as the organic integration of carefully selected and complementary direct and online instructional methodologies and technologies [21].

1.2. Theoretical framework of blended learning in tertiary education

Individual adaptability in blended learning in tertiary education

Individual adaptability is a crucial theoretical framework for enhancing blended learning in tertiary education. This pedagogical model combines traditional face-to-face instruction with digital platforms,

requiring students to navigate various instructional modalities effectively. The Individual Adaptability (I-ADAPT) Theory, conceptualized by Ployhart and Bliese (2006), provides a comprehensive framework for understanding students' adaptability in blended learning settings [23]. Adaptability is defined as the capacity to modify behaviors, skills, and cognitive strategies to fit varying tasks and environmental conditions, influenced by cognitive ability, personality traits, motivation, and stress-coping mechanisms. I-ADAPT theory identifies multiple dimensions of adaptability relevant to blended learning, including cognitive, interpersonal, and technological adaptability. Cognitive adaptability involves efficiently processing and integrating new knowledge, particularly significant in environments where students must navigate complex digital resources alongside traditional coursework [24]. Interpersonal adaptability is equally vital as students interact in both online and physical spaces, necessitating fluid communication across multiple platforms. Technological adaptability ensures effective use of learning management systems, digital tools, and multimedia resources to facilitate education. The application of I-ADAPT theory in tertiary education extends beyond content mastery; it involves students' adaptability to various instructional delivery methods. Research by Tomlinson et al. (2023) examined university students' expectations of teaching and found that interactive and structured learning approaches were preferred over self-directed online learning, indicating varying levels of adaptability among individuals [25]. When students lack adaptability, they may struggle with self-regulated learning in digital environments, leading to disengagement. Adaptability is a learned trait influenced by prior experiences, motivation, and self-efficacy, suggesting that targeted interventions can enhance student readiness for blended learning [23], [11]. Moreover, stress management and coping mechanisms significantly impact adaptability in changing environments. Students navigating blended learning frequently encounter technological challenges, requiring effective stress regulation. By leveraging I-ADAPT, universities can implement strategies like adaptive learning models, digital literacy training, and personalized learning pathways tailored to students' adaptability profiles. Instructors can foster adaptability by incorporating dynamic instructional methods, such as flipped classrooms and collaborative digital projects, which require students to shift between different learning modalities. Integrating individual adaptability within blended learning environments offers a strategy for enhancing student engagement, developing essential skills, and improving academic outcomes, preparing students for complex and dynamic professional environments.

Student-centered approach and personalized learning in Blended learning

Student-centered approach and personalized learning are fundamental principles underpinning effective blended learning environments, as they emphasize learner autonomy, flexibility and adaptive instruction [26]. Blended learning inherently supports student-centeredness by combining face-to-face interaction with online modalities that allow learners to control the pace, path, and place of learning [27]. This approach shifts the role of teachers from knowledge transmitters to facilitators, enabling students to actively construct knowledge through interaction, collaboration, and self-directed inquiry [28].

Empirical studies highlight that learner characteristics such as self-regulation, motivation, and attitudes are central to personalized learning in blended contexts. Van Der Graaf et al. (2022) demonstrated that self-regulated learning and intrinsic motivation significantly predicts learning outcomes and satisfaction in blended environments, indicating the importance of tailoring instruction to individual learner profiles [29]. These constructs are commonly measured using validated instruments such as the Online Self-regulated Learning Questionnaire (OSLQ) [30], and the Intrinsic Motivation Inventory (IMI), alongside performance indicators such as course grades and satisfaction levels [31].

In addition, student-centered blended learning emphasizes interactivity and personalization through adaptive design features [19], [6]. The research from 2021 up to now has identified key dimensions including instruction, interactivity, instructor support, and technology, as influencing student satisfaction and engagement, measured through Customer Satisfaction Index (CSI), Importance-Performance Analysis (IPA), and Structural Equation Modeling (SEM) [32], [33], [34], [35]. The measurement frameworks capture both perceived importance and actual performance of learning components, providing insights into the personalized learning effectiveness.

Furthermore, personalized learning in blended environments promotes independence, responsibility, and self-paced learning [36]. Han (2024) shows that blended models foster student autonomy and character development, assessed through multi-level performance scales reflecting frequency of behaviors (e.g. always, often, sometimes) [37]. Verstajlen et al. (2023) emphasizes that student-centered blended learning enhances higher-order thinking, metacognition [26], and problem-solving skills through flexible and inquiry-based learning designs [28].

In a word, the integration of self-centered pedagogy and personalized learning in blended environments requires robust measurement through cognitive, behavioral, and affective scales. These include self-regulation, motivation, satisfaction, and performance metrics, forming a comprehensive framework for evaluating student competence and engagement.

The Digital Competency Framework for Learners

Circular no. 02/2025/TT-BGDDT (Ministry of Education and Training, 2025) stipulates the Digital Competency Framework for learners which comprises six competency domains, encompassing 24 component competencies, structured into four proficiency levels ranging from basic to advanced across eight levels [38]. The framework aims to ensure that systematic digital literacy among Vietnamese learners. This structure not only addresses fundamental digital skills such as information management, communication, and collaboration but also incorporates advanced competencies like digital problem-solving, creativity, and ethical use of technology. The emphasis on progressive proficiency levels enables educators to assess and foster growth in students' digital capabilities, which is crucial as Vietnam transitions toward technology-enhanced education and blended learning environments.

Despite this robust framework, a significant research gap exists regarding student competence in blended learning involvement, particularly in tertiary education settings. Current literature and policies focus extensively on digital literacy and general technology adoption, but there is limited empirical investigation into how students apply these digital competencies within blended learning contexts. Specifically, few studies have examined the interplay between digital skills and adaptability to technological devices, and effective management of personalized blended learning plans among university students. The challenges of integrating online and offline modalities, managing time, and navigating digital platforms are not sufficiently explored in Vietnamese tertiary education research. Furthermore, there is a lack of data on how students' digital proficiency translates into successful blended learning engagement, including their ability to self-regulate, collaborate across platforms, and leverage adaptive learning technologies.

Adaptability, as defined by I-ADAPT, is the capacity to modify behaviours, skills, and cognitive strategies to meet changing tasks and environmental conditions. In blended learning, students must continuously adapt to shifting instructional modalities, digital tools, and collaborative platforms, besides I-DAPT identifies cognitive, interpersonal, and technological adaptability as essential dimensions: cognitive adaptability enables efficient processing of new information, interpersonal adaptability facilitates fluid communication across physical and digital spaces, technological adaptability ensures effective use of learning management systems and digital resources [23]. Embedding these dimensions within a competence framework acknowledges the dynamic nature of blended learning and positions adaptability as a prerequisite for academic success and engagement.

Meanwhile, a student-centered approach, prioritizing individual needs, interests, and learning styles, complements blended learning by making education more interactive and participatory [26], [28], [19], [6]. This pedagogical shift empowers students to take responsibility for their learning and aligns with the flexibility inherent in blended learning environments. Personalized learning theory further enhances this by tailoring educational experiences to individual student profiles, allowing for adaptive content delivery and pacing. The integration of these approaches within a competence framework supports the development of critical skills such as self-regulation [3], time management, and autonomy [4]. By ensuring that learning is relevant and accessible, student-centered and personalized pedagogies foster deeper engagement and accountability, mitigating the risk of isolation or disengagement often associated with digital learning components. For blended learning, digital competence is indispensable, students must navigate complex digital platforms, integrate online and offline learning, and manage personalized learning plans [38]. The framework's emphasis is on progressive proficiency enables educators to assess and foster growth in digital capabilities, which is crucial for effective blended learning engagement and for preparing students for technology-driven professional environments [39]. Those analyses above show that a holistic student competence framework for blended learning should integrate individual adaptability, student-centered and personalized learning, and digital competence. This synthesis recognizes that successful blended learning requires not only adaptability to new modalities but also the capacity to personalize learning experiences and master digital tools. By combining these foundations, universities can implement targeted interventions such as adaptive learning models, digital literacy training, and personalized learning pathways. Instructors can foster competence by incorporating dynamic instructional methods, such as flipped classrooms and collaborative digital projects, which require students to shift between learning modalities and actively engage with content and peers.

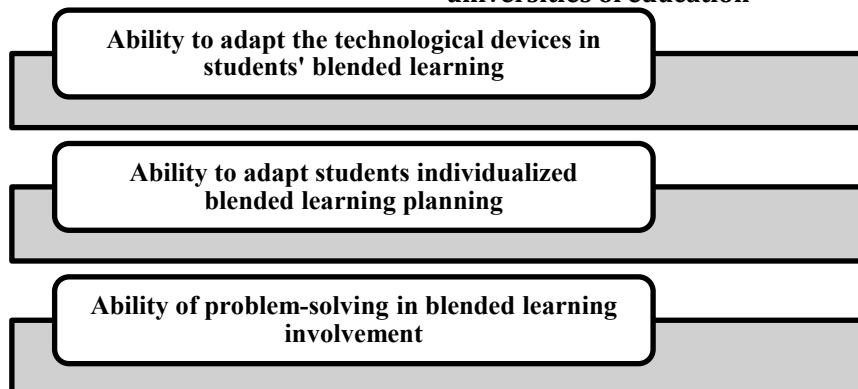
Despite the existence of robust frameworks, significant research gaps remain regarding student competence in blended learning involvement. Current literature and policy focus heavily on digital literacy and general technology adoption, yet there is limited empirical investigation into how students apply these competencies within blended learning contexts, particularly in Vietnamese tertiary education. The interplay between digital skills, adaptability to technological devices, and management of personalized learning plans is underexplored. Challenges such as integrating online and offline modalities, time management and navigating digital platforms lack sufficient empirical evidence. Additionally, there is a lack of data on how digital proficiency translates into successful blended learning engagement, including self-regulation, collaboration across platforms, and leveraging adaptive learning

technologies. Addressing these gaps requires targeted research into practical applications, effectiveness of digital competency training, and contextual challenges unique to Vietnamese universities.

Student competence of blended learning involvement in universities of education in Vietnam

Based on the combination of three frameworks and theories mentioned above, the framework of student competence of blended learning involvement in university has been proposed, as shown in Figure 2.

Figure 2. Theoretical framework of student competence of blended learning involvement in universities of education



Ability to adapt the technological devices in students' blended learning means the students' individualized digital competence.

The concept of adaptability to technological devices is paramount in blended learning, where students interact with digital tools and devices for online learning. Adaptability includes a person's ability to apply knowledge and skills to change, improve, and innovate themselves and their environment to meet learning and professional demands [40]. Ployhart and Bliese (2006) describe personal adaptability as reflecting an individual's skills, readiness, and motivation to align with new tasks and environmental conditions [23]. Adaptability in this context includes learning devices, conditions of learning involvement, and learning space. Learning devices encompass connectivity equipment like computers and phones that connect to the school's training system for online classes [41], as well as learning materials such as textbooks and class resources. Using educational software for composing and designing is equally important [42]. Conditions of learning involvement address the ability to engage in both online and in-person learning [3], [16], [4]. Qin (2025) and Alarifi & Song (2024) emphasize that in-person learning at educational institutions requires attendance at specific locations, including practical sessions and internships, necessitating commuting between various learning sites [43], [44]. For online learning, network-connected devices and sufficient bandwidth are crucial. Offline content allows students to download resources, reducing dependency on network quality. A conducive learning space is vital, free from distractions and supportive of concentration and knowledge assimilation. Adaptability to technological devices significantly influences students' effectiveness in blended learning by equipping them with the necessary skills and tools to navigate the integration of online and in-person educational experiences [40]. This adaptability is crucial for managing the diverse demands of blended learning environments and optimizing educational outcomes [4], [23], [37].

Ability to adapt students individualized blended learning planning in which the core competence focuses on their timing management.

The adaptability of students in creating individualized blended learning plans is crucial in tertiary education. This adaptability primarily hinges on effective time management skills. According to Istenic (2024), blended learning typically involves a distribution of 30% online learning and 70% onsite learning [22]. This necessitates students not only to meet the demands of online coursework but also to manage their time effectively for in-person sessions. The concept of self-regulated learning, as Sinkkonen & Tapani (2024) suggest, forms the foundation for personal learning plan development [45]. This approach has long been established in educational research. Thanasi-Boce (2021) discussed adult learners' motivations [34], while Lourenco & Paiva (2024) emphasized that students should align their learning schedules with personal timetables, considering the preparatory, ongoing, and post-learning phases [46]. This insight enables students to set specific goals and ensures timely progress and completion. Additionally, the ability to self-assess is vital to enhancing the effectiveness of personal time management. As noted by Istenic (2024) and Lourenco & Paiva (2024), students must also navigate both online and offline learning environments [19], [46]. For in-person learning, this includes attending classes at designated locations, such as practical sessions and internships, which require commuting between various learning sites. For online learning, the presence of network-connected devices and

sufficient bandwidth is essential. By developing and adhering to personalized blended learning plans, students can better manage their time, meet the diverse requirements of blended learning, and optimize their educational experiences [41], [43].

Ability of problem-solving in blended learning

means a lot with student skills in involving in blended learning in university.

Problem-solving ability in blended learning environments is essential for student success in tertiary education. According to Wang and Bhagat (2025), problem-solving involves thinking and acting towards resolving situations without predefined solutions [47]. It includes characteristics such as having a goal without a specific method to achieve it, the potential for conflict between the goal and the approach and resolving these conflicts through step-by-step exploration. Therefore, the competence to solve problems during blended learning involves the student's ability to address conflicts through specific methods and actions to ensure their participation in both online and in-person educational experiences. This competence is critical for navigating the unique challenges posed by blended learning environments, where students must balance the demands of digital and traditional educational settings [47]. In addition, developing this ability enables students to adapt to the dynamic nature of blended learning, fostering a proactive and resilient approach to their studies. Consequently, enhancing problem-solving skills can significantly impact students' effectiveness and overall academic outcomes in a blended learning context, aligning with the broader goals of tertiary education to prepare students for complex professional environments [48], [33], [37].

Methods

The purpose of this paper is to validate the proposed theoretical framework of student competence in blended learning involvement and to examine the variability of the items and dimensions within the scales. By employing both quantitative and qualitative methods, the study aims to ensure the reliability and construct validity of the framework, as well as to assess the consistency and differentiation of student responses across the key domains of technological adaptability, individualized learning planning, and problem-solving ability. This comprehensive approach supports the refinement of the scale and contributes to advancing blended learning practices in higher education.

This study employed a mixed-methods research design to comprehensively investigate student competence in blended learning involvement at universities of education in Vietnam. The methodology integrates both quantitative and qualitative approaches, allowing for a robust explanation of the proposed theoretical framework and scale developed from three foundational theories and frameworks (I-ADAPT, student-centered and personalized learning in blended learning, and Digital competence for learners).

This involved developing a structured questionnaire designed to assess student competence across three key domains: technological adaptability, individualized learning planning, and problem-solving ability. The scale was carefully validated to ensure reliability and construct validity, drawing on established practices for educational instrument development [49]. The survey was administered to a sample of 340 university students enrolled at Hanoi National University of Education, which randomly selected to achieve representation across diverse academic disciplines. The questionnaire consists of 15 items, each rated on a 5-point Likert scale (1 = Poor, 2 = Below Average, 3 = Medium, 4 = Good, 5 = Excellent), which enabled the quantification of student competence in blended learning. The instrument's items were directly informed by the proposed framework, ensuring alignment between theoretical and constructs and empirical measurement. Data collection was conducted electronically, and all responses were screened for validity prior to analysis. The quantitative data provided measurable evidence of student competencies and facilitated the validation of the scale, supporting its use in further research and practice [50].

Besides the quantitative survey, the qualitative phase involved semi-structured interviews with 22 students selected from the same three academic groups. These interviews focused on exploring students' perspectives regarding the specific items of the questionnaire and the broader framework. The interviews were designed to elicit detailed responses about their experience, challenges, and perceptions related to blended learning. Each session lasted approximately 30 minutes and was audio-recorded with participants' consent. Interviews are transcribed verbatim to ensure accuracy and facilitate in-depth analysis. Qualitative data enriched the study by providing context for the quantitative findings and revealing underlying factors influencing student competence. The interviews were analyzed using thematic analysis, which involved coding the transcripts and identifying recurring themes connected to the theoretical framework [51].

Data Analysis

The quantitative data were analyzed using descriptive statistics (mean, frequency, and standard deviation) to summarize the participants' responses. Reliability analysis was performed using Cronbach's Alpha to assess the internal consistency of the questionnaire items. Exploratory Factor

Analysis (EFA) was conducted to identify the underlying structure of student competencies in blended learning. Items with factor loadings below 0.4 were excluded from the final analysis, resulting in 12 items being retained for further examination.

Equations

Mean score (M): the mean score is calculated by summing all individual scores and dividing by the total number of respondents $M = (\sum X) / N$ where $\sum X$ is the sum of all scores, and N is the number of respondents.

Frequency (f) refers to the number of times a particular response or score occurs in the dataset f = count of occurrences for a specific score or category.

Standard Deviation (SD) measures the variability of dispersion of scores. $SD = \sqrt{[\sum (X - M)^2 / N]}$ where X is each individual score, M is the mean, and N is the number of respondents.

Exploratory Factor Analysis (EFA) is used to identify the underlying factor structure of a set of observed variables. The basic equation for EFA is $X = \Lambda F + \epsilon$ where X is the vector of observed variables, Λ (lambda) is the matrix of factor loadings, F is the vector of common factors, and ϵ is the vector of unique variances (errors).

In this study, EFA was employed to determine the underlying structure of student competencies in blended learning. EFA helps to reveal how questionnaire items group together to represent distinct domains, such as technological adaptability, individualized learning planning, and problem-solving ability. By identifying factors and excluding items with low factor loadings, EFA ensures that the scale accurately measures the intended constructs, thereby validating the theoretical framework and supporting reliable assessment in further research and practice.

The qualitative data from the semi-structured interviews were analyzed using thematic analysis. This process involved coding the data to identify recurring themes and patterns related to students' adaptability, personalized learning planning, and problem-solving skills in blended learning environments. The coding process was iterative, with themes refined and reviewed to ensure consistency and accuracy.

Results and Discussion

4.1. The situation of student competence of blended learning involvement in tertiary education: evidence in Hanoi National University of Education, Vietnam

Figure 3. Demographics of the survey

Characteristic	Respondents	
	Frequency (n = 340)	%
Student GPA		
Excellent (GPA: 8.6 - 10)	71	20,9
Good (GPA: 7.8 - 8.59)	116	34,1
Medium (GPA: 5.5 - 7.79)	123	36,2
Mid average (GPA: 4.0 - 5.49)	26	7,6
Poor (GPA: <4.0)	3	0,9
Majors		
Major of Natural Sciences	70	20.6%
Major of Social Sciences	46	13.5%
Major of Education	224	65,9%

Currently, Hanoi National University of Education (HNUE) is one of the leading institutions in Vietnam in the field of teacher education. The university offers 25 programs in the field of Pedagogical Sciences and 16 programs outside of Pedagogical Sciences, divided into two groups: Natural Sciences and Social Sciences. Mentioned in Figure 3, of the 340 participants in the survey, 65.9% were students from the Education Sciences group, 13.5% were students from non-pedagogical Social Sciences, and 20.6% were students from non-pedagogical Natural Sciences.

Figure 4. Results of KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.942	
	Approx. Chi-Square	
	3372.139	
	df	
Bartlett's Test of Sphericity	66	
	Sig.	
	.000	

The results of factor analysis show that the KMO index of both dependent and independent variables are greater than (>) 0.4 (mentioned in Figure 4). The Bartlett's test results have a significance level Sig. =

$0.000 < 0.05$, indicating that the variables are related to each other and meet the conditions for factor analysis.

The reliability of Cronbach's Alpha after eliminating duplicate variables from the questionnaire is shown in Figure 5.

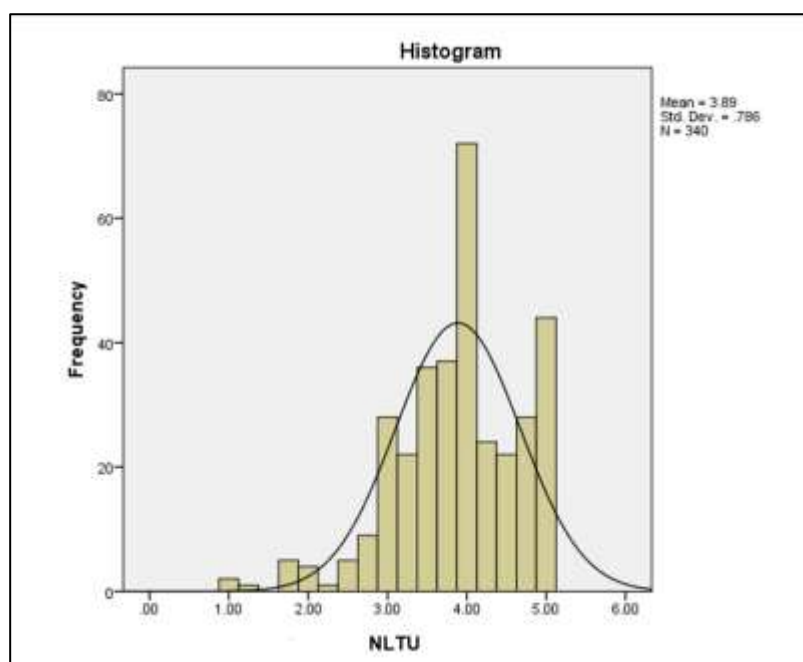
Figure 5. Cronbach's Alpha reliability coefficient - Reliability Statistics

Cronbach's Alpha	N of Items
.949	12

It can be said that this scale has all the necessary criteria to carry out the next steps of the research.

4.2. Ability to adapt the technological devices in students' blended learning in Hanoi National University of Education, Vietnam

Figure 6. Distribution chart of the average value of student competence of adapting to technical devices when participating in blended learning in Hanoi National University of Education, Vietnam



Shown in Figure 6, it was evident that the group of students from the Educational Sciences at HNUE demonstrated the highest ability to adapt to technological devices in blended learning, with an average score significantly above the overall mean. Conversely, students from Natural Sciences, despite their high individual scores, fell short of the overall average. The Social Sciences students displayed relatively stable results, approaching the overall mean. The distribution chart (Figure 6) illustrates the average competence in adapting to technical devices, with a minimum value of 1, a maximum of 5, an average of 3.89, and a standard deviation of 0.786.

Among the four surveyed areas, the highest average score was for "I fully satisfy the learning facilities (computers, textbooks, notebooks, ...)" with an average of 4.11. Particularly, students in the Educational Sciences scored an average of 4.23, surpassing the general mean. This indicates that students are well-prepared with learning resources, and HNUE provides a supportive infrastructure, including computer labs and functional rooms, especially beneficial for Natural Sciences students.

While blended learning encompasses both in-person and online education, the facets of "I fully satisfy the operation of equipment and software", "I fully satisfy the problem solving in communication and cooperation in studying", and "I fully satisfy the material exploring responsively" had the lowest average score of 3.81. Some surveyed students mentioned that the primary issue lies in the school's online education system. Although HNUE currently uses an LMS to facilitate online management and interaction, different faculties use various platforms like Zoom, Google Meet, Teams, and Classroom for teaching. This diversity requires students to adapt repeatedly, which can hinder consistent interaction and assignment submission. Studies by Hanaysha et al. (2023), Meier (2021); Yilmaz and Yilmaz (2022), and Otto et al. (2024) highlight these technological challenges in online education [33], [42], [52], [39]. Regarding problem-solving and communication skills in blended learning, recent classroom practices have improved these competencies among educational students. However, these skills are not yet fully developed. Alarifi & Song (2024) noted that many students struggle to maintain effective communication

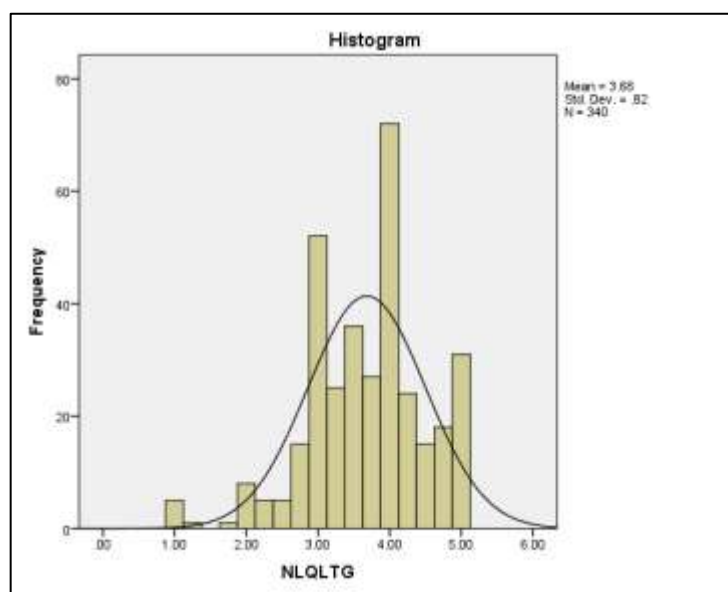
and cooperation online [44]. The study on blended learning involvement shows that students demonstrate relatively high adaptability to technological devices, indicating familiarity with digital tools and platforms used in hybrid environments. This aligns with the findings from teacher-focused studies, where both pre-service and in-service teachers exhibit strong competence in basic ICT use and digital resource interaction [53], [54]. However, several studies emphasize that technical adaptability alone is insufficient for effective blended learning, for instance, research ICT competencies among pre-service teachers indicates limitations in applying technology for pedagogical purposes and assessment, despite adequate technical knowledge [55]. Similarly, studies on university lecturers highlight that effective digital competence requires integration of design, implementation, and evaluation skills, not just operational ability [56], [57]. These findings suggest that adaptability must be complemented by higher-order competencies such as critical thinking, instructional design, and self-regulated learning.

From a student perspective, in in-depth interviews, the blended learning study further reveals moderate levels of individualized learning planning and problem solving, indicating gaps in deeper engagement despite high technological adaptability. This is consistent with broader evidence that digital competence development is influenced by curriculum integration, institutional support, and learning environments rather than technology access alone [58], [48].

In summary, while HNUE students meet the criteria for blended learning competence, their application of these skills in their studies remains limited. Further research on tool usage, pre-class and post-class engagement, and digital competence is necessary to enhance learning [59], [60]. This will aid in developing individual learning plans and upgrading HNUE's online platforms.

4.3. Ability to adapt students individualized blended learning planning in Hanoi National University of Education, Vietnam

Figure 7. Distribution chart of the average value of student competence of individualized learning planning when participating in blended learning in Hanoi National University of Education, Vietnam



The ability to adapt to individualized blended learning planning among students at HNUE (mentioned in Figure 7) demonstrates varied competency levels, with average scores ranging from 3.52 to 3.86. The normal distribution chart indicates a minimum value of 1, a maximum of 5, and an average value of 3.68, with a standard deviation of 0.82 (see Figure 7). Notably, students in the Educational Sciences consistently achieved the highest average scores, exceeding the overall mean and reaching 3.93. The highest-rated aspect, “I satisfy the course completion”, received an average score of 3.86, reflecting the high percentage of students achieving excellent, good, and fair academic performance levels. According to Akpen et al. (2024), students tend to complete online courses more swiftly, particularly when motivated by external factors such as grades, responsibilities, and employment [61]. Additionally, the flexibility of online courses suits the current credit-based training characteristics, allowing students to enroll in modules according to their schedules [24], [41]. However, the limited availability of specialized classes per semester poses a challenge, potentially affecting students' ability to effectively complete their studies.

The lowest average score of 3.52 (see Figure 7) was observed in “I satisfy the critical learning syllabus planning”. Students indicated that the current credit-based system limits their ability to plan their

studies precisely, as many courses are only offered for 30 to 60 periods over 10 to 15 weeks. The school's limited course offerings and prerequisite requirements hinder students from creating specific learning plans, often leading them to follow the school's preliminary schedules. Lourenco & Paiva (2024) emphasized the significant impact of specific learning plans on course completion and achievement [46]. Similarly, a study on first-year students at HNUE revealed that 65.4% of students (see Figure 7) were unaware of their chosen major's purpose, leading to difficulties in course selection and a lack of targeted learning plans. This issue is critical in blended learning environments, where open-ended formats in both assessment and reference materials require students to have clear, individualized plans to ensure effective participation and prevent dropout [59], [57], [62].

The lack of precise study plans also affects the students' ability to identify clear learning targets for each session and the online content, an area with an average score of 3.54 (see Figure 7). The close relationship between these two areas is logical, as the consistency in scores suggests. Theoretical learning, practical application, and discussion are interwoven processes that require systematic planning from the supervising lecturers. Without specific plans and time allocations, students' learning processes are directly impacted [46], [63]. Results from the survey indicate that 50.8% of participants were uncertain about their post-graduation career paths, indicative of broader uncertainties in their education planning.

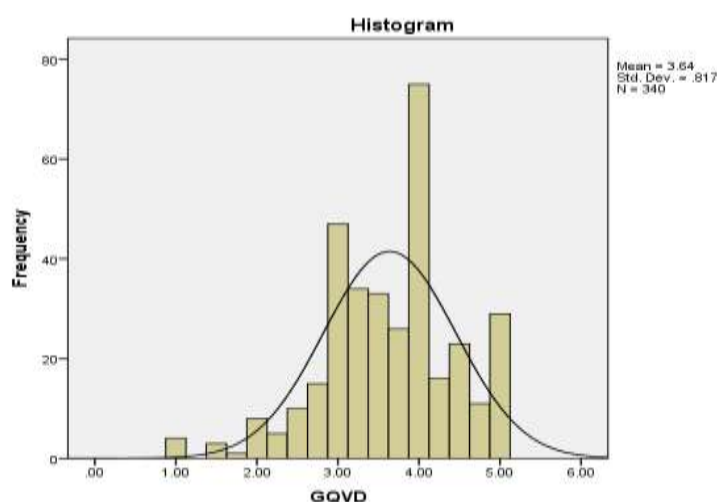
The comparative findings across recent studies highlight that students' ability to adapt individualized blended learning planning remains moderately developed but unevenly supported by institutional and pedagogical factors. Duc Giang et al. (2026) found that while students demonstrate acceptable levels of individualized planning in blended learning environments, this dimension is weaker compared to technological adaptability, indicating limited self-regulated learning strategies and proactive planning behaviours [60]. Studies on digital competence among pre-service teachers reveal that learners possess foundational ICT skills but struggle with applying these skills to support instructional design, assessment, and personalized learning pathways [55], [53].

Furthermore, research on university students and lecturers emphasizes that digital competence significantly influences learners' capacity to engage in adaptive and flexible learning environments. Nguyen et al. (2024) highlights that competences such as designing, implementing, and evaluating digital learning activities are essential for supporting individualized learning processes [56]. On the other hand, Tu et al. (2025) note that higher education institutions often focus on technical skills while neglecting critical competencies such as digital content creation and learning autonomy, which are crucial for personalized blended learning [48].

In a word, HNUE students currently do not fully recognize the necessity of constructing precise study plans and are not yet proactive in their learning and knowledge enhancement. Poor time management and lack of personalized study plans can negatively affect practice sessions, leading to suboptimal outcomes in blended learning environments. Addressing these issues is essential for achieving educational objectives and fostering essential competencies for professional readiness. Further research and strategic interventions are needed to improve tool usage, pre-class and post-class engagement, and digital competence to enhance the effectiveness of blended learning. This will support the development of personalized learning plans and the improvement of HNUE's online platforms.

4.4. Ability of problem solving in student blended learning in Hanoi National University of Education, Vietnam

Figure 8. Distribution chart of the average value of student competence of problem-solving in blended learning in Hanoi National University of Education, Vietnam



The study conducted at Hanoi National University of Education (HNUE) surveyed 340 students to evaluate their problem-solving abilities in a blended learning environment. The survey revealed an average score of 3.64, with a minimum of 1, a maximum of 5, and a standard deviation of 0.817.

A key finding was that students were generally satisfied with their learning methodology in both online and onsite formats, achieving an average score of 3.74 (see Figure 8). However, the remaining three areas assessed had slightly lower average scores: 3.61 for the ability to integrate online and onsite learning, 3.58 for critical learning syllabus planning, and 3.62 for identifying clear learning targets. These lower scores suggest that while students are relatively adept at adapting to blended learning, there is room for improvement in specific areas critical to achieving higher educational outcomes. The results in Figure 8 indicate that HNUE students often struggle with personalized study plans and effective time management. These issues can negatively impact on practical sessions and overall academic performance. The survey also highlighted that 50.8% of students were uncertain about their career paths post-graduation, reflecting broader uncertainties in their education planning. Implementing these strategies could help HNUE students better manage their learning processes and achieve their academic goals.

The comparative analysis of recent studies reveals that students' problem-solving ability in blended learning environments is a critical yet underdeveloped dimension of digital competence. Duc Giang et al. (2026) found that students exhibit only moderate levels of problem-solving competence in blended learning, with limitations in critical thinking, deep engagement, and the ability to apply knowledge to complex digital tasks [60]. This finding aligns with Ha et al. (2026), who report that although students demonstrate basic technological proficiency, their higher-order competencies, particularly problem-solving and creativity application, remain insufficiently developed in teacher education programs [64]. Similarly, Tu et al. (2025) and Do et al. (2025) emphasize that current university training programs in Vietnam tends to prioritize technical skills such as data handling and tool operation, while neglecting problem-based and experiential learning approaches that are essential for developing problem-solving capacity [48], [65]. Supporting this, Ngoc et al. (2025) highlights that integrating digital tools into curricula significantly enhances students' analytical and problem-solving abilities, especially when linked to real-world applications and interactive learning environments [58]. From an assessment perspective, learning-oriented assessment plays a crucial role in strengthening problem-solving competence. Ha et al. (2025) demonstrate that learning-oriented assessment fosters metacognitive thinking, self-regulated learning, and critical problem-solving skills through formative feedback and authentic assessment tasks [59]. However, challenges such as limited infrastructure, insufficient teacher capacity, and traditional assessment practices hinder its effective implementation. Overall, the discussion suggests that enhancing problem-solving ability requires a shift toward competence-based curricula, problem-based learning, and integrated digital pedagogy to ensure effective student engagement in blended learning environments.

4.5. Correlation between the three domains of student competence of blended learning involvement in Hanoi National University of Education, Vietnam

Figure 9. Correlation between the three domains of student competence of blended learning involvement in Hanoi National University of Education, Vietnam

		Competence in adapting to technological devices	Competence of individualized learning planning	Competence of problem-solving in student blended learning
Competence of adapting to technological devices	Pearson Correlation	1	.708**	.719**
	Sig. (1-tailed)		.000	.000
	N	340	340	340
Competence of individualized learning planning	Pearson Correlation	.708**	1	.785**
	Sig. (1-tailed)	.000		.000
	N	340	340	340
Competence of problem-solving in student blended learning	Pearson Correlation	.719**	.785**	1
	Sig. (1-tailed)	.000	.000	
	N	340	340	340

The table above shows a high level of positive correlation between the ability to adapt to technical devices, the ability to develop a personal learning plan, and the ability to solve problems during the blended learning process, all of which are statistically significant with $\text{Sig.}=0.000$. This shows that the relationship between these three areas is very closely correlated, with correlation coefficients all >0.7 (see Figure 9). First, the correlation between the ability to adapt to technical devices and the ability to develop a personal learning plan has a Pearson correlation coefficient of 0.708. This shows that students who are able to use technical devices effectively are often able to manage and develop a personal learning plan better. This association reflects the importance of technology proficiency in optimizing online and face-to-face learning time. Second, the correlation between the ability to adapt to technical devices and problem-solving ability has a Pearson correlation coefficient of 0.719. This indicates that students who are able to adapt quickly to technology can improve their problem-solving ability in complex learning situations. Technology can support students in finding resources, interacting with the learning environment, and making appropriate decisions when faced with challenges. Third, the correlation between the ability to develop a personal learning plan and problem-solving ability has a Pearson correlation coefficient of 0.785, indicating a strong correlation between the two abilities. Students who are able to manage their time effectively often have better problem-solving skills, which can be seen as students who know how to organize their work reasonably, allocate time to different tasks, and optimize time to solve problems that arise. This result emphasizes the necessity of practicing these competencies in parallel during the blended learning process, because they not only support each other but also help students achieve higher learning efficiency.

Semi-structured interviews were conducted with 22 students from HNUE, representing a diverse range of GPA scores and academic majors. These interviews aimed to delve deeper into the students' competencies in blended learning environments. A notable finding from these discussions was the students' adeptness at adapting to technological devices, which significantly enhanced their learning experiences. Furthermore, the ability to develop personalized learning plans emerged as a critical skill, particularly in terms of effective time management. Students demonstrated a strong capability to organize their schedules, allocate time to various tasks, and optimize their efforts to overcome challenges independently. The problem-solving abilities of these students were also scrutinized, revealing a pronounced focus on resolving issues encountered during independent work rather than teamwork. This insight underscores the importance of fostering individual problem-solving skills alongside collaborative efforts in blended learning settings. These findings offer a nuanced understanding of the current state of student competencies in blended learning, providing a valuable foundation for curriculum development and further research in teacher education programs. They also highlight the need for ongoing support in technological adaptability, personalized learning, and problem-solving skills to enhance student readiness for blended learning [11].

Recommendations for student competence of Blended Learning involvement in tertiary education in Vietnam

Vietnam's ongoing digital transformation has prompted universities to integrate blended learning into teacher education programs. This shift requires a comprehensive framework to enhance student competence, ensuring education quality and effective policy alignment [38], [9]. The recommendations address strategic actions across technology integration, personalized learning, problem-solving skills, and continuous support, tailored to tertiary education and teacher training in Vietnam. Universities in Vietnam should prioritize the deployment of advanced technological tools and platforms to facilitate seamless blended learning. Ensuring access to high-quality digital resources and stable internet connectivity is essential for equitable participation. Institutions must invest in infrastructure that supports both online and offline learning environments, fostering innovation and inclusivity.

In terms of personalized learning, to meet diverse student needs, universities should encourage the creation of individualized learning plans. Workshops and training sessions focused on time management, self-regulation, and goal setting will empower students to take ownership of their educational progress. Personalized approaches enable students to optimize their learning schedules and adapt strategies for various teaching contexts. Curriculum design should emphasize critical thinking and practical knowledge application. Incorporating project-based learning, case studies, and real-world problem-solving tasks will cultivate essential skills for teacher candidates. These strategies encourage independence and collaboration problem-solving, preparing students for complex challenges in blended teaching environments.

In blended learning, ongoing mentorship and academic guidance are vital. Regular feedback, peer collaboration opportunities, and access to advisors will help students navigate blended learning effectively. Universities must establish support systems that promote resilience and sustained engagement. In terms of policy development, policymakers should align regulations with these strategic actions to enhance education quality. Investments in technology, personalized learning initiatives, and problem-solving curricula must be supported by national guidelines. Continuous evaluation of blended learning outcomes will inform adaptive policies, ensuring that teacher education remains relevant in the

digital era. This framework advances student competence and education quality, positioning Vietnam’s teacher education programs for success amid digital transformation.

Limitations

This research faces several limitations. The sample size is relatively small, comprising mostly third-year students, which may not provide a comprehensive view of all university students' competencies in blended learning environments. Additionally, the study lacks feedback from university teachers regarding their assessment of students' blended learning skills. These constraints may affect the generalizability of the findings, and future research should include a broader participant base and incorporate educators' perspectives to gain a more holistic understanding of the effectiveness of blended learning in teacher education programs.

Conclusion

In the context of ongoing transformations, the competency of university students in teacher education programs to engage in blended learning is of paramount importance. This competency comprises a combination of key skills, including adaptability to technological devices, the ability to develop personalized learning plans, and problem-solving skills in blended teaching and learning environments. A study conducted at HNUE highlights the current state of blended learning engagement competencies among students in teacher education programs in Vietnam. Simultaneously, these findings serve as a foundation for further research on curriculum development, student competencies, and program learning outcomes in teacher education institutions. More broadly, they provide insights into policy development concerning teacher training in the current era of digital transformation.

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AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Nam-Phuong Nguyen	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Dinh Chien Tran		✓			✓	✓				✓	✓			
Trung Kien Phan	✓	✓	✓	✓		✓		✓		✓	✓		✓	✓
Thi Thanh Hien Nguyen		✓			✓		✓		✓	✓				

C : Conceptualization M : Methodology So : Software Va : Validation Fo : Formal analysis	I : Investigation R: Resources D: Data Curation O: Writing - Original Draft E: Writing - Review & Editing	Vi : Visualization Su : Supervision P: Project administration Fu : Funding acquisition
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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

The study received approval from the Ethics Committee of the Department of Science and Technology at Hanoi National University of Education, Hanoi, Vietnam, with the certificates number 300/GCN-DHSPHN dated on May 23rd, 2025, under the Vietnamese Ministry of Education and Training.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request, in accordance with IJERE and APA guidelines. The dataset was constructed based on three main foundations: (1) the Individual Adaptability (I-ADAPT) Theory [23], which provided a comprehensive framework for assessing adaptability in blended learning environments; (2) principles of student-centered and personalized learning, which informed the design of survey instruments and interview protocols tailored to capture learners’ experiences and preferences in blended learning contexts [26], [27]; and (3) the digital competence framework for Vietnamese learners, ensuring the data reflect the specific technological skills and competencies relevant to the local educational context [9], [38], [60]. The integration of these foundations allowed for a robust and contextually relevant

dataset that supports both quantitative and qualitative analyses. All data have been anonymized to protect participant confidentiality. Researchers interested in accessing the data for replication or further study are encouraged to contact the corresponding author via the provided email address. Data will be shared in compliance with ethical and institutional guidelines and only for academic purposes.

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