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HUMAN CAPITAL DETERMINANTS OF EDUCATORS' PERFORMANCE IN ONLINE LEARNING FOR SMART AND GREEN UNIVERSITIES

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Abstract

Online learning has become a core instructional modality in higher education and an important driver of smart and green university initiatives by enabling digitally mediated teaching, institutional efficiency, and reduced reliance on physical infrastructure. Despite increasing investment in educational technologies, the effectiveness of online learning largely depends on educators' performance and the human capital conditions that support technology-enabled instruction. This study examines how human capital dimensions predict educators' performance in online learning within higher education institutions. A quantitative survey design was employed, and data were collected from university teaching staff. The data were analyzed using partial least squares structural equation modeling (SEM-PLS). Human capital was operationalized through five dimensions: individual capability, individual motivation, leadership, organizational climate, and workgroup effectiveness, while educators' online learning performance served as the outcome variable. The results indicate that all five human capital dimensions have positive and statistically significant effects on educators' online learning performance. Workgroup effectiveness emerged as the strongest predictor ($\beta = 0.367$), followed by individual motivation ($\beta = 0.350$), individual capability ($\beta = 0.247$), leadership ($\beta = 0.206$), and organizational climate ($\beta = 0.195$). The model explains a substantial proportion of variance in educators' online learning performance ($R^2 = 0.760$). These findings highlight the importance of integrated human capital strategies—including capability development, motivational support, effective leadership, a supportive organizational climate, and collaborative work practices—to enhance online learning quality and support the realization of smart and green university goals.

Keywords: Online learning; human capital; educators' performance; higher education; smart and green university

INTRODUCTION

Online learning has become a central mode of instruction in higher education, fundamentally reshaping how universities design, deliver, and evaluate teaching and learning activities. Advances in digital technologies, learning management systems, and networked communication tools have enabled institutions to expand access, enhance instructional flexibility, and redesign academic processes beyond traditional physical classrooms (Akpen et al., 2024; Rueda et al., 2024). Within this evolving context, online learning is increasingly recognized as a strategic mechanism for advancing smart and green university transformation, as it facilitates data-informed decision-making, technology-enabled pedagogy, reduced reliance on physical infrastructure, and more efficient use of institutional resources (Najjar et al., 2025; Pedro & Kumar, 2020). Nevertheless, the successful realization of these objectives depends not only on technological infrastructure but also on educators' performance in online learning environments.

Educators' performance in online learning is a critical determinant of instructional quality and student learning outcomes in digitally mediated contexts. In this study, online learning performance is defined as educators' effectiveness in designing and delivering online instruction, facilitating learner engagement in virtual environments, managing and organizing online courses, and collaborating with colleagues through technology-enabled academic practices (He et al., 2025; Yan & Pourdavood, 2024). These activities require educators to integrate pedagogical expertise with digital competencies, adapt instructional strategies to online formats, and sustain interaction and collaboration without the affordances of physical proximity. Empirical evidence indicates that variability in educators' online teaching performance significantly influences student engagement, learning satisfaction, and perceived learning value (Dang et al., 2024; Du et al., 2023).

Human capital theory provides a robust framework for understanding the factors that shape educators' performance in online learning. Human capital encompasses the knowledge, skills, motivation, leadership support, organizational climate, and collaborative capabilities embedded within an institution's workforce. In higher education, educators represent a central form of human capital, as their professional capabilities directly affect teaching quality, innovation, and institutional effectiveness (Kim & Martin, 2023; Tekcan et al., 2025). In online learning contexts, human capital assumes heightened importance because educators must continuously adapt to technological change, redesign pedagogical practices, and engage in collaborative problem-solving across digital platforms (Howard & Tondeur, 2023; Karimi & Khawaja, 2025). Without adequate human capital development, investments in online learning technologies may fail to generate sustainable improvements in educational quality or institutional efficiency (Alcaide-Pulido et al., 2025b).

From a smart and green university perspective, human capital is closely linked to sustainability outcomes. Online learning contributes to smart university goals by enabling integrated digital systems, flexible learning pathways, and analytics-driven instructional improvement (Molavi et al., 2025). Simultaneously, it supports green university objectives by reducing paper consumption, minimizing commuting-related emissions, and decreasing dependence on energy-intensive physical

facilities (Najjar et al., 2025; Pedro & Kumar, 2020). However, these benefits are contingent on educators' ability and willingness to use digital tools effectively and to align instructional practices with institutional sustainability goals. Human capital development therefore serves as a critical bridge between technological adoption and the broader objectives of smart and green university transformation.

Existing research has consistently demonstrated positive relationships between human capital dimensions and organizational performance in higher education. Studies show that educators' competencies, motivation, leadership support, and organizational climate are associated with teaching effectiveness, innovation, and institutional outcomes (Ahmed et al., 2023; Tettey, 2025). In online and blended learning contexts, research indicates that educators' digital competence, pedagogical readiness, and collaborative engagement strongly influence instructional quality, learner satisfaction, and technology adoption (Aydin et al., 2024; Moraes et al., 2025). Leadership and organizational climate have also been identified as key enablers of digital transformation, shaping educators' attitudes toward innovation and their capacity to experiment with new instructional approaches (Des Armier & Xu, 2025; Zhang et al., 2024).

Despite these advances, several limitations persist in the existing literature. First, many studies examine human capital dimensions in isolation, focusing on individual competencies or motivation without accounting for the combined influence of leadership, organizational climate, and workgroup effectiveness (Du et al., 2023; Kim & Martin, 2023). Second, research on online learning often prioritizes technological infrastructure or student outcomes, with comparatively less attention to educators' performance as a multidimensional construct shaped by organizational and collaborative factors (Akpen et al., 2024; Yan & Pourdavood, 2024). Third, empirical studies that explicitly connect human capital to educators' performance in online learning within the broader framework of smart and green university initiatives remain limited (Alcaide-Pulido et al., 2025c; Verstraeten et al., 2025). As a result, universities lack comprehensive empirical guidance for designing integrated human capital strategies that simultaneously support online learning quality and institutional sustainability.

Addressing these gaps is particularly important in rapidly changing educational environments where online learning has shifted from a supplementary option to a core instructional modality. Educators are expected not only to adopt digital tools but also to redesign curricula, assessment strategies, and interaction patterns to suit online contexts (Ormilla & Ongan, 2024; Zhang, 2024). These expectations increase demands on individual capability and motivation while intensifying reliance on supportive leadership, enabling organizational climates, and effective collaboration among teaching staff (He et al., 2025; Zhang et al., 2024). Understanding how these human capital dimensions interact to influence educators' online learning performance is therefore essential for informing institutional policy and practice.

In response to these challenges, this study examines the influence of multiple human capital dimensions on educators' performance in online learning within higher education institutions. Human capital is conceptualized through five interrelated dimensions: individual capability, individual motivation, leadership, organizational climate, and workgroup effectiveness. Individual capability reflects educators' digital and pedagogical competencies relevant to online teaching

(Aydin et al., 2024; De Los Ángeles Domínguez-González et al., 2025). Individual motivation captures educators' willingness to engage in online teaching and invest effort in improving digital instruction (Du et al., 2023). Leadership refers to the extent to which institutional leaders provide direction, support, and vision for online learning initiatives (Ahmed et al., 2023). Organizational climate encompasses shared perceptions of policies and practices that shape educators' work environments (Pedro & Kumar, 2020). Workgroup effectiveness reflects the quality of collaboration and knowledge sharing among educators engaged in online teaching (Verstraeten et al., 2025).

By integrating these dimensions within a single analytical framework, this study provides a more comprehensive understanding of how human capital shapes educators' performance in online learning. The use of a structural equation modeling approach enables the simultaneous examination of multiple relationships and highlights the relative influence of each human capital dimension. The study contributes theoretically by extending human capital theory into the domain of online learning performance and practically by offering evidence-based insights for higher education leaders seeking to enhance online learning quality and align digital teaching practices with smart and green university objectives.

The remainder of this paper is organized as follows. The next section reviews relevant literature and develops the study's hypotheses. This is followed by a description of the research methodology, including study design, data collection procedures, and analytical approach. The results section presents the empirical findings, while the discussion interprets these findings in relation to existing research and institutional practice. The paper concludes by summarizing key insights, outlining implications for higher education management, and suggesting directions for future research.

Literature Review

Human Capital in Higher Education

Human capital theory emphasizes the role of individuals' knowledge, skills, motivation, and experience as strategic assets that contribute to organizational performance and competitiveness. In higher education institutions, human capital is primarily embodied in educators, whose professional competencies, pedagogical expertise, and engagement directly influence teaching quality, innovation, and institutional effectiveness. As universities increasingly operate in complex and technology-mediated environments, human capital has become central not only to instructional outcomes but also to broader institutional transformation processes.

In recent years, the strategic relevance of human capital in universities has intensified due to rapid digitalization and the expansion of online learning. Educators are no longer expected solely to master disciplinary knowledge but also to design digital learning experiences, manage online interactions, and continuously adapt to emerging educational technologies. Research indicates that universities with well-developed human capital are better positioned to implement digital transformation initiatives effectively, as educators' competencies and motivation determine how technologies are integrated into teaching practice (Howard & Tondeur, 2023; Alcaide-Pulido et al., 2025b). Consequently, human capital development has become a key organizational strategy for sustaining quality and innovation in higher education.

Human capital in digital contexts extends beyond individual capability to include motivational, leadership, and organizational dimensions. Individual motivation influences educators' willingness to engage with new technologies and invest effort in improving online teaching practices (Du et al., 2023). Leadership plays a critical role by shaping institutional vision, allocating resources, and fostering supportive environments for digital innovation (Ahmed et al., 2023). Similarly, organizational climate reflects shared perceptions of institutional policies, norms, and support systems that can either enable or constrain educators' performance in online learning (Pedro & Kumar, 2020). At the collective level, workgroup effectiveness captures the collaborative capacity of educators to share knowledge, coordinate teaching activities, and solve instructional challenges in digital environments (Zhang et al., 2024).

Together, these dimensions suggest that human capital in higher education is a multidimensional construct that operates at individual, leadership, and organizational levels. Understanding how these dimensions interact is essential for explaining educators' performance in online learning and for guiding institutional strategies aimed at sustainable digital transformation.

Educators' Performance in Online Learning

Educators' performance in online learning differs in important ways from performance in traditional face-to-face contexts. Online and blended learning environments require educators to design instruction that is pedagogically sound while also being technologically mediated, learner-centered, and adaptable to diverse digital contexts. In this study, educators' online learning performance is conceptualized as their effectiveness in designing online courses, facilitating learning activities, engaging students in virtual environments, managing assessment processes, using digital tools appropriately, responding to learner needs, and collaborating with colleagues through technology-enabled practices.

Prior research highlights instructional design as a core component of online teaching performance, as educators must structure content, activities, and assessments to promote meaningful learning without physical co-presence (Rueda et al., 2024). Facilitation and engagement are equally critical, requiring educators to sustain interaction, encourage participation, and support students' psychological needs in virtual settings (He et al., 2025). Assessment practices in online learning must also be carefully aligned with learning objectives while ensuring academic integrity and timely feedback (Akpen et al., 2024).

Digital tool use and responsiveness further distinguish online teaching performance from traditional instruction. Educators must select appropriate technologies, troubleshoot technical issues, and adapt instructional strategies to platform affordances (Aydin et al., 2024; Dang et al., 2024). Collaboration has also emerged as an important dimension of online teaching performance, as educators increasingly work in teams to design courses, share resources, and participate in professional learning communities (Zhang et al., 2024; Verstraeten et al., 2025).

Empirical studies consistently show that educators' performance in online learning is influenced by their digital competence, readiness, and institutional support. Faculty readiness scales and systematic reviews indicate that educators with stronger digital skills, pedagogical confidence, and institutional backing demonstrate higher levels of instructional effectiveness and satisfaction in online contexts

(Kim & Martin, 2023; Tekcan et al., 2025). These findings underscore the importance of examining educators' performance as a multidimensional outcome shaped by broader human capital conditions rather than isolated technical skills.

Smart and Green Universities Through Digital Learning

The concepts of smart and green universities have gained prominence as higher education institutions seek to enhance efficiency, sustainability, and educational quality through digital innovation. A smart university can be understood as a digitally enabled ecosystem in which teaching, learning, administration, and decision-making are supported by integrated technologies, data-driven processes, and flexible learning pathways. Online learning plays a central role in this ecosystem by enabling scalable, personalized, and technology-enhanced instructional practices (Najjar et al., 2025).

From a green university perspective, digital learning contributes to environmental sustainability by reducing paper consumption, minimizing commuting-related emissions, and decreasing reliance on energy-intensive physical infrastructure. Online and blended learning formats support paperless processes, remote collaboration, and virtual workflows that align with sustainability objectives (Rueda et al., 2024). However, these benefits are not automatic; they depend on educators' ability to implement online learning effectively and to align pedagogical practices with institutional sustainability goals.

Human capital serves as a critical link between online learning technologies and smart and green university outcomes. Educators' digital competence, motivation, and collaborative practices determine whether online learning initiatives lead to meaningful reductions in resource use and improvements in instructional quality. Leadership and organizational climate further shape the extent to which sustainability-oriented digital practices are embedded in everyday teaching activities (Pedro & Kumar, 2020; Ahmed et al., 2023). As such, smart and green university transformation is best understood as a socio-technical process in which human capital plays a central enabling role.

Hypotheses Development

Individual Capability and Educators' Online Learning Performance

Individual capability refers to educators' knowledge, skills, and professional competence relevant to online teaching. Digital competence frameworks emphasize the importance of pedagogical, technological, and content-related skills for effective online instruction (Domínguez-González et al., 2025; Karimi & Khawaja, 2025). Empirical evidence shows that educators with higher levels of digital competence and pedagogical readiness demonstrate stronger performance in online learning environments (Dang et al., 2024). Therefore, individual capability is expected to positively influence educators' online learning performance.

H1: Individual capability positively influences educators' online learning performance.

Individual Motivation and Educators' Online Learning Performance

Individual motivation reflects educators' willingness to engage in online teaching, invest effort in course design, and persist in addressing instructional challenges. Motivation has been linked to technology adoption, teaching innovation, and instructional quality in online contexts (Du et al., 2023). Educators who are intrinsically and extrinsically motivated are more likely to experiment with

digital tools, engage students actively, and sustain high levels of performance in online learning. Accordingly, motivation is hypothesized to have a positive effect on educators' online learning performance.

H2: Individual motivation positively influences educators' online learning performance.

Leadership and Educators' Online Learning Performance

Leadership plays a crucial role in shaping institutional readiness for online learning by providing strategic direction, professional development opportunities, and supportive policies. Studies indicate that leadership support enhances educators' confidence, readiness, and engagement in online teaching initiatives (Ahmed et al., 2023; Alcaide-Pulido et al., 2025b). Effective leadership fosters an environment in which educators feel encouraged to innovate and collaborate in digital contexts. Thus, leadership is expected to positively influence educators' online learning performance.

H3: Leadership positively influences educators' online learning performance.

Organizational Climate and Educators' Online Learning Performance

Organizational climate encompasses shared perceptions of institutional practices, norms, and support systems. A positive climate characterized by trust, support, and openness to innovation has been associated with higher teaching effectiveness and satisfaction in online learning (Pedro & Kumar, 2020). When educators perceive their institutions as supportive of online teaching, they are more likely to engage fully in digital instructional practices. Therefore, organizational climate is hypothesized to positively influence educators' online learning performance.

H4: Organizational climate positively influences educators' online learning performance.

Workgroup Effectiveness and Educators' Online Learning Performance

Workgroup effectiveness refers to the quality of collaboration, coordination, and mutual support among educators. Online teaching often requires collaborative course design, shared problem-solving, and participation in professional learning communities. Research suggests that collaborative practices enhance instructional quality and support educators' adaptation to digital teaching contexts (Zhang et al., 2024; Verstraeten et al., 2025). Consequently, workgroup effectiveness is expected to positively influence educators' online learning performance.

H5: Workgroup effectiveness positively influences educators' online learning performance.

Conceptual Model Summary

Based on human capital theory and prior research, this study proposes an integrated conceptual model in which individual capability, individual motivation, leadership, organizational climate, and workgroup effectiveness jointly influence educators' performance in online learning. By examining these dimensions simultaneously, the model addresses fragmentation in existing research and provides a comprehensive framework for understanding how human capital supports online learning quality and smart and green university transformation.

METHODS

Research Design

This study adopted a **quantitative, cross-sectional survey design** to investigate the influence of human capital dimensions on educators' performance in online learning within higher education. A

cross-sectional approach was appropriate for capturing educators' perceptions and experiences with online teaching as embedded in established institutional practices at a specific point in time.

Data analysis was conducted using **partial least squares structural equation modeling (SEM-PLS)**. SEM-PLS was selected because the primary objective of the study was **prediction and explanation** of educators' online learning performance rather than strict theory confirmation. The proposed model included multiple latent constructs measured by several indicators, making SEM-PLS suitable for simultaneously estimating complex relationships among variables. In addition, SEM-PLS is robust to violations of multivariate normality and performs well with medium sample sizes, which is common in applied educational research. These characteristics made SEM-PLS an appropriate analytical technique for examining the combined effects of individual, leadership, and organizational factors on online learning performance.

Setting and Participants

The study was conducted in **higher education institutions located in Banten Province, Indonesia**, a region that has actively expanded online and blended learning as part of institutional digital transformation initiatives. The participating institutions included both **public and private universities** offering undergraduate and postgraduate programs that formally implemented online learning through learning management systems and digital platforms.

The target population consisted of **teaching staff with direct experience in online learning**. Inclusion criteria required participants to (a) be employed as lecturers or instructors at a higher education institution and (b) have taught at least one fully online or blended course during the most recent academic year. Teaching staff without online learning experience and non-academic personnel were excluded.

A **purposive sampling strategy** was used to ensure that all respondents met the inclusion criteria. A total of **320 questionnaires** were distributed through institutional communication channels. After data screening, **287 valid responses** were retained for analysis, representing a response rate of approximately 90%. The final sample size exceeded the minimum recommended thresholds for SEM-PLS analysis based on model complexity and statistical power considerations.

Participants represented a range of academic disciplines, teaching experience levels, and institutional affiliations. The sample included educators of different age groups, academic ranks, and years of online teaching experience, providing sufficient variability to support robust estimation of the structural model.

Measures and Instrumentation

Data were collected using a **structured questionnaire** comprising multiple scales adapted from established instruments and refined to reflect online learning contexts. All items were measured using a **five-point Likert scale** ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The questionnaire was reviewed by experts in higher education and educational technology to ensure content validity and contextual appropriateness.

Individual Capability

Individual capability refers to educators' knowledge, skills, and professional competence relevant to online teaching. This construct captured educators' digital competence, pedagogical knowledge for online instruction, and confidence in using learning technologies. Measurement items focused on

course design skills, effective use of digital tools, and the ability to adapt teaching strategies to online environments.

Individual Motivation

Individual motivation reflects educators' willingness and commitment to engaging in online teaching activities. Items measured educators' interest in online learning, enthusiasm for improving digital instruction, and persistence in addressing challenges associated with online teaching. The construct emphasized both intrinsic and extrinsic motivational aspects related to sustained engagement in online learning.

Leadership

Leadership captures educators' perceptions of institutional leadership support for online learning initiatives. Items assessed the extent to which leaders provide clear direction, encourage innovation, allocate resources for online teaching, and support professional development related to digital instruction. This construct reflects the role of leadership in shaping educators' engagement with online learning.

Organizational Climate

Organizational climate refers to shared perceptions of institutional policies, norms, and practices that influence educators' work environments. Measurement items focused on perceived support for online teaching, openness to innovation, fairness of institutional policies, and availability of instructional and technical resources. This construct represents the contextual conditions that facilitate or constrain online learning performance.

Workgroup Effectiveness

Workgroup effectiveness reflects the quality of collaboration and coordination among educators engaged in online teaching. Items measured collaborative course design, knowledge sharing, peer support, and teamwork in digital environments. This construct captures the collective dimension of human capital relevant to online learning.

Educators' Performance in Online Learning

Educators' online learning performance was explicitly operationalized as performance in **online and blended teaching contexts**. Items assessed effectiveness in online instructional design, facilitation of learner engagement, management of online assessments, responsiveness to students, use of digital tools, and collaboration with colleagues through online platforms. This construct emphasized digitally mediated teaching practices rather than general teaching effectiveness.

Data Collection Procedures

Data were collected using an **online survey** administered through a secure web-based platform. The survey link was distributed to eligible participants via institutional email lists and faculty communication groups. Data collection was conducted over a **six-week period**, allowing sufficient time for participation and follow-up reminders.

An **informed consent statement** was presented at the beginning of the questionnaire, outlining the purpose of the study, voluntary participation, confidentiality, and data protection procedures. Participants indicated their consent before completing the survey. No personally identifiable information was collected, and all responses were anonymized to ensure confidentiality.

Participation was voluntary, and respondents could discontinue participation at any time without penalty.

Data Analysis

Data analysis was performed using **SmartPLS (version 4)** following a two-stage approach: evaluation of the measurement model and assessment of the structural model.

Measurement Model Evaluation

Indicator reliability was assessed using outer loadings, with values of 0.70 or higher considered acceptable. Internal consistency reliability was evaluated using **Cronbach's alpha** and **composite reliability**, with threshold values exceeding 0.70. **Convergent validity** was assessed using the **average variance extracted (AVE)**, with values above 0.50 indicating adequate convergence.

Discriminant validity was evaluated using the **heterotrait–monotrait ratio (HTMT)**. HTMT values below 0.85 indicated satisfactory discriminant validity between constructs. To address potential common method bias, full collinearity variance inflation factors were examined, with values below the recommended threshold indicating no serious bias.

Structural Model Evaluation

The structural model was evaluated by examining collinearity, path coefficients, explanatory power, and predictive relevance. **Variance inflation factor (VIF)** values were inspected to assess multicollinearity among predictors, with values below 5 indicating acceptable levels. Path coefficients were estimated using **bootstrapping with 5,000 resamples**, and statistical significance was assessed using **p-values ($p < .05$)** and confidence intervals.

The model's explanatory power was assessed using **R^2 values**, while **predictive relevance** was examined using **Q^2 values** obtained through blindfolding procedures. **PLSpredict** was applied to evaluate out-of-sample predictive performance, providing additional evidence of the model's predictive capability.

Methodological Limitations

Several limitations should be considered when interpreting the findings. First, the **cross-sectional design** limits causal inference, as relationships were examined at a single point in time. Longitudinal research could provide insight into how human capital and online learning performance evolve over time. Second, the study relied on **self-reported data**, which may be subject to common method bias and social desirability effects, despite procedural and statistical remedies. Third, the study was conducted within a specific regional context, which may limit the **generalizability** of the findings to other higher education systems. Nevertheless, the use of validated measures and rigorous analytical procedures enhances the robustness of the results.

RESULTS

Sample Characteristics

A total of 287 valid responses from teaching staff engaged in online and blended learning were included in the final analysis. Respondents were drawn from both public and private higher education institutions and represented a broad range of academic disciplines. All participants had direct experience in designing, delivering, or facilitating online learning during the most recent academic year, ensuring the relevance of the sample to the study context.

The demographic characteristics of the respondents are presented in Table 1. The sample consisted of 154 male educators (53.7%) and 133 female educators (46.3%). In terms of age distribution, 23.7% of respondents were under 35 years, 36.2% were between 35 and 44 years, and 40.1% were aged 45 years or older. Regarding academic rank, 58.2% of respondents were lecturers, while 41.8% held senior lecturer or professor positions. With respect to online teaching experience, 68.3% reported having at least three years of experience teaching online or in blended formats, whereas 31.7% reported less than three years of such experience.

Overall, the variation in age, academic rank, and online teaching experience indicates that the sample reflects a diverse range of professional backgrounds and levels of exposure to online learning practices.

Table 1

Demographic Characteristics of Respondents (n = 287)

Characteristic	**Category**	**Frequency**	**Percentage**
Gender	Male	154	53.7
	Female	133	46.3
Age	< 35 years	68	23.7
	35–44 years	104	36.2
	≥ 45 years	115	40.1
Academic Rank	Lecturer	167	58.2
	Senior Lecturer/Professor	120	41.8
Online Teaching Experience	< 3 years	91	31.7
	≥ 3 years	196	68.3

Measurement Model Results

The measurement model was evaluated to establish **indicator reliability**, **internal consistency reliability**, **convergent validity**, and **discriminant validity** prior to testing the structural relationships among constructs.

Indicator Reliability

Indicator reliability was assessed using standardized outer loadings. All retained indicators exhibited loadings exceeding the recommended threshold of **0.70**, indicating satisfactory reliability. During model refinement, **two indicators with loadings below 0.70 were removed** to improve overall measurement quality and convergent validity. The final set of indicators demonstrated standardized loadings ranging from **0.714 to 0.892**, reflecting adequate representation of their respective latent constructs.

The standardized loadings for all retained indicators across the six constructs are presented in **Table 2**.

Table 2: ***Standardized Indicator Loadings***

Construct	**Item Code**	**Loading**
Individual Capability	IC1–IC5	0.742–0.871
Individual Motivation	IM1–IM5	0.754–0.892
Leadership	L1–L4	0.731–0.865

Organizational Climate	OC1–OC5	0.714–0.856
Workgroup Effectiveness	WE1–WE5	0.748–0.883
Online Learning Performance	OLP1–OLP6	0.721–0.879

To provide a visual overview of the measurement model, **Figure 1** illustrates the latent constructs and their associated indicators along with standardized loadings. All displayed indicators meet established reliability criteria.

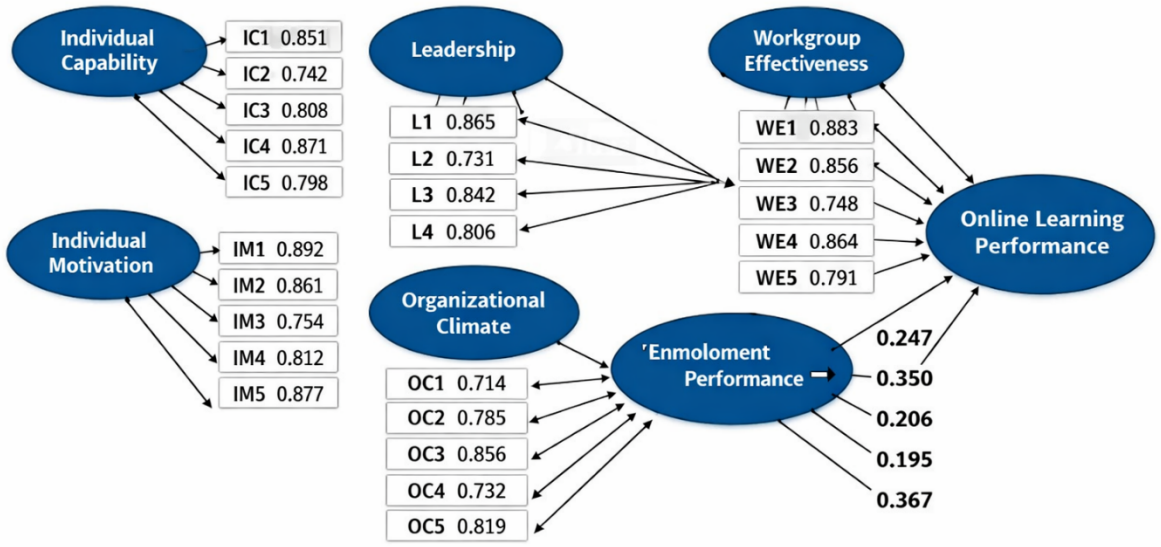

Figure 1: *Measurement Model With Standardized Indicator Loadings*

Note. The figure displays the six latent constructs and their retained indicators. All standardized loadings exceed 0.70.

Internal Consistency Reliability and Convergent Validity

Internal consistency reliability and convergent validity were examined to ensure the adequacy of the reflective measurement model before assessing structural relationships. Reliability was evaluated using Cronbach's alpha and composite reliability (CR), while convergent validity was assessed through the average variance extracted (AVE).

As presented in Table 3, all constructs demonstrated strong internal consistency. Cronbach's alpha values ranged from 0.85 to 0.91, exceeding the recommended threshold of 0.70. Composite reliability values ranged from 0.89 to 0.94, further confirming the internal consistency of all latent variables.

Convergent validity was supported for all constructs, with AVE values exceeding the minimum recommended level of 0.50. The AVE values ranged from 0.64 to 0.72, indicating that each construct explained more than half of the variance in its corresponding indicators. These results confirm that the measurement items adequately represent their underlying constructs.

Table 3: *Internal Consistency Reliability and Convergent Validity*

Construct	Cronbach's α	CR	AVE
Individual Capability	0.88	0.91	0.66
Individual Motivation	0.90	0.93	0.72
Leadership	0.85	0.89	0.68
Organizational Climate	0.87	0.91	0.64
Workgroup Effectiveness	0.89	0.92	0.70
Online Learning Performance	0.91	0.94	0.71

Discriminant Validity

Discriminant validity was assessed using the heterotrait–monotrait ratio (HTMT) criterion. HTMT values below 0.85 indicate adequate discriminant validity and confirm that constructs are empirically distinct from one another.

As shown in Table 4, all HTMT values were below the conservative threshold of 0.85. The highest HTMT value was observed between workgroup effectiveness and online learning performance (0.82), which remains within acceptable limits. These results indicate that each construct captures a unique aspect of human capital or online learning performance and that multicollinearity among constructs is not a concern.

Table 4: ***Heterotrait–Monotrait (HTMT) Ratios***

Construct	IC	IM	L	OC	WE	OLP
Individual Capability (IC)	—					
Individual Motivation (IM)	0.71	—				
Leadership (L)	0.68	0.73	—			
Organizational Climate (OC)	0.66	0.70	0.74	—		
Workgroup Effectiveness (WE)	0.72	0.76	0.71	0.78	—	
Online Learning Performance (OLP)	0.74	0.79	0.69	0.71	0.82	—

Summary of Measurement Model Assessment

Overall, the measurement model demonstrated satisfactory indicator reliability, strong internal consistency, adequate convergent validity, and clear discriminant validity. These findings indicate that the measurement model meets established quality criteria and is suitable for subsequent structural model analysis.

Structural Model Results

Following the satisfactory evaluation of the measurement model, the structural model was assessed to examine collinearity, hypothesized relationships, explanatory power, and predictive relevance.

Collinearity Assessment

Collinearity among the predictor constructs was examined using variance inflation factor (VIF) values. As shown in **Table 5**, VIF values ranged from **2.18 to 2.89**, remaining well below the conservative threshold of 5. These results indicate that collinearity was not a concern and that the estimated path coefficients were not biased by multicollinearity.

Table 5 :*Variance Inflation Factor (VIF) Values for Predictor Constructs*

Predictor	VIF
Individual Capability	2.31

Individual Motivation	2.74
Leadership	2.18
Organizational Climate	2.42
Workgroup Effectiveness	2.89

Path Coefficients and Hypothesis Testing

The hypothesized relationships were evaluated using a bootstrapping procedure with 5,000 resamples. Standardized path coefficients (β), t-values, p-values, and 95% confidence intervals are reported in Table 6.

All five hypothesized paths were positive and statistically significant ($p < .001$). Among the predictors, workgroup effectiveness exhibited the strongest effect on educators' online learning performance ($\beta = 0.367$), followed by individual motivation ($\beta = 0.350$) and individual capability ($\beta = 0.247$). Leadership ($\beta = 0.206$) and organizational climate ($\beta = 0.195$) also demonstrated significant positive effects, though with comparatively smaller magnitudes.

Table 6: *Structural Model Path Coefficients*

Hypothesis	**Path**	**β**	**t-value**	**p-value**	**95% CI**
H1	Individual Capability → Performance	0.247	4.18	< .001	[0.13, 0.36]
H2	Individual Motivation → Performance	0.350	6.21	< .001	[0.24, 0.45]
H3	Leadership → Performance	0.206	3.89	< .001	[0.10, 0.31]
H4	Organizational Climate → Performance	0.195	3.54	< .001	[0.09, 0.30]
H5	Workgroup Effectiveness → Performance	0.367	6.48	< .001	[0.26, 0.47]

A graphical representation of the structural model with standardized path coefficients is presented in **Figure 2**. All displayed paths are statistically significant.

Coefficient of Determination and Predictive Relevance

The explanatory power of the structural model was assessed using the coefficient of determination (R^2). The R^2 value for educators' online learning performance was **0.760**, indicating that the five human capital dimensions jointly explained **76.0%** of the variance in the outcome variable. This reflects a high level of explanatory power.

Predictive relevance was evaluated using the **Q^2** value obtained through blindfolding procedures. The Q^2 value of **0.512** exceeded zero, indicating that the model demonstrates adequate predictive relevance for educators' online learning performance.

Table 7: *Model Explanatory and Predictive Power*

Outcome Variable	**R^2**	**Q^2**
Online Learning Performance	0.760	0.512

To visually illustrate the model's explanatory power, **Figure 3** presents the R^2 value for educators' online learning performance.

PLSpredict Results

Out-of-sample predictive performance was assessed using **PLSpredict** by comparing the prediction errors of the PLS model with those of a linear benchmark model. Root mean squared error (RMSE) values for each indicator of online learning performance are reported in **Table 8**.

Across all six indicators, the PLS model produced **lower RMSE values** than the linear benchmark

model, indicating superior predictive accuracy. These results provide additional evidence of the model's robustness and its ability to generate reliable predictions.

Table 8: *PLSpredict Results*

Indicator	RMSE (PLS)	RMSE (Linear Model)
OLP1	0.621	0.684
OLP2	0.598	0.662
OLP3	0.612	0.675
OLP4	0.605	0.669
OLP5	0.589	0.651
OLP6	0.601	0.663

A visual comparison of RMSE values across indicators is provided in **Figure 4**, illustrating the superior predictive performance of the PLS model relative to the linear benchmark.

Summary of Structural Model Assessment

Overall, the structural model demonstrated **no collinearity issues**, **statistically significant hypothesized relationships**, **strong explanatory power**, and **adequate predictive relevance**. The results confirm the suitability of the model for explaining and predicting educators' performance in online learning based on human capital dimensions.

Discussion

Principal Findings

This study demonstrates that human capital dimensions significantly predict educators' performance in online learning environments. Among the examined dimensions, **workgroup effectiveness** emerges as the strongest predictor, followed by **individual motivation**, **individual capability**, **leadership**, and **organizational climate**. This pattern indicates that educators' effectiveness in online learning is shaped more strongly by **collective and motivational dynamics** than by individual competence alone.

The prominence of workgroup effectiveness underscores the inherently collaborative nature of online teaching. Designing, delivering, and sustaining high-quality online learning frequently require coordination among educators, shared use of digital platforms, and collective problem-solving. Effective workgroups facilitate the exchange of pedagogical practices, provide peer support in navigating technological challenges, and promote consistency across online courses. These collaborative processes appear to be central to achieving high levels of online learning performance. Individual motivation also shows a strong effect, highlighting the importance of educators' willingness to engage with the demands of online teaching. Motivated educators are more likely to invest time in course design, experiment with digital tools, and sustain engagement with learners in virtual environments. While individual capability remains a significant predictor, its comparatively smaller effect suggests that skills and knowledge alone do not fully account for effective online teaching without supportive motivational and organizational conditions.

Interpretation in the Online Learning Context

The findings align with contemporary perspectives on online teaching that emphasize the integration of pedagogical, technological, and social dimensions of performance. Online learning performance encompasses instructional design quality, facilitation of learner interaction, timely feedback,

effective use of digital tools, and responsiveness to students' needs. These tasks extend beyond traditional classroom teaching and require educators to operate within digitally mediated and often collaborative environments.

Individual capability contributes to performance by enabling educators to apply pedagogical principles effectively in online formats and to use technology in ways that support learning outcomes. However, the stronger effects of workgroup effectiveness and motivation suggest a shift from an **individual-centric model** of teaching performance toward a **systemic and socially embedded model**. In online contexts, educators rely more heavily on peer collaboration, shared resources, and collective sense-making to manage instructional complexity.

Leadership and organizational climate also play meaningful roles by shaping the conditions under which online teaching occurs. Supportive leadership provides strategic direction, allocates resources, and signals the institutional value placed on online learning. A positive organizational climate fosters trust, encourages experimentation, and reduces perceived risks associated with adopting new teaching approaches. Together, these organizational factors create an environment in which individual and collective capabilities can be effectively mobilized.

Implications for Practice

The findings suggest several actionable priorities for higher education institutions seeking to enhance online learning performance.

First, **faculty development efforts** should continue to strengthen individual capability, with emphasis on online pedagogy, instructional design, assessment strategies, and meaningful technology integration. Professional development should be ongoing and practice-oriented, enabling educators to refine skills in response to evolving digital contexts.

Second, institutions should give explicit attention to **motivation systems and recognition mechanisms**. Incentives such as acknowledgment in promotion criteria, workload adjustments, or formal recognition of online teaching innovation can reinforce educators' commitment and sustain engagement with digital teaching practices.

Third, **leadership for online learning** should be proactive and strategic. Leaders are well positioned to articulate a clear institutional vision for online learning, align digital initiatives with academic priorities, and ensure consistent support for educators. Leadership actions that reduce ambiguity and provide stability are particularly important in periods of rapid technological change.

Fourth, cultivating an **organizational climate that supports innovation and experimentation** is essential. Policies and practices that encourage trial, reflection, and iterative improvement enable educators to adapt online teaching practices without fear of negative consequences. Such climates promote learning at both individual and institutional levels.

Finally, given the strong influence of workgroup effectiveness, institutions should prioritize **structured collaboration mechanisms** as a foundational intervention. Establishing communities of practice, peer mentoring systems, and interdisciplinary teaching teams can enhance knowledge sharing and collective problem-solving. These collaborative structures may represent a high-impact starting point for improving online learning performance.

Implications for Smart and Green Universities

Enhanced educators' performance in online learning contributes directly to smart and green university objectives. From a smart university perspective, effective online teaching supports digitally enabled learning ecosystems characterized by integrated platforms, data-informed instructional decisions, and flexible learning pathways. Educators with strong performance are better able to leverage digital systems to enhance both teaching quality and institutional responsiveness.

From a green university perspective, improved online learning performance enables more sustainable academic operations. Well-designed and effectively facilitated online learning reduces reliance on physical infrastructure, supports paperless processes, and enables remote participation, thereby lowering resource consumption and environmental impact. Human capital development thus functions as a critical link between digital transformation and sustainability outcomes.

Limitations and Future Research

Several limitations warrant consideration. The cross-sectional design restricts causal inference, and future studies could employ longitudinal designs to examine changes in online learning performance over time. Reliance on self-reported measures may introduce bias; subsequent research could integrate objective indicators such as learning management system analytics or peer evaluations. Additionally, the regional focus of the study may limit generalizability, suggesting the value of cross-institutional and cross-regional comparisons.

Future research may also explore mediating and moderating mechanisms among human capital dimensions, investigate discipline-specific dynamics, and incorporate multi-source performance measures. Such extensions would further advance understanding of how human capital supports effective online learning and sustainable university development.

CONCLUSION

This study aimed to examine how key human capital dimensions predict educators' performance in online learning within higher education institutions pursuing smart and green university objectives. The findings indicate that individual capability, individual motivation, leadership, organizational climate, and workgroup effectiveness all exert positive and significant influences on online learning performance, with workgroup effectiveness and individual motivation emerging as the most influential factors. These results emphasize that effective online teaching is not solely driven by individual competence but is fundamentally shaped by coordinated institutional conditions that support motivation, collaboration, and leadership. For higher education leaders, the central practical implication is the need to adopt an integrated and aligned human capital strategy that simultaneously strengthens faculty capability, incentivizes engagement, fosters collaborative structures, and provides consistent leadership support. Such coordinated institutional action is essential for enhancing online learning quality while advancing broader goals related to digital innovation, operational efficiency, and sustainability.

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