Determinants of Student Learning Engagement in National Defense and Security Education under Blended Learning: A Structural Equation Modeling Study in Vietnam

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***Abstract*—The transition to blended learning presents significant benefits but also poses challenges in maintaining student participation, particularly for highly normative courses. This study investigates the determinants of student learning engagement in National Defense and Security Education within a blended learning framework. Quantitative data were collected from 423 university students in Vietnam. To rigorously examine both direct and mediating structural relationships, data were analyzed utilizing Structural Equation Modeling (SEM). The empirical findings demonstrate that online system quality, instructor support, and learner interaction exert significant positive effects on both intrinsic motivation and learning engagement. Notably, the practical nature of the instructional content does not directly drive engagement behavior; instead, its effect is fully mediated by intrinsic learning motivation. These results offer crucial empirical evidence highlighting the indispensable role of self-driven motivation in sustaining student engagement. Consequently, this research provides valuable empirical insights for higher education institutions to optimize their technological platforms and refine pedagogical strategies, ultimately enhancing the training quality of specialized disciplines in digital learning environments.**

***Keywords*—blended learning, intrinsic motivation, learning engagement, national defense and security education, structural equation modeling**

I. Introduction

The rapid development of information technology has been a key driver of digital transformation in higher education [1, 2]. In this context, blended learning is a popular pedagogical approach [3, 4]. Recent studies indicate that this model is adaptable and facilitates learner interaction [5]. In digital learning ecosystems, student learning engagement is a measure of educational quality and outcomes [6]. This engagement is usually influenced by the quality of the technological platforms, the style of instruction, and the content delivered. Although blended learning has been widely implemented, prior studies have primarily assessed learner engagement in voluntary or core academic fields.

However, there is still a theoretical and empirical gap in the engagement mechanisms in mandatory (or normative) contexts, such as National Defense and Security Education (NDSE) in Vietnam [7]. NDSE is a pedagogical paradox as it needs to integrate and harmonize normative political theory and real-world military practice. Given this context, transitioning to a blended format is a challenging endeavor. The digital space can dilute the collective discipline of military training, and theoretical modules often lack pedagogical depth, resulting in cognitive overload and student passivity [8]. Transitioning this instructional process to a blended format may alter how technology and pedagogy influence student behavior. This creates a paradox in teaching NDSE: while it demands a team effort and strict compliance, the online environment emphasizes autonomy and flexibility [9]. Without direct supervision in digital spaces, the disciplined nature of military life becomes absent.

Therefore, understanding the psychological drivers behind student engagement in NDSE is a critical theoretical imperative. The traditional models of learning in NDSE may not be able to describe the process. Therefore, to address this gap in the literature, this study investigates intrinsic learning motivation as the mediating mechanism. Therefore, the objective of this study is to build and empirically validate a structural model that analyzes the drivers of student learning engagement in NDSE. By analyzing the direct and mediating mechanisms via Structural Equation Modeling (SEM), this research aims to shift the focus from technological adoption to an understanding of psychological motivation.

II. Literature Review

A. Multidimensional Learning Engagement and the Overarching Theoretical Framework

Based on the concepts of previous works, this study defines student Learning Engagement (LE) as a multi-dimensional composite that involves behavioral participation and cognitive focus [10, 11]. Early e-learning studies used login frequency, but as later research has shown, that does not reflect learning quality [12]. Contemporary perspectives emphasize deeper psychological and cognitive engagement [13]. For normative subjects, such as NDSE, engagement has to be sustained by technological and pedagogical interventions as well [14].

To understand the foundations of this engagement in theory, we rely on Self-Determination Theory (SDT) [15]. SDT suggests that intrinsic Learning Motivation (LM) is formed when three basic psychological needs are fulfilled: autonomy, competence, and relatedness [16, 17]. As such, intrinsic motivation is the mechanism to convert the external instructional and technological stimuli and their impact into learning behavior [18]. According to SDT, sustainable learning engagement is achieved only when external influences (technological systems or support from teachers) meet three basic psychological needs of autonomy, competence, and relatedness [19]. In a blended learning system, a stable Learning Management System (LMS) enhances students' sense of technological competence, and interaction with instructors and peers enhances their sense of

"relatedness". On the contrary, when these needs are met, external stimuli are internalized into intrinsic motivation and then lead to deep engagement behaviors and not just superficial compliance.

H9: Intrinsic learning motivation has a positive impact on students' learning engagement.

B. Online System Quality (SQ)

System quality is a technological boundary of the blended learning ecosystem [20]. Initial studies found that stability and access speed are essential for user adoption. Modern Learning Management Systems (LMS) have user-friendly interfaces and cross-device support. From the SDT perspective, an optimal LMS minimizes technical friction and provides students the autonomy to do their own work [21]. This psychological comfort is a source of intrinsic motivation and a force for engagement.

H1: Online system quality exerts a positive effect on intrinsic learning motivation.

H5: Online system quality exerts a positive effect on learning engagement.

C. Instructor Support (ISP) and Learner Interaction (LI)

The social aspects of blended learning are studied through the Community of Inquiry (CoI) model and Social Constructivism [22, 23]. ISP and LI are in line with the CoI's concept of "teaching presence": the instructor has the ability to design and direct the digital space and to communicate and provide psychological support. Learner Interaction (LI) combines "social and cognitive presence" and takes us from passive forum reading to collective knowledge formation [24]. ISP and LI are fulfilling the SDT requirement for relatedness. Social interaction and instructor support are evidence of motivation and behavior.

H2: Instructor support and presence have a positive impact on intrinsic learning motivation.

H3: Learner interaction has a positive impact on intrinsic learning motivation.

H6: Instructor support and presence have a positive impact on learning engagement.

H7: Learner interaction has a positive impact on learning engagement.

D. Content Practicality (CP) in Specialized Contexts and the Mediating Role of Motivation

According to the Andragogy theory, adult learners are more involved if they see the practical application of their knowledge [25]. Historically, digital learning content was merely an electronic version of traditional textbooks. Content Practicality (CP) is, in fact, the perceived practical value of the material [26]. Content in normative courses like NDSE must be relevant to real-world practices and contemporary contexts. If students feel that the content can be applied in practice, they have a greater sense of intrinsic motivation and connection to the subject.

Intrinsic learning motivation is the desire to be able to explore and work in the direction of learning and self-advancement. Grounded in Self-Determination Theory, intrinsic motivation flourishes when an educational environment effectively satisfies learners' fundamental psychological needs for autonomy, competence, and relatedness. Motivation is the mediating factor. If technological systems or instructional content do not translate into self-directed motivation, then students may be less motivated to take mandatory courses [27]. Thus, this study suggests that intrinsic learning motivation is the link between learning environment factors, such as content practicality, and student engagement levels.

H4: Content practicality exerts a positive effect on intrinsic learning motivation.

H8: Content practicality exerts a positive effect on learning engagement.

H9: Intrinsic learning motivation has a positive impact on students' learning engagement.

To synthesize the theoretical arguments and proposed hypotheses, the comprehensive conceptual framework of this study is visually presented in Fig. 1.

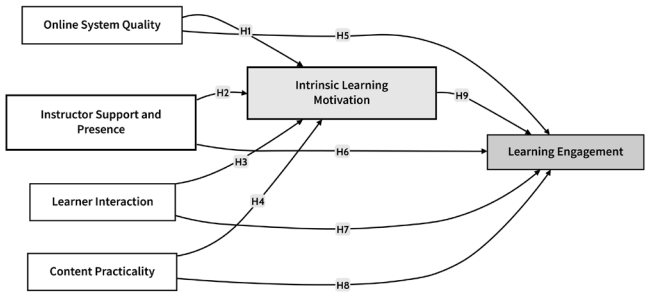

Fig. 1. Conceptual model diagram.

III. Materials and Methods

A. Participants and Data Collection Procedure

A convenience sampling approach was utilized to recruit undergraduate students enrolled in blended NDSE courses in Vietnam. Survey invitations were sent online through the official Learning Management System (LMS) to nearly 500 students enrolled. A total of 452 responses were received, with an initial response rate of 90.4%. After screening for missing or unengaged answers, 423 valid questionnaires were retained for formal analysis. A widely accepted methodological guideline for Structural Equation Modeling (SEM) recommends maintaining a minimum sample size of 5 to 10 observations per measured variable [28]. Given the 24 observable items, a sample size of $N = 423$ is highly adequate to ensure statistical robustness. The sample consisted of 191 males (45.2%) and 232 females (54.8%). The majority of students were freshmen (41.1%), sophomores (29.8%), juniors (17.7%), and seniors (11.3%). The sample composition is also in line with the curriculum structure of universities where NDSE is typically implemented in the first year of university education.

B. Measurement Instruments

The measurement instruments were built using and adapting validated scales from international empirical studies. The questionnaire items were translated and used to reflect the NDSE course. A pilot study was performed prior to a formal survey to ensure linguistic equivalence and conceptual clarity. The formal survey was conducted using 24 observable items: Online System Quality (SQ-4 items), Instructor Support and Presence (ISP-4 items), Learner Interaction (LI-4 items), Content Practicality (CP-4 items),

Intrinsic Learning Motivation (LM-4 items), and Learning Engagement (LE-4 items). The 5-point Likert scale was used to evaluate the observable items, from 1 to 5 (Strongly Disagree to Strongly Agree). In Table 1, we present detailed measurement items and their original literature sources.

Instrument standardization was conducted through a two-step process. First, the scales from international studies were translated into Vietnamese using a back-translation technique to ensure semantic accuracy. Subsequently, a pilot study ($n = 30$) was conducted to refine the language, ensuring alignment with the terminology used by military and defense departments in Vietnam. This ensured that all participants had a clear understanding of the items before the formal survey.

C. Data Analysis Method

We conducted all quantitative analyses using the Jamovi statistical software (version 2.6) [29]. Data processing proceeded as follows: First, descriptive statistics were performed to summarize the characteristics of the sample. Second, to address possible Common Method Bias (CMB) in cross-sectional self-reported data, Harman's single-factor test was performed. Third, scale reliability was evaluated using Cronbach's Alpha and Composite Reliability (CR). Convergent and discriminant validity were assessed using Average Variance Extracted (AVE) and a competing model analysis (comparing 6-factor and 5-factor structures). Finally, Structural Equation Modeling (SEM) was used to confirm the research hypotheses. We tested the fit of our model by using standard indices and thresholds: Comparative Fit Index (CFI) ≥ 0.90, Tucker-Lewis Index (TLI) ≥ 0.90, Root Mean Square Error of Approximation (RMSEA) ≤ 0.08, and Standardized Root Mean Square Residual (SRMR) ≤ 0.08 [30]. To test the mediation effects, we performed a bootstrapping procedure with 1000 resamples to obtain 95% confidence intervals for all indirect effects.

D. Ethical Approval and Informed Consent

This research strictly adhered to all basic ethical principles in social science research. The formal ethical approval was waived due to the usual research procedures in Vietnam as a non-experimental study was carried out, and data were collected purely via anonymous questionnaires with no physical or psychological risks to the participants at all. Electronic written consent was obtained from all students before they participated in the survey. Students were made aware of the research objectives, that they could voluntarily participate or withdraw at any point and that their data would be used only for research purposes.

Table 1. Measurement items and sources

Construct	Items	Sources
Online System Quality (SQ)	**SQ1:** The LMS platform is stable and ensures efficient access for NDSE learning activities. **SQ2:** The digital learning system has a user-friendly interface that is easy to navigate. **SQ3:** The platform responds promptly and reliably when I access course materials. **SQ4:** The information system provides all necessary features to support blended learning effectively.	[31]
Instructor Support and Presence (ISP)	**ISP1:** The instructor provides timely emotional and academic support throughout the course. **ISP2:** The instructor actively guides us through the blended learning tasks and defense topics. **ISP3:** The instructor creates a supportive environment that encourages active participation. **ISP4:** The instructor's teaching presence is clearly felt in both online and face-to-face sessions.	[15, 22, 23]
Learner Interaction (LI)	**LI1:** I frequently engage in course-related discussions with my peers regarding security topics. **LI2:** I comfortably exchange views and information with the instructor and classmates. **LI3:** I actively participate in group collaborations and online interactive forums. **LI4:** I interact deeply and effectively with the provided digital course content.	[24]
Content Practicality (CP)	**CP1:** The NDSE content is highly relevant to real-world situations and practical security contexts. **CP2:** The theoretical knowledge I learn is directly applicable to actual scenarios. **CP3:** The practical exercises enhance my understanding of defense and security concepts. **CP4:** The learning materials focus on practical problem-solving with immediate applicability.	[25]
Intrinsic Learning Motivation (LM)	**LM1:** I study National Defense and Security because I find the topics genuinely interesting. **LM2:** Discovering new concepts in this course provides me with a deep sense of satisfaction. **LM3:** I participate in the blended learning activities out of curiosity and a desire to learn. **LM4:** I feel internally driven and self-determined to master the course content.	[16, 18]
Learning Engagement (LE)	**LE1:** I consistently pay attention and maintain focus during both online and offline sessions. **LE2:** I actively contribute to class activities and complete all assignments proactively. **LE3:** I put significant cognitive effort into analyzing and understanding complex defense strategies. **LE4:** I feel emotionally invested and maintain a positive attitude toward participating in this course.	[10, 11, 13]

IV. Result and Discussion

A. Descriptive Statistics and Normality Check

Before model testing, we performed descriptive statistics to assess the response tendencies and verify the data's normality. Descriptive statistics indicated that the mean scores of the observable variables ranged from 3.51 (Learner Interaction) to 3.88 (Content Practicality). Furthermore, univariate normality was confirmed, as skewness values (-0.582 to -0.123) and kurtosis values (-0.715 to -0.237) fell well within the recommended absolute thresholds of 3 and 10, respectively. While self-reported data are subject to multivariate normality assumptions, we used the Maximum Likelihood (ML) estimation method and bootstrapping strategy (1000 estimates). This approach ensures that standard errors and confidence intervals for indirect effects are robust to non-normality. Furthermore, the bivariate relationships among the constructs were examined, and the detailed correlation matrix is provided in Table 2.

Table 2. Correlation matrix of the constructs

Constructs	SQ	ISP	LI	CP	LM	LE
SQ	**1.000**					
ISP	0.408	**1.000**				
LI	0.407	0.318	**1.000**			
CP	0.479	0.446	0.317	**1.000**		
LM	0.656	0.639	0.525	0.737	**1.000**	
LE	0.676	0.701	0.546	0.669	0.881	**1.000**

Note: All correlation coefficients are statistically significant at $p < 0.001$

B. Common Method Bias (CMB) Testing

To address the common method bias in self-reported data, Harman's single-factor test was carried out. Using the Exploratory Factor Analysis (EFA) with all 24 items being on one unrotated factor, we found that the factor was responsible for 42.9% of the variance. As this variance falls below the 50% threshold, CMB is not considered a pervasive issue in this study.

C. Measurement Model Assessment

The measurement model was evaluated using Confirmatory Factor Analysis (CFA). We confirmed reliability and convergent validity with Cronbach's Alpha coefficients (0.860–0.925) and Composite Reliability (CR) values (0.860–0.925) above 0.70. Average Variance Extracted (AVE) for all constructs ranges from 0.605 to 0.756, exceeding 0.50. Standardized factor loadings ranged from 0.744 to 0.889 ($p < 0.001$). Table 3 shows detailed results.

Initial EFA results indicated statistical convergence between Intrinsic Motivation (IM) and Learning Engagement Engagement (LE), a common occurrence given their high correlation in psychological literature. In addition, because of this relationship, the traditional discriminant validity measures based on variance and correlation (e.g., the Fornell-Larcker criterion and HTMT ratio) indicated a degree of construct overlap.

Table 3. Reliability and measurement model assessment

Constructs	Items		Cronbach's α	CFA Loadings (β)	p-value	CR	AVE
System Quality (SQ)	SQ1–SQ4	4	0.883	0.777–0.850	<0.001	0.884	0.655
Instructor Support and Presence (ISP)	ISP1–ISP4	4	0.866	0.760–0.805	<0.001	0.886	0.617
Learner Interaction (LI)	LI1–LI4	4	0.860	0.744–0.800	<0.001	0.860	0.605
Content Practicality (CP)	CP1–CP4	4	0.869	0.770–0.808	<0.001	0.870	0.626
Intrinsic learning motivation (LM)	LM1–LM4	4	0.907	0.820–0.876	<0.001	0.907	0.710
Learning Engagement (LE)	LE1–LE4	4	0.925	0.853–0.889	<0.001	0.925	0.756

Note: All standardized factor loadings are significant at p < 0.001. CR = Composite Reliability; AVE = Average Variance Extracted

However, in keeping with the strong theoretical underpinning of SDT (which clearly delineates motivation as an internal psychological driver and engagement as the subsequent behavioral manifestation), we kept the six-factor structure. To determine whether these constructs should be merged, a competing CFA model analysis was conducted for a more rigorous comparison.

To address the high correlation between Intrinsic Learning Motivation (LM) and Learning Engagement (LE) ($r = 0.881$), a competing model analysis was performed. The theoretical 6-factor model exhibited a superior fit ($\chi^2 = 242$, df = 237, $p = 0.392$, CFI = 0.999, TLI = 0.999, RMSEA = 0.007) compared to a constrained 5-factor model where LM and LE items were merged ($\chi^2 = 409$, df = 242, $p < 0.001$, CFI = 0.976, TLI = 0.972, RMSEA = 0.040). The significant difference ($\Delta\chi^2 = 167$, Δdf = 5, $p < 0.001$) justifies treating LM and LE as distinct constructs within the structural model.

The significant Chi-square difference ($\Delta\chi^2 = 167$, $p < 0.001$) provides robust empirical evidence that the six-factor model exhibits superior fit. This finding confirms that while Intrinsic Motivation and Learning Engagement are closely correlated, they remain distinct theoretical constructs, reflecting different stages within the learner's psychological progression.

D. Structural Model and Hypothesis Testing

Structural Equation Modeling (SEM) results indicated that the model aligns with the empirical data (Fig. 2 and Table 4). The structural model fit indices are exceptionally high (CFI = 0.999, TLI = 0.999, RMSEA = 0.007). This optimal fit is analytically consistent with the high homogeneity of the student sample - who share the same institutional context and standardized LMS platform - and is further supported by the prior cross-validation. Eight of the nine hypotheses were supported. Online System Quality (SQ), Instructor Support and Presence (ISP), and Learner Interaction (LI) exerted positive impacts on both Motivation (LM) and Engagement (LE) ($p < 0.001$). Content Practicality (CP) demonstrated a strong effect on Motivation (LM) ($\beta = 0.426$, $p < 0.001$), but its direct impact on Engagement (LE) was not statistically significant ($\beta = 0.076$, $p < 0.136$), leading to the rejection of H8. Mediation analysis using bootstrapping (1,000 resamples) confirmed significant indirect effects for all predictors.

Table 4. Hypothesis testing results

Hypothesis		Path	β	p-value	Conclusion
Direct Effects	H1	SQ–LM	0.257	<0.001	Supported
	H2	ISP–LM	0.281	<0.001	Supported
	H3	LI–LM	0.195	<0.001	Supported
	H4	CP–LM	0.427	<0.001	Supported
	H5	SQ–LE	0.165	<0.001	Supported
	H6	ISP–LE	0.243	<0.001	Supported
	H7	LI–LE	0.114	<0.001	Supported
	H8	CP–LE	0.076	0.107	Rejected
	H9	LM–LE	0.501	<0.001	Supported
Indirect Effects	-	SQ–LM–LE	0.129	<0.001	Significant
	-	ISP–LM–LE	0.141	<0.001	Significant
	-	LI–LM–LE	0.098	<0.001	Significant
	-	CP–LM–LE	0.214	<0.001	Significant

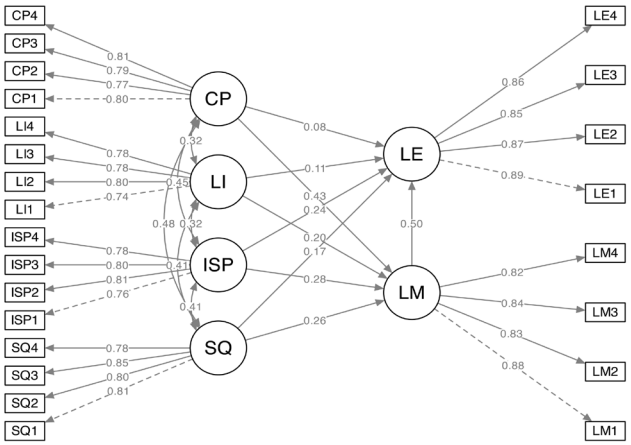

Fig. 2. Structural model and path analysis results.

Specifically, Intrinsic Motivation partially mediated the relationships between SQ, ISP, LI, and Engagement, as their direct effects remained significant. Conversely, Motivation fully mediated the effect of Content Practicality (CP) on Engagement, given the non-significant direct path.

E. Discussion

We believe the results underscore the need for technological infrastructure and social interactions in blended learning [32]. Consistent with the IS Success Model, System Quality (SQ) affects motivation and engagement [31]. When technical barriers are minimized, students can better focus on cognitive processes. The impacts of Instructor Support (ISP) and Learner Interaction (LI) support the Community of Inquiry (CoI) framework. Given the NDSE context where theoretical content is often prescriptive, online teaching is required to communicate theory with military practice [33]. The peer interactions also prevent students from being isolated in digital environments.

The demographic composition (41.1% first-year students) also contributes to this. As freshmen transitioning into self-directed blended learning, these students face unique academic challenges [34]. Consequently, Instructor Support and Presence (ISP) is crucial, providing the necessary instructional scaffolding to foster their intrinsic motivation.

This research suggests that online NDSE instruction ought to go beyond just listing some examples of real-world scenarios and should be about the students' self-discovery needs [35]. The rejection of H8 clarifies the role of Content Practicality (CP) in specialized education. In mandatory courses like NDSE, perceiving the practical value of a lesson is insufficient to directly trigger engagement behavior. Rather, CP acts as a "necessary condition" that drives Intrinsic Learning Motivation (LM) (β = 0.426). This full mediation effect extends SDT by demonstrating that while practical materials initiate interest, students sustain proactive engagement only when this intrinsic motivation is activated.

The high correlation of LM and LE is consistent with the causal nature of SDT, where internal motivation is the starting point for a subsequent behavior. However, the statistical superiority of the 6-factor model argues that they are different stages in the learning process. In practice, this means that NDSE instructional materials should not be limited to mandatory modules but must prioritize materials that will motivate the students to do the work [36].

V. Conclusion

In this work, we provide empirical evidence for the students' learning engagement in the NDSE course using a blended learning model and structural equation modeling analysis to assess the potential drivers of students' engagement in the NDSE course. Results from the structural equation modeling of 423 students demonstrate the influence of system quality, instructor support, and learner interaction on students' engagement. These factors have a direct and indirect impact on the students' engagement through the mediating mechanism of intrinsic motivation. In this study, intrinsic learning motivation was found to be the strongest predictor of learning engagement ($\beta = 0.501$, $p < 0.001$). This research is a key contribution to understanding the impact of content accessibility in normative courses. The practicality of digitized lectures does not directly lead to engaging behavior but is the prerequisite for motivation to learn. Based on these findings, educators should develop high-quality instructional materials optimized for online environments, and institutions should enhance pedagogical training for their teaching staff.

In fact, there are limitations of the present study. First, the use of convenience sampling from only a few universities in Vietnam might limit the generalization of the findings in future work. Therefore, in future investigations, stratified random sampling should be employed across different regions. For instance, the cross-sectional approach does not provide an objective picture of students' feelings and cannot provide any causal direction for the behavior. Future research could employ longitudinal approaches to examine the evolution of engagement over time. Third, although we did not find any bias associated with common methods, we believe that the self-reported data may be biased by social desirability bias. Future work may provide objective data on LMS activity and academic performance. Finally, although the 6-factor model was statistically more accurate in the study, the high correlation between motivation and engagement suggests that there is a strong conceptual link to motivation. Further qualitative methods, such as in-depth interviews, could be used to investigate the psychological barriers students face in blended NDSE environments.

Conflict of Interest

The author declares no conflict of interest.

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References

[1] W. Kayanja, M. Kyambade, and T. Kiggundu, "Exploring digital transformation in higher education setting: The shift to fully automated and paperless systems," *Cogent Education*, vol. 12, no. 1, 2025. doi: 10.1080/2331186X.2025.2489800

[2] J. Feng, B. Yu, W. H. Tan, Z. Dai, and Z. Li, "Key factors influencing educational technology adoption in higher education: A systematic review," *PLOS Digital Health*, vol. 4, no. 4, 2025. doi: 10.1371/journal.pdig.0000764

[3] N. Shaya, R. AbuKhait, R. Madani, and V. Ahmed, "Conceptualizing blended learning models as a sustainable and inclusive educational approach: an organizational dynamics perspective," *International Journal of Sustainability in Higher Education*, vol. 26, no. 9, pp. 90–111, 2025. doi: 10.1108/IJSHE-03-2024-0167

[4] H. Chen *et al.*, "Development and validation of learning behaviour scale for university students in blended learning: A technology acceptance model perspective," *European Journal of Education*, vol. 61, no. 1, 2026. doi: 10.1111/ejed.70406Digital

[5] B. Brenya, Y. Owusu-Agyeman, and S. Adjei Tachie, "Educators' perceptions about factors that affect blended learning adoption in higher education," *Educational Research and Evaluation*, pp. 1–29, 2026. doi: 10.1080/13803611.2026.2613927

[6] A. Tick and W. Ling, "Transforming learning: digital platforms and their effect on student engagement and learning outcomes," *Practice and Theory in Systems of Education*, vol. 20, no. 1, pp. 1–24, 2025. doi: 10.63145/ptse.v20i1.50

[7] N. L. Phong, "Teaching national defense and security education for Vietnamese universities' student: Execution model and innovative solutions," *J Adv Educ Philos*, vol. 9, no. 9, pp. 338–345, 2025. doi: 10.36348/jaep.2025.v09i09.002

[8] S. Caso, "Emerging technologies in military space operations: current applications and future research for educational and training purposes," *International Journal of Training Research*, vol. 23, no. 2, pp. 140–155, 2025. doi: 10.1080/14480220.2024.2431482

[9] С. Пєьол, А. Корєхов, В. Чмир, and С. Партика, "Fostering digital transformations in military engineering education: introduction of a technologyenhanced learning environment," *Problems of Education in the 21st Century*, vol. 82, no. 2, pp. 162–185, 2024. doi: 10.33225/pec/24.82.162

[10] H. Chai, T. Hu, and G. Niu, "How proactive personality promotes online learning performance? Mediating role of multidimensional

learning engagement," *Education and Information Technologies*, vol. 28, no. 4, pp. 4795–4817, 2023. doi: 10.1007/s10639-022-11319-7
[11] X. Pan, "Online learning environments, learners' empowerment, and learning behavioral engagement: The mediating role of learning motivation," *Sage Open*, vol. 13, no. 4, 21582440231205098, 2023. doi: 10.1177/21582440231205098
[12] F. Qiu *et al.*, "Predicting students' performance in e-learning using learning process and behaviour data," *Scientific Reports*, vol. 12, no. 1, 453, 2022. doi: 10.1038/s41598-021-03867-8
[13] D. Ge, "Resilience and online learning emotional engagement among college students in the digital age: A perspective based on self-regulated learning theory," *BMC Psychology*, vol. 13, no. 1, 326, 2025. doi: 10.1186/s40359-025-02631-1
[14] L. Zou *et al.*, "The synergy of embodied cognition and cognitive load theory for optimized learning," *Nature Human Behaviour*, vol. 9, no. 5, pp. 877–885, 2025. doi: 10.1038/s41562-025-02152-2
[15] J. Longakit *et al.*, "The influence of teacher emotional support on academic engagement of university students: Examining the mediating role of academic motivation through the lens of Self-determination theory," *Scientific Journal of School Sport, Physical Education and Psychomotricity*, vol. 11, no. 2, pp. 1–25, 2025. doi: 10.17979/sportis.2025.11.2.11328
[16] A. Alharfi and A. Alamer, "The interrelationship between basic psychological needs, intrinsic motivation, classroom engagement, and L2 academic achievement: A large-scale study of self-determination theory," *Studies in Second Language Learning and Teaching*, vol. 16, no. 1, pp. 43–75, 2026. doi: 10.14746/ssllt.47709
[17] Y. Li, R. Sueb, and K. Said Hashim, "Basic psychological needs and psychological well-being among undergraduate students in China: the mediating role of autonomous motivation and academic engagement," *Psychology Research and Behavior Management*, vol. 2025, no. 18, pp. 527–549, 2025. doi: 10.2147/PRBM.S501467
[18] X. Xiaoping, W. Chenhui, T. Jiawei, J. Dian, and X. Fanghe, "The driving mechanism of innovative behavior of vocational education students: an analysis of the role of psychological satisfaction, intrinsic motivation and career needs," *Frontiers in Psychology*, vol. 17, 1724865, 2026. doi: 10.3389/fpsyg.2026.1724865
[19] Y. Yang, J. Chen, and X. Zhuang, "Self-determination theory and the influence of social support, self-regulated learning, and flow experience on student learning engagement in self-directed e-learning," *Frontiers in Psychology*, vol. 16, 1545980, 2025. doi: 10.3389/fpsyg.2025.1545980
[20] S. Batista-Toledo and D. Gavilan, "A blended learning future: COVID-19 lessons for 'phygital' higher education," *International Review of Research in Open and Distributed Learning*, vol. 26, no. 2, pp. 1–22, 2025. doi: 10.19173/irrodl.v26i2.8259CopiedAn
[21] W. Zhaoqiong, I. N. Jampel, and I. W. S. Warpala, "Exploration of students' autonomous learning motivation in educational technology environments," *Indonesian Journal of Instruction*, vol. 6, no. 2, pp. 222–235, 2025. doi: 10.23887/iji.v6i2.103718
[22] J. Wang, "Research on the interaction mechanism of presence elements and optimization strategies in blended learning from the perspective of community of inquiry," *Foro de Educacion*, vol. 24, no. 1, pp. 20–35, 2026. doi: 10.14201/fde.24102
[23] M. S. Adam, J. A. Hamid, A. Khatibi, and S. F. Azam, "The impact of community of inquiry presences on student motivation in blended learning: a self-determination theory perspective," *Discover Education*, vol. 4, no. 1, 186, 2025. doi: 10.1007/s44217-025-00612-5
[24] Y. Yang and Y. F. Lay, "Academic buoyancy and learner interactions as mediators of deep learning in blended learning contexts: The role of teaching, social, and cognitive presence," *Education and Information Technologies*, vol. 30, no. 5, pp. 6261–6286, 2025. doi: 10.1007/s10639-024-13066-3
[25] N. Osman, N. C. Hat, M. S. Nasir, M. A.-U. Othman, and M. F. Yahaya, "Application of andragogical theory in language and communication learning among adults," *International Journal of Academic Research in Business and Social Sciences*, vol. 15, no. 11, pp. 1186–1194, 2025. doi: 10.6007/IJARBSS/v15-i11/26915
[26] T. Ma, A. S. Al-Adwan, N. Li, E. Purwanto, W. Meng, and H.-N. Liang, "Effective use of digital textbooks: A hybrid framework of acceptance and self-determination in higher education programming courses," *IEEE Transactions on Education*, vol. 28/5/2025, pp. 1–10, 2025.
[27] M. Mekheimer, "Technological self-efficacy, motivation, and contextual factors in advanced EFL e-learning: A mixed-methods study of strategy use and satisfaction," *Humanities and Social Sciences Communications*, vol. 12, no. 1, pp. 1–18, 2025. doi: 10.1057/s41599-025-04947-0
[28] J. E. Gaskin, P. B. Lowry, W. Rosengren, and P. T. Fife, "Essential validation criteria for rigorous covariance-based structural equation modelling," *Information Systems Journal*, vol. 35, no. 6, pp. 1630–1661, 2025. doi: 10.1111/isj.12598Digital
[29] J. F. Hair, E. L. Lopes, M. L. Gabriel, F. S. Bizarrias, and D. da Silva, "Coffee, data and Jamovi: The perfect recipe for great statistical analysis," *Journal of Sustainable Institutional Management*, vol. 12, pp. e0178–e0178, 2025. doi: 10.37497/jsim.v12.id178.2025
[30] H. Oh, M. D. Hunter, and S.-M. Chow, "Measurement model misspecification in dynamic structural equation models: Power, reliability, and other considerations," *Structural Equation Modeling: A Multidisciplinary Journal*, vol. 32, no. 3, pp. 511–528, 2025. doi: 10.1080/10705511.2025.2452884
[31] O. A. Taufik, O. Y. Pamungkas, A. K. Ahmad, D. W. Andini, and P. Cahyandaru, "Mapping determinants of success through information systems in higher education: A structural equation modeling approach," *Educational Process: International Journal*, vol. 14, 2025. doi: 10.22521/edupij.2025.14.67
[32] Y. Arfat, M. K. Shahid, R. S. Al-tayyar, K. Mahmood, and A. Alghamdi, "Building inclusive learning environment through hybrid learning system: Role of technology and corresponding engagement," *Sustainable Futures*, vol. 10, 2025. doi: 10.1016/j.sftr.2025.100887
[33] E. Kappe, "Exploring the beliefs about education and the teaching practices of science teachers located at higher education schools inside the United States military," Ph.D. dissertation, University of Oxford, Oxford, U.K., 2025. [Online]. Available: https://ora.ox.ac.uk/objects/uuid:a217ab59-d5d3-429e-9997-0a26bf3025fe/files/dg732d973c.
[34] M. J. M. Beray, A. M. Cubero, R. G. Casidsid, and R. J. B. Codenera, "Assessing education students' self-directed learning experiences for optimal online learning," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 14, no. 4, pp. 2781–2789, 2025. doi: 10.11591/ijere.v14i4.32610
[35] R. Mortimer *et al.*, "Experience of self-discovery and change in a psychodynamic internet delivered programme for university students experiencing low mood," *Psychotherapy Research*, pp. 1–16, 2025. doi: 10.1080/10503307.2025.2538552
[36] L. T. V. Nguyen, D. Cleveland, C. T. M. Nguyen, and C. E. Joyce, "Empowering and implementing sustainability integration into higher education curriculum in emerging countries: 'walk the talk' or 'talk the talk'?" *International Journal of Sustainability in Higher Education*, vol. 26, no. 9, pp. 389–411, 2025. doi: 10.1108/IJSHE-10-2024-0757