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Living Labs in Higher Education: Exploring Factors Influencing the Innovation in Teaching Methods and Learning Creativity

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In the era of Education 4.0 and digital transformation, higher education institutions (HEIs) are increasingly required to innovate teaching and learning methods to foster creativity and meet modern societal demands. This study investigates the factors influencing the adoption of the Living Lab (LL) approach in universities to promote innovation in teaching methods by lecturers and enhance students' learning creativity. Using a mixed-methods approach, including a structured survey and in-depth interviews with lecturers and students from three universities (Vietnam, South Korea, and Rwanda), the study employs statistical techniques such as descriptive analysis, exploratory factor analysis, and multiple linear regression basing on the data of 204 valid respones. The findings confirm that both exogenous and organizational factors significantly influence teaching innovation and student creativity, with internal organizational factors (e.g., culture, leadership, infrastructure, and implementation mechanisms) having a stronger impact. The results also reveal strong correlations between teaching innovation and learning creativity. Based on these findings, the study proposes targeted solutions, including strengthening internal capacity, promoting a culture of collaboration, offering faculty development programs, enhancing student engagement through real-world projects, and reinforcing partnerships with external stakeholders. These recommendations contribute to the growing body of knowledge on Living Labs in education and provide practical implications for policy and institutional strategy in higher education.

Keywords: Living Labs, Innovation, Teaching methods, Learning creativity, Higher education, Influencing factors

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INTRODUCTION

In the context of the Fourth Industrial Revolution and the increasing globalization of education, particularly in higher education, there is a growing demand for universities to fundamentally transform teaching and learning methods to meet contemporary societal and labor-market needs (Schwab, 2016; UNESCO, 2017). Learners are now expected to develop not only disciplinary knowledge but also a broad set of transversal competencies, including critical thinking, problem-solving, communication, collaboration, creativity, and innovation (OECD, 2019; World Economic Forum, 2020). In parallel, digital literacy and the effective use of information and communication technologies have become essential components of higher education outcomes (Redecker, 2017). In response to these changes, the concept of Education 4.0 has emerged as a guiding paradigm for educational transformation.

Education 4.0 is commonly described as an intelligent and learner-centered education model that integrates key stakeholders—such as educational institutions, administrators, industry, and society—to foster innovation, creativity, and productivity in a knowledge-based economy (Hussin, 2018; Puncreobutr, 2016). This model emphasizes entrepreneurship, interdisciplinary collaboration, and stronger linkages between higher education and industrial as well as regional development (Trilling & Fadel, 2009). Moreover, Education 4.0 promotes flexible, technology-enabled learning environments that allow teaching and learning to occur anytime and anywhere, enabling learners to personalize and take greater ownership of their learning processes (Fisk, 2017).

Within this paradigm, the role of university lecturers is undergoing a significant transformation—from traditional knowledge transmitters to facilitators, mentors, and learning designers who support active, interactive, and student-centered learning experiences (Laurillard, 2012; Salmon, 2013). Educational goals are shifting from the mere transmission of knowledge toward unlocking learners' potential and empowering them to develop creative and critical thinking skills (Fullan & Langworthy, 2014). Consequently, classrooms are increasingly conceptualized as collaborative spaces where knowledge and ideas are co-created through dialogue, problem-solving, and experiential learning, with lecturers acting as coordinators of learning processes rather than sole authorities (Biggs & Tang, 2011). In this context, university lecturers are required to redesign curricula and learning activities that integrate theoretical knowledge with authentic, skill-enhancing practices.

Against this backdrop, the Living Lab (LL) approach has gained prominence as an innovative pedagogical model in higher education, particularly in developed regions such as Europe, South Korea, and the United States (Schuurman et al., 2016; Veeckman et al., 2013). Living Labs are defined as open, user-centered innovation ecosystems that emphasize close collaboration among multiple stakeholders in real-life settings to co-create, test, and refine new solutions (ENoLL, 2020; Leminen et al., 2012). In educational contexts, Living Labs function as interactive learning ecosystems where students, lecturers, researchers, and external partners jointly address real-world problems, thereby integrating theory with practice and promoting experiential learning (Mulder et al., 2008; Pallot et al., 2010).

Empirical studies suggest that Living Lab-based learning environments enhance student engagement, creativity, problem-solving abilities, and teamwork, while simultaneously encouraging lecturers to adopt more innovative and flexible teaching practices (Almirall & Wareham, 2008; Ballon et al., 2005). Furthermore, the Living Lab approach supports the integration of digital technologies and innovative thinking, preparing learners to respond effectively to complex societal challenges associated with Industry 4.0 and sustainable development (Hossain et al., 2019; Trencher et al., 2014). By combining academic knowledge, technological tools, and real-world experience, Living Labs contribute to the creation of dynamic and meaningful learning environments that improve educational quality and societal impact.

More recently, the Living Lab approach has begun to spread to developing countries through international educational collaboration and support from institutions and organizations in developed regions (van den Heuvel et al., 2021). For example, the Institute for Poverty Alleviation and International Development (IPAID) at Yonsei University (South Korea) has initiated multiple Living Lab–based educational collaborations with universities in countries such as Vietnam, the Philippines, Indonesia, and Rwanda. Since 2023, the Living Lab collaboration between IPAID and Tan Trao University has played a notable role in promoting innovation in teaching and learning practices at the institutional level, reflecting the growing relevance of Living Labs in diverse higher education contexts.

LITERATURE REVIEW

Living Labs (LLs) represent collaborative environments that engage various stakeholders—including educational institutions, businesses, public organizations, communities, students, and faculty—in co-creating innovative solutions within learning and research contexts. Globally, numerous studies have explored the application of LLs in education, particularly focusing on enhancing teaching methodologies and fostering student creativity.

A systematic review by Hossain et al. (2019) analyzed 114 scholarly articles to delineate the core components of Living Labs. The study identified key paradigms, including real-life experimentation, user co-creation, and multi-method approaches. The authors emphasized the importance of contextualizing LLs within specific domains to enhance their effectiveness. Similarly, Schuurman et al. (2016) proposed a three-layered model to understand LL operations, including: Macro Level- The overarching LL constellation involving public-private-people partnerships; Meso Level- Specific innovation projects undertaken within the LL framework; and Micro Level- Research activities focusing on user interactions and feedback. Then, they examined the role of LLs as innovation environments, emphasizing stakeholder collaboration to develop novel learning methods. Their research highlighted that LLs enable faculty to innovate teaching practices and assist students in cultivating creative thinking through real-world problem-based learning.

Almirall and Wareham (2008) investigated the implementation of LLs in universities, where students, faculty, and businesses collaborate on innovative projects. They found that LLs facilitate the integration of practical, multidimensional elements into curricula, thereby enhancing teaching methods. Ballon et al. (2005) demonstrated how LLs support innovation in teaching and learning by involving students and faculty in practical projects. Active student participation in real-world projects was shown to improve creativity and prompt faculty to innovate pedagogical approaches. Veeckman et al. (2013) explored how LL models support pedagogical innovation, particularly through community-involved learning projects. Their study confirmed that LLs allow faculty to adopt flexible teaching methods and enable students to develop creative thinking in real-life environments. Pallot et al. (2010) provided an overview of LL implementation in European universities, highlighting their impact on teaching and creative learning. They noted that LLs help faculty integrate theory with practice and encourage students to engage in solving real-world problems. Mulder et al. (2012) discussed how LLs promote pedagogical innovation through community-based, interdisciplinary learning projects. Students participate in practical learning activities, while faculty adjust teaching methods to meet the demands of socially and industrially linked projects.

Currently, there are numerous studies on the application of the Living Lab approach across various fields. Notable sectors include: (i) Urban development: Urban Living Labs (ULLs) address sustainability challenges in cities by engaging citizens, businesses, and public institutions in co-creating solutions for issues like mobility, energy, and housing (Steen & van Bueren, 2017). ULLs also have gained prominence as platforms for addressing complex urban challenges. They facilitate stakeholder engagement in co-creating solutions for sustainable urban living, encompassing areas such as mobility, energy, and housing. (ii) Healthcare: Living Labs in healthcare settings facilitate collaboration among patients, providers, and other stakeholders to develop patient-centered innovations, enhancing the acceptability and feasibility of healthcare interventions (Vandenhoudt et al., 2023). Living Labs have been effectively employed in healthcare settings to develop and implement patient-centered innovations. An integrative review highlighted that LLs foster collaboration among patients, providers, and other stakeholders, leading to increased acceptability and feasibility of healthcare interventions (Zipfel et al., 2022). (iii) Higher Education: In academic contexts, Living Labs serve as experiential learning environments where students, faculty, and external partners collaborate on real-world projects, fostering innovation and social outreach (Morales et al., 2023; Tercanli & Jongbloed, 2022). (iv) Smart cities and infrastructure: Living Labs contribute to the development of smart cities by integrating technology and citizen participation to create responsive urban environments (Esashika et al., 2023). (v) Environmental sustainability: Living Labs address environmental challenges by promoting sustainable practices and co-developing solutions for issues like energy efficiency and climate change (Arias et al., 2025). Despite their benefits, LLs face challenges related to ethical considerations, stakeholder engagement, and scalability. Ethical concerns arise from the involvement of users in real-life experimentation, necessitating clear guidelines to ensure informed consent and data privacy. Moreover, sustaining stakeholder participation over time and scaling successful LL initiatives require strategic planning and resource allocation.

The European Network of Living Labs (ENoLL) defines LLs as "user-centered, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings" (ENoLL, 2020, as cited in van den Heuvel et al., 2021). This definition underscores the participatory and experiential nature of LLs, emphasizing real-world contexts and stakeholder engagement. The theoretical underpinnings of LLs are rooted in concepts such as open innovation, user-centered design, and experiential learning theories. These frameworks highlight the importance of collaborative knowledge creation and iterative development processes in authentic settings. In Vietnam, the Living Lab (LL) model is emerging as a novel approach in higher education, though it remains less developed than in other countries. Research highlights the importance of stakeholder collaboration in fostering creativity and enhancing teaching practices. Nguyen and Le (2019) emphasized student engagement in real-world projects with businesses and communities, noting gains in creative thinking and teamwork. Dinh (2021) explored implementation challenges, urging stronger ties between universities and external partners to promote practical learning. Tran and Nguyen (2020) showcased LL experiences at FPT University, where students and faculty co-created tech solutions with businesses, resulting in more adaptive teaching. Nguyen and Le (2022) stressed that community-based projects enhance students' problem-solving and critical thinking, while offering faculty opportunities for pedagogical innovation. Pham (2018) discussed both the potential and limitations of LLs in Vietnam, citing infrastructure and resource issues. Le (2023) found LLs improve student creativity by engaging them in real-world challenges, recommending strategies to strengthen the model in higher education.

An increasing number of higher education institutions (HEIs) have integrated the LL approach into their core missions and activities (Evans et al., 2015; Purcell et al., 2019), viewing it as a key leverage point for embedding sustainability within their organizations (Trencher et al., 2014; Vargas et al., 2019). Living Labs established and operated by HEIs are designed to foster unique capabilities, reflected through their specific activities, structures, organization, and pursued outcomes. However, LLs require distinct governance and organizational mechanisms to enhance learning (Leminen et al., 2012; Leminen & Westerlund, 2017), build knowledge in specific domains, advance research and theoretical development, and foster innovation on campus (Tang et al., 2010). This perspective on governance and management is the central focus of this article, which also examines the supporting role of HEIs in enhancing LLs through strategies for user engagement, innovation methodologies, and long-term development efforts (Compagnucci et al., 2021). Consequently, LLs managed by HEIs referred to serve as collaborative platforms for knowledge exploration with societal stakeholders, enabling them to engage in real-world actions beyond the academic environment (Kumari et al., 2019). Although universities are increasingly striving to address sustainability challenges, doing so often presents complex challenges for the HEIs themselves (Chankseliani & McCowan, 2020). The Talloires Declaration issued an urgent call for universities to become more socially engaged and actively address sustainability issues. Since then, the so-called "third mission" of universities- social responsibility- has become central in policy discussions under themes such as "relevance," "engagement," and "social impact" (Pinheiro et al., 2015). Initially, third mission activities focused on university-business relationships and research commercialization (Compagnucci et al., 2021) with engagement primarily occurring in the "development periphery" of HEIs, such as science parks and technology transfer offices. This approach resembled a linear, one-directional model of knowledge transfer, whereas today's societal challenges demand a systems-based, bidirectional engagement strategy (Knudsen et al., 2017).

Integrating the economic, social, and environmental dimensions of sustainability into the missions of HEIs introduces managerial complexity (Cai & Ahmad, 2021). Addressing sustainability issues typically requires a holistic approach (Knudsen et al., 2017), one that calls for transformative engagement models where the third mission is embedded into the core functions of the university, including teaching, research, and institutional governance structures (Trencher et al., 2014). This necessitates new strategies and stakeholder relationship management approaches (Benneworth et al., 2015).

Although research on Living Labs is quite extensive, very few studies have approached LLs from the perspective of higher education institutions. Most existing research focuses on specific sectors when examining LLs, such as innovation management, engineering, and information and communication technology (Hossain et al., 2019; Schuurman et al., 2016), as well as urban governance (Voytenko et al., 2016) and public administration (Dekker et al., 2020). Reviews that consider the impact of LLs on HEIs themselves typically concentrate on their role in knowledge transfer (Trencher et al., 2014) or on evaluating specific laboratories (van Geenhuizen, 2018). This study aims to contribute a new approach by presenting an integrated overview of LLs operated by HEIs. It may be stated that both international and Vietnamese studies suggest that LL models significantly improve student creativity and faculty teaching methods through collaboration and practical learning. Although LLs are relatively new in Vietnam, universities are increasingly recognizing their importance in innovating teaching practices and fostering student creativity (Vietnam Living Lab, 2023).

METHODOLOGY

Research Design

The study adopts a mixed-methods research design, integrating quantitative and qualitative approaches to comprehensively examine the factors influencing the application of the Living Lab (LL) model in higher education and its effects on innovation in teaching methods and students' learning creativity. The mixed-methods approach is particularly appropriate for this research because it enables the study to capture both measurable relationships among key variables and contextual, experiential insights into how Living Labs are implemented in diverse institutional settings.

The quantitative component allows for statistical testing of hypothesized relationships between exogenous factors, organizational factors, teaching innovation, and student creativity. In parallel, qualitative in-depth interviews provide contextual understanding of lecturers' and students' experiences with LL-based teaching and learning, thereby enriching the interpretation of quantitative findings and supporting methodological triangulation.

Participants and Sampling

The study was conducted across three universities located in different national contexts: Tan Trao University (Vietnam), Yonsei University (South Korea), and UNILAK University (Rwanda). These institutions were purposively selected due to their active involvement in Living Lab–based educational initiatives and international collaboration programs.

Participants included both lecturers and students who had direct experience with LL-based courses. Survey questionnaires were distributed to all students enrolled in Living Lab–applied courses during the study period. In total, 204 valid responses were collected, comprising 9 lecturers who directly implemented the Living Lab approach and 195 students who participated in LL-based learning activities. The sample size is considered adequate and statistically representative based on established methodological guidelines. Following Hair et al. (2010), the minimum required sample size for Exploratory Factor Analysis (EFA) is five observations per observed variable.

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With 37 observed variables, a minimum of 185 responses was required; thus, the final sample of 204 responses satisfies this criterion.

Data Collection

Quantitative data were collected using a structured questionnaire developed based on an extensive review of prior Living Lab and educational innovation literature. The questionnaire employed a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) to measure respondents' perceptions of: Exogenous factors, Organizational factors (including organizational culture and resources, individual and group factors, and LL planning and implementation), Innovation in teaching methods by lecturers, and Students' learning creativity.

In terms of qualitative data, in-depth semi-structured interviews were conducted with all lecturers who had implemented the Living Lab approach at the three universities. The interviews focused on experiences with LL design, pedagogical innovation, student engagement, institutional support, and implementation challenges. While qualitative data were not analyzed as standalone case studies, they were used to contextualize the survey design and support interpretation of quantitative findings.

The measurement scales were adapted from validated instruments in prior studies and refined to align with the higher education Living Lab context. To assess internal consistency and reliability, Cronbach's Alpha coefficients were calculated for all key constructs. Following Nunnally and Bernstein (1994) and Hair et al. (2010), a Cronbach's Alpha value of 0.70 or higher was considered acceptable. All constructs exceeded this threshold, indicating satisfactory to excellent internal reliability and confirming the suitability of the instruments for subsequent analyses, including EFA and regression modeling.

Data Analysis

Quantitative data were processed using Excel and SPSS. The main analytical techniques included: Descriptive statistics, Reliability testing using Cronbach's Alpha, Pearson correlation analysis, Exploratory Factor Analysis (EFA) with Varimax rotation, Multiple linear regression analysis to examine the effects of exogenous and organizational factors on teaching innovation and student creativity.

Qualitative interview insights were used to support interpretation of statistical results and to clarify institutional and contextual factors influencing Living Lab implementation.

Table 1 summarizes the items to measure influencing factors, the innovation in teaching methods and students' learning creativity through applying Living lab approach. The scales were developed in 5- level Likert (1-5).

RESULTS AND DISCUSSION

The implementation of Living Lab (LL) methods at Yonsei University (South Korea), Tan Trao University (Vietnam), and UNILAK (Rwanda) offers valuable insights into how educational innovation can be adapted across diverse institutional and regional contexts. When compared to global benchmarks particularly in European and North American institutions distinct patterns emerge regarding the objectives, methodologies, and constraints in applying the LL approach.

In many European universities, Living Labs (LLs) are often situated within technologically advanced ecosystems, serving as platforms for co-creation between academia, industry, government, and civil society. For instance, Aalto University (Finland) and TU Delft (Netherlands) utilize Living Labs to test smart city innovations, sustainability solutions, and digital technologies (Leminen et al., 2012). These models benefit from robust funding, advanced infrastructure, and strong public-private partnerships, aligning with national strategies for innovation and economic competitiveness.

Table 1. Measured items

Factors	Code	Mesuared items
Exogenous Factors	EF1	National and regional policies encourage the implementation of innovative models such as Living Labs.
	EF2	The local community has a tradition of participating in sustainability-related activities.
	EF3	Political barriers or personnel turnover make it difficult to maintain long-term collaboration with local authorities.
	EF4	The lack of networks connecting stakeholders is an obstacle to implementing Living Labs.
Organizational Factors (OF) including Organizational Culture and Resources, Individual and Group Factors, Living Lab Planning and Implementation		
Organizational Culture and Resources	O1	The university's strategy is oriented towards integrating Living Labs into teaching and research.
	O2	University leadership facilitates and encourages faculty members to innovate teaching methods.
	O3	Short academic terms or teaching pressure affect the feasibility of implementing Living Labs.
	O4	The university's facilities and IT infrastructure are sufficient to support Living Lab activities.
	O5	The university provides financial and human resources for the long-term implementation of Living Labs.
Individual and Group Factors	O6	I am interested in interdisciplinary, collaborative, and learner-centered teaching methods.
	O7	I feel confident in implementing Living Lab activities in my teaching.
	O8	My colleagues share a common interest in innovating and improving teaching methods.
	O9	Students show enthusiasm and actively participate in creative learning activities within the Living Lab model.
Living Lab Planning and Implementation	O10	Having clear procedures makes it easier for me to implement Living Lab activities.
	O11	The university has mechanisms to connect with the community and stakeholders to support Living Labs.
	O12	There is a system in place to evaluate the effectiveness of Living Lab activities for continuous improvement.
	O13	Ethical guidelines and data privacy regulations are well-established and implemented in Living Lab projects.
Lecturer-Related Factors	L1	Living lab make the lecturers actively update and apply innovative teaching methods.
	L2	Lecturers use new technologies and learning tools to foster students' creativity in Living lab courses.
	L3	Lecturers receive professional support and training to improve my innovation skills thru Living lab cooperation.
	L4	Lecturers' teaching experience is an important foundation for innovating teaching methods in Living labs.
	L5	Lecturers feel encouraged by the university to implement innovative teaching practices, such as Living labs.
	L6	Lecturers can be capable of effectively applying new technologies in teaching activities, including Living labs.
	L7	With Living labs, Lecturers can be personally motivated to enhance teaching quality through innovation.
	L8	Lecturers regularly participate in training courses and workshops on innovative teaching methods, such as Living lab conferences.
	L9	Lecturers feel pressured by societal and labor market demands to innovate in teaching, such as applying Living labs.
	L10	Lecturers have flexibility in designing and choosing appropriate teaching methods for learners in Living lab courses.
Student-Related Factors	S1	Students in my Living lab classes actively engage in learning and participate in creative activities.
	S2	Students desire flexible and practical learning methods, such as Living lab approach.
	S3	Group work and collaboration activities in Living lab courses enhance students' learning creativity.
	S4	Living lab methods helps students possess soft skills (communication, teamwork, critical thinking, etc.) to participate in creative learning activities.
	S5	Students want to join Living lab courses because they can learn through real-life situations, simulations, or project-based learning.
	S6	Students' active participation motivates lecturers to innovate teaching methods in Living labs.
	S7	The pressure to meet international education standards increases the demand for teaching innovation and learning creativity.
	S8	Students have access to and effectively use technology to support their learning, especially in Living lab courses.
	S9	Students are capable of self-directed learning and managing their own learning processes in Living lab courses.
	S10	By Living lab application, collaboration among students, lecturers, and enterprises contributes to enhancing students' creativity in learning.

Source: Proposed by authors.

By contrast, the application of LL principles at Tan Trao University is deeply contextualized within a rural, under-resourced educational environment. The focus is not on technological experimentation but on enhancing pedagogical practices, fostering student creativity, and connecting learning activities with local socio-economic needs. Despite limited access to innovation ecosystems, the university leverages LL model such as codesign, experiential learning, and community-based projects to empower students as cocreators of knowledge and solutions. This contrasts with the dominant European model, yet illustrates the flexibility and scalability of LLs in Global South settings (Schuurman et al., 2016). At Yonsei University, the LL model is more aligned with international best practices. The university acts as a regional and global hub for Living Lab collaboration, participating in joint projects that span sectors and borders. Yonsei integrates research, education, and societal engagement into its LL approach, supported by structured frameworks and inter-institutional partnerships (e.g., its cooperation with Tan Trao and Unilak). However, even within this advanced context, Yonsei emphasizes inclusive participation and educational transformation, differentiating its focus from purely technology-driven models. Meanwhile, UNILAK represents a compelling case of LL adoption in a developing African context. Here, the LL is a vehicle for social innovation, student engagement, and community development. Given Rwanda's national emphasis on education and innovation as drivers of development, the university's LL model seeks to connect academic learning with real-world problem-solving, even in the absence of sophisticated infrastructure. This mirrors efforts seen in other African universities experimenting with LLs for grassroots innovation (e.g., the LLs of Southern Africa network), where the focus is on inclusive, low-cost, and locally grounded innovation (Coetzee, H., & Nell, W., 2018).

To ensure internal consistency of the measurement scales before conducting the Exploratory Factor Analysis (EFA), this study employed Cronbach's Alpha to assess the reliability of each scale. According to Hair et al. (2010), a scale is considered reliable when Cronbach's Alpha coefficient is ≥ 0.7. Specifically: Cronbach's Alpha ≥ 0.9: Excellent, 0.8 ≤ Cronbach's Alpha < 0.9: Good, 0.7 ≤ Cronbach's Alpha < 0.8: Acceptable. The study tested the reliability of the scales using Cronbach's Alpha for the following key constructs: Exogenous Factors (EF), Organizational Factors (OF), Innovation in Teaching Methods (L), and Students' Learning Creativity (S). The results are presented in Table 2 below.

The reliability testing results show that all measurement scales have Cronbach's Alpha coefficients greater than 0.7—meeting the acceptable threshold recommended by Nunnally and Bernstein (1994) , which indicates that the scales demonstrate high internal consistency and are suitable for subsequent quantitative analyses.

- The scale for Organizational factors (OF) achieved a Cronbach's Alpha of 0.902, reflecting a very high level of internal consistency among the observed variables in this group.
- The scales for Innovation in teaching methods (L) and Students' learning creativity (S) recorded alpha values of 0.845 and 0.867 respectively, indicating good reliability in measuring learners' perceptions of teaching innovation and creative learning.
- The scale for Exogenous factors (EF) had the lowest value among the four groups (α = 0.781), but still falls within the acceptable range, which is consistent with the nature of external environmental factors that tend to be more diverse and subjective.

Table 2. Reliability of measurement

Factors	Number of Items	Cronbach's Alpha	Evaluation
Exogenous Factors (EF)	4	0.781	Acceptable
Organizational Factors (OF)	13	0.902	Excellent
Innovation in teaching methods (L)	10	0.845	Good
Students' learning creativity (S)	10	0.867	Good

Source: Synthesized by authors.

These results confirm that the measurement scales used in this study are appropriate and can be confidently applied in the following quantitative analyses.

To provide an overview of the key research concepts in the study on the influencing factors of applying the Living Labs approach to foster innovation in teaching methods and students' learning creativity, the proposed impact model includes: (i) two composite variables representing two groups of influencing factors, namely: External Factors (EF) and Organizational Factors (OF). Specifically, the organizational factors group consists of three sub-factor groups: Organizational culture and resources (O), Individual and group factors (I), and Planning and implementation of Living Labs (P); (ii) Innovation in teaching methods by lecturers (L); and (iii) Learning creativity of students (S). The study conducted descriptive statistics for the composite variables representing each concept.

Table 3 below presents the minimum, maximum, mean, and standard deviation values of these composite variables based on the dataset of 204 valid observations.

The descriptive statistics presented in Table 3 show that the mean scores of the variables range from 3.65 to 4.22. Specifically, Organizational factors (OF) recorded the highest mean (Mean = 4.22) and the lowest standard deviation (SD = 0.41), indicating a relatively high level of agreement among respondents regarding the positive and consistent role of internal organizational elements (including culture, resources, and the implementation of Living Lab activities). Next is Innovation in teaching methods (L) with a mean score of 4.05 and a standard deviation of 0.49, reflecting a fairly positive assessment by learners of the extent to which teaching practices have been innovated, while also showing a certain degree of variability in respondents' perceptions. Students' Learning Creativity (S) ranks third with a mean of 3.92 and a standard deviation of 0.52, suggesting a generally favorable trend in students' adoption of creative learning approaches, though the level of adoption varies across individuals. In contrast, Exogenous factors (EF) have the lowest mean score (Mean = 3.65) and the highest standard deviation (SD = 0.62), indicating that the influence of external factors such as policies, community support, and innovation ecosystems is perceived as relatively limited and inconsistent, with notable differences in how respondents perceive the impact of these factors on the implementation of Living Labs. These results indicate that internal organizational factors play a more important and consistent role than external factors in promoting the adoption of the LL approach to foster teaching innovation and creative learning in the context of contemporary higher education.

Table 3. Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Exogenous Factors (EF)	204	1.80	4.85	3.65	0.62366
Organizational Factors (OF)	204	2.50	5.00	4.22	0.41452
Innovation in teaching methods (L)	204	2.10	5.00	4.05	0.48997
Students' learning creativity (S)	204	2.20	4.95	3.92	0.51578
Valid N (listwise)	204				

Source: Synthesized by authors.

Table 4. Pearson correlation matrix among variables

Variable	EF	OF	L	S
Exogenous Factors (EF)	1	0.312**	0.387**	0.295**
Organizational Factors (OF)	0.312**	1	.521**	0.468**
Innovation in Teaching (L)	0.387**	0.521**	1	0.614**
Learning Creativity (S)	0.295**	0.468**	0.614**	1

Note: $p < 0.05$ (**), $p < 0.01$ (*)
Source: Synthesized by authors.

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Additionally, to assess the linear relationships among the research variables, a Pearson correlation analysis was conducted among the four composite variables: Exogenous factors (EF), Organizational factors (OF), Innovation in teaching methods (L), and Students' learning creativity (S). The results are presented in Table 4.

The correlation analysis (Table 4) reveals that: Organizational factors (OF) have the strongest correlation with Innovation in teaching methods (L) (r = .521, $p < 0.01$), indicating that when an institution has a strong cultural foundation, sufficient resources, and a clear implementation plan for Living Labs, the likelihood of teaching innovation is significantly enhanced. Innovation in teaching methods (L) also shows a strong correlation with Students' learning creativity (S) (r = .614, $p < 0.01$), suggesting that changes in teaching methods have a substantial impact on students' level of creative learning. Exogenous factors (EF) are also significantly correlated with both Innovation in teaching methods (r = .387) and Students' learning creativity (r = .295), though to a lesser extent compared to organizational factors. Organizational factors (OF) show a moderate correlation with Students' learning creativity (r = .468), suggesting that organizational support not only influences faculty innovation but also plays an indirect role in enhancing students' creative learning behaviors. In summary, these results highlight a strong interrelationship among organizational factors, teaching innovation, and students' creativity, reinforcing the assumption that organizational factors play a pivotal role in promoting the effective implementation of the LL approach in higher education.

To examine the structure of the measurement scales and identify latent factor groups within the survey dataset, an

Table 5. Results of KMO and Bartlett's Test

Criterion	Value
KMO Measure of Sampling Adequacy	0.890
Bartlett's Test of Sphericity – Sig.	0.000

Source: Synthesized by authors.

Table 6. Rotated factor matrix after EFA (Varimax)

Factor	1	2	3	4
EF1	0.756			
EF2	0.744			
EF4	0.725			
EF3	0.708			
O2		0.802		
O7		0.812		
O1		0.793		
O12		0.792		
O5		0.785		
O10		0.768		
O4		0.761		
O9		0.755		
O3		0.749		
O13		0.744		
O11		0.736		
O6		0.729		
L8			0.790	
L5			0.782	
L2			0.775	
L6			0.755	
L3			0.749	
L1			0.734	
L10			0.732	
L9			0.726	
L4			0.704	
S5				0.776
S8				0.733
S2				0.767
S9				0.759
S4				0.753
S10				0.748
S1				0.745
S6				0.720
S3				0.712
S7				0.701

Source: Synthesized by authors.

Exploratory Factor Analysis (EFA) was conducted using the Principal Component Analysis extraction method with varimax rotation, and a factor loading threshold of ≥ 0.5 was applied.

The KMO value of 0.890 (> 0.8) indicates that the data are suitable for EFA. The Bartlett's Test is statistically significant ($p < 0.001$), confirming that there are substantial correlations among the observed variables (Table 5).

The EFA results (Table 6) extracted four factors consistent with the theoretical model, with a total variance explained of approximately 67.3%, which meets the accepted threshold (>50%). Specifically: Factor 1 (Organizational factors): Includes variables related to organizational culture and resources, individual and group factors, and planning and implementation of Living Labs—confirming the structural stability of the organizational factors scale. Factor 2 (Lecturers' innovation in teaching methods): Represents innovation in teaching methods, reflecting changes in how lecturers organize and deliver their instruction. Factor 3 (Students' learning creativity): Relates to manifestations of student learning creativity such as critical thinking, problem-solving, and self-directed learning. Factor 4 (Exogenous factors): Consists of supportive elements from the external environment, such as policies, communities, and partnerships.

After EFA, the total number of retained items is 35 (reduced from the initial 37). Items O8 (colleagues' opinions) and L7 (lecturer's personal experience foundation) were removed due to technical reasons (factor loading < 0.5). The remaining structure retains its robustness and clarity, with each observed variable loading strongly on only one factor.

To examine the extent to which Exogenous factors (EF) and Organizational factors (OF) influence the outcomes of innovation in teaching methods by lecturers (L) and students' learning creativity (S), the study conducted

Table 7. Regression results of Model 1 (L as Dependent Variable)

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.725	0.526	0.518	0.428	1.812

Independent Variables	Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	Sig.	Collinearity Statistics	
	B	Std. Error	Beta		Tolerance	VIF
(Constant)	1.102	0.184	—	0.000	—	—
Exogenous Factors (EF)	0.196	0.057	0.231	0.002	0.745	1.325
Organizational Factors (OF)	0.487	0.060	0.519	0.000	0.724	1.242

Source: Synthesized by authors.

Table 8. Regression results of Model 2 (S as Dependent Variable)

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
2	0.703	0.494	0.486	0.438	1.845

Independent Variables	Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	Sig.	Collinearity Statistics	
	B	Std. Error	Beta		Tolerance	VIF
(Constant)	1.312	0.191	—	0.000	—	—
Exogenous Factors (EF)	0.178	0.060	0.211	0.004	0.745	1.325
Organizational Factors (OF)	0.445	0.064	0.478	0.000	0.724	1.242

Source: Synthesized by authors.

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Table 9. ANOVA results of Model 1 (EF, OF → Innovation in Teaching Methods)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	42.612	2	21.306	116.463	0.000
Residual	38.391	210	0.183		
Total	81.003	212			

Source: Synthesized by authors.

Table 10. ANOVA results of Model 2 (EF, OF → Students' Learning Creativity)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	38.298	2	19.149	99.975	0.000
Residual	38.908	203	0.192		
Total	77.206	205			

Source: Synthesized by authors.

multiple linear regression analyses with two models: (1) Model 1: EF, OF → L; (2) Model 2: EF, OF → S

The results indicate that both Exogenous and Organizational factors have significant and positive impacts on teaching innovation, with Organizational factors showing a much stronger standardized effect ($\beta = 0.519$) compared to Exogenous factors ($\beta = 0.231$). The adjusted $R^2 = 0.518$ suggests that more than half of the variance in teaching innovation can be explained by the model.

This reinforces the view that internal organizational capacity, including supportive leadership, infrastructure, and strategic orientation, plays a critical role in driving lecturers to innovate their teaching practices in the context of Living Labs. Although external influences (e.g., policies, partnerships) are also meaningful, they appear less direct and potent.

Model 2 also reveals significant positive effects of Exogenous factors (EF) and Organizational factors (OF) on students' learning creativity, with OF again being the dominant predictor ($\beta = 0.478$). The adjusted $R^2 = 0.486$ shows that nearly 49% of the variance in students' creative learning outcomes is explained by the model.

These findings suggest that internal organizational environments are not only instrumental in shaping how lecturers teach, but also create conditions that encourage student engagement in creative, collaborative, and self-directed learning activities. The lesser but still significant role of external factors reflects the indirect influence of ecosystem-level support structures.

Both models yielded large F-values and $p < 0.001$, indicating that the models are statistically significant—meaning the independent variables (EF and OF) explain a substantial portion of the variance in the dependent variables (L and S). Model 1 has an F-value of 116.463 and Model 2 has an F-value of 99.975. In sum, the ANOVA results confirm that the regression model is highly significant and suitable for the research hypotheses.

Thus, the findings of this study provide strong empirical support for the pivotal role of the Living Lab (LL) approach in fostering innovation in teaching methods and enhancing students' learning creativity within higher education institutions. By integrating quantitative evidence with comparative insights from existing literature, this discussion situates the results within broader scholarly debates on pedagogical innovation, organizational capacity, and experiential learning under the Education 4.0 paradigm.

Organizational factors exert as the primary driver of teaching innovation. Internal organizational elements- such as leadership support, institutional culture, resource availability, and structured LL implementation mechanisms- are the most powerful predictors of lecturers' innovation in teaching methods. This finding is consistent with prior studies emphasizing that Living Labs require strong internal governance and institutional embedding to function effectively in higher education contexts (Leminen et al., 2012; Schuurman et al., 2016). Previous research has shown that universities with clearly articulated strategies, supportive leadership, and dedicated resources are more likely to adopt learner-centered and innovation-oriented pedagogies (Evans et al., 2015; Trencher et al., 2014). The high mean score and low variance of organizational factors in this study further suggest that respondents perceive internal institutional conditions as both stable and influential. Moreover, the strong effect of organizational factors aligns with the concept of the university's "third mission," which highlights the importance of organizational transformation to support societal engagement and innovation beyond traditional teaching and research roles (Compagnucci et al., 2021; Pinheiro et al., 2015). Living Labs, as organizationally embedded platforms, appear to operationalize this mission by linking pedagogical innovation with real-world problem-solving.

While organizational factors dominate, the study also confirms that exogenous factors—such as public policy, community engagement, and external stakeholder networks—have a positive but comparatively weaker influence on both teaching innovation and student creativity. This result echoes findings from earlier studies suggesting that external environments provide enabling conditions rather than direct drivers of pedagogical change (Hossain et al., 2019; van den Heuvel et al., 2021). In contexts where policy frameworks, funding mechanisms, or innovation ecosystems are still developing—such as Vietnam and Rwanda—the impact of exogenous factors may be uneven and fragmented. Similar observations have been reported in studies of Living Labs in developing regions, where institutional readiness often outweighs ecosystem maturity in determining successful implementation (Morales et al., 2023; Steen & van Bueren, 2017). Thus, the findings reinforce the argument that external support must be mediated through internal institutional capacity to generate meaningful pedagogical outcomes.

Another critical contribution of this study lies in the strong and statistically significant relationship between teaching innovation and students' learning creativity. The correlation and regression analyses demonstrate that innovative teaching practices, enabled by the Living Lab approach, are closely associated with higher levels of student creativity, self-directed learning, and collaborative engagement. This result is highly consistent with experiential learning theory and prior LL-based educational research, which emphasizes that creativity emerges most effectively in authentic, problem-based, and collaborative learning environments (Mulder et al., 2012; Pallot et al., 2010). Studies conducted in European and Asian universities have similarly found that when lecturers adopt facilitative roles and integrate real-world challenges into curricula, students demonstrate stronger creative thinking and problem-solving capabilities (Almirall & Wareham, 2008; Tercanli & Jongbloed, 2022). Importantly, the present findings extend this literature by empirically confirming that teaching innovation functions as a mediating mechanism between organizational conditions and student learning outcomes. This underscores the central role of lecturers as change agents who translate institutional support into meaningful learning experiences.

Then, the comparative implementation of Living Labs at Yonsei University, Tan Trao University, and UNILAK University highlights the contextual adaptability of the LL model. While European and North American Living Labs often emphasize advanced technological experimentation and smart-city innovation (Leminen et al., 2012), the cases examined in this study demonstrate that LLs can be effectively adapted to resource-constrained environments by prioritizing pedagogical innovation and community engagement. This finding resonates with studies conducted in the Global South, which argue that Living Labs need not be technology-intensive to be impactful; rather, their value lies in co-creation, contextual relevance, and stakeholder collaboration (Coetzee, H., & Nell, W., 2018; Nguyen & Le, 2022). The results thus support a more inclusive and flexible understanding of Living Labs as pedagogical ecosystems rather than purely technological platforms.

Taken together, the findings contribute to the Living Lab literature in three important ways. First, they empirically validate a multi-level model linking organizational and exogenous factors to teaching innovation and student creativity. Second, they strengthen the argument that organizational readiness is a prerequisite for successful LL-based pedagogy, particularly in developing higher education systems. Third, they provide evidence that teaching innovation is not merely an outcome but a key mechanism through which Living Labs enhance creative learning.

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By systematically integrating empirical results with established theories and prior studies, this discussion enhances the robustness and credibility of the study and positions it as a meaningful contribution to research on Living Labs, Education 4.0, and pedagogical transformation in higher education.

CONCLUSION AND RECOMMENDATIONS

Based on empirical findings and practical grounds and the aforementioned foundation for proposing solutions, particularly the research findings on the impact of various factors on innovation in teaching methods by lecturers and students' creative learning in universities through the promotion of Living Lab collaboration. The following recommendations aim to effectively embed the Living Labs (LLs) into higher education institutions (HEIs), thereby promoting both teaching innovation and students' creative learning. These recommendations are proposed for four primary stakeholder groups, including HEIs, lecturers, students, and educational policymakers/authorities, to foster innovation in teaching methods and enhance students' creative learning through the adoption of the Living Labs.

Recommendations for HEIs

First, strengthen internal organizational capacity to institutionalize LLs. HEIs must develop comprehensive internal mechanisms to integrate LLs as a strategic component of institutional development. This includes embedding LLs into strategic planning, securing leadership commitment, ensuring adequate resource allocation, and developing clear implementation frameworks (Bergvall-Kåreborn et al., 2009; Schuurman et al., 2016). Faculty development programs and innovation-focused policies should be formalized to support sustainable Living Lab integration.

Second, foster a culture of innovation and interdisciplinary collaboration in teaching. A culture that encourages experimentation and knowledge co-creation across disciplines is essential. HEIs should support peer learning, cross-departmental cooperation, and communities of practice that enable knowledge exchange and pedagogical innovation (Almirall & Wareham, 2008). This environment will motivate faculty to engage more actively in LL-based initiatives and contribute to institutional innovation.

Third, provide continuous training and support for lecturers. Ongoing professional development is vital to equip lecturers with the skills necessary for innovative teaching. HEIs should organize regular workshops, focusing on LL pedagogy, digital competencies, and problem-based learning (Ballon et al., 2005). Tailored support systems and access to external expertise can further enhance implementation effectiveness.

Fourth, enhance student engagement through Living Lab-integrated course design. Active student participation is a cornerstone of LL methodology. Course structures should incorporate real-world problem-solving, project- based learning, and opportunities for students to co-create solutions with stakeholders (Leminen & Westerlund, 2017). Such practices foster students' creativity, critical thinking, autonomy, and teamwork—key competencies for the 21st century.

Fifth, strengthen external linkages and promote supportive policy frameworks. HEIs should cultivate partnerships with businesses, local authorities, and community organizations to create authentic learning environments and broaden LL applications (Westerlund et al., 2018). Engaging policymakers is also crucial to ensure enabling policies, financial incentives, and recognition of LL outcomes in institutional evaluations.

Last but not least, strengthening Living Lab educational collaboration among universities. Collaborative networks among universities can greatly enhance the effectiveness of Living Labs. Joint research, shared curriculum development, student and faculty exchanges, and thematic academic forums should be prioritized (Nyström et al., 2014). One of the key solutions to enhance the effectiveness of the LL approach in higher education is to strengthen collaboration among universities, similar to the initiative currently led and implemented by IPAID

(Yonsei University). Such collaboration not only facilitates the sharing of resources, knowledge, and implementation experiences but also contributes to the development of sustainable innovation networks. Specifically, universities can establish joint programs based on research and teaching projects that involve multiple stakeholders (faculty members, students, businesses, and local communities). Through co-developing cross-border or interregional LL initiatives, institutions can leverage their unique strengths to address real-world challenges in education and society. In addition, organizing academic forums, thematic workshops, and faculty and student exchange programs is an effective way to promote the LL spirit. HEIs should proactively build long-term cooperation mechanisms, including agreements on data sharing, technology exchange, and the adoption of innovative pedagogical practices, to enhance teaching quality, research, and pedagogical innovation. Promoting LL collaboration among universities not only boosts each institution's innovation capacity but also contributes to the advancement of the entire higher education ecosystem, especially in the context of digital transformation and increasing globalization.

Besides, HEIS also can apply other private and detailed solutions, such as:

(1) Institutional integration of the Living Labs: HEIs should embed the LLs within their institutional strategies to promote Education 4.0 and fulfill their third mission—social responsibility and community engagement (Trencher et al., 2014). This includes the development of mission statements, policy guidelines, and academic roadmaps that explicitly recognize Living Labs as core educational instruments. The formation of dedicated LL coordination units or innovation centers will facilitate implementation, oversight, and cross-departmental integration.

(2) Investment in infrastructure and digital resources: Robust infrastructural support is essential for LL effectiveness. HEIs should invest in smart classrooms, flexible co-working environments, IoT systems, and cloud-based platforms (e.g., Microsoft Teams, Miro, Padlet) that enable collaborative, technology-enhanced learning. Digital ecosystems must support synchronous and asynchronous project management, data sharing, and real-time feedback. Thus, investments should prioritize smart learning environments, digital platforms for collaboration (e.g., LMS, cloud-based co-creation tools), and flexible workspaces to support student-centered and interdisciplinary learning.

(3) Promotion of multi-stakeholder engagement: HEIs must act as facilitators of collaboration between internal actors (faculty, students) and external stakeholders (industry, civil society, and government). They should actively engage internal (faculty, students, administrators) and external (industries, NGOs, local communities) stakeholders in co-creating LL initiatives. Creating stakeholder advisory panels, community-based research clusters, and university–industry partnership forums can support this engagement (Westerlund et al., 2018). Such participation ensures contextual relevance and societal impact.

(4) Faculty development and capacity building: Continuous professional development is required to enhance lecturers' competencies in participatory pedagogy, digital literacy, and project-based learning (Tercanli & Jongbloed, 2022). HEIs should provide workshops, peer-learning opportunities, and certification programs to develop the competencies required to shift from traditional teaching to facilitator roles. Effective LL implementation hinges on lecturer readiness. HEIs must deliver training on project-based learning, user-centered design, systems thinking, and digital pedagogy.

(5) Reform of incentive structures: Institutional reward systems must evolve to recognize LL-related work. Innovations in teaching, interdisciplinary teamwork, and community engagement should be included in promotion, tenure, and grant evaluation criteria. It means faculty performance appraisal systems should reward contributions to LL activities, especially interdisciplinary research and community-engaged teaching. This may involve revising promotion criteria to include innovation-oriented teaching outcomes.

(6) Monitoring and scaling frameworks: HEIs should adopt data-driven monitoring systems to assess LL performance. Universities should establish rigorous performance evaluation mechanisms for LL projects,

using KPIs such as student learning outcomes, societal impact, and stakeholder satisfaction. Successful LL models should be scaled across faculties through internal policy reforms and cross-unit knowledge sharing (Huang & Thomas, 2021). Successful models can be institutionalized and scaled across departments to ensure sustainable integration.

Recommendations for Lecturers

Curriculum redesign based on real-world challenges: Lecturers are encouraged to redesign curricula around pressing community, environmental, and industrial challenges, so they should align course outcomes with real-world problems to make learning authentic and meaningful. LL-based modules should incorporate community issues, sustainability challenges, or industry needs. Courses should include collaborative problem definition, design-based inquiry, and local stakeholder engagement. This aligns student learning with authentic, context-rich problems and enhances relevance.

Adoption of collaborative facilitation roles: Lecturers should transition from content-delivery roles to facilitators of co-learning. They are encouraged to mentor students through iterative design processes and collaborative inquiry.

Application of technology-enhanced learning tools: Educators should integrate digital tools to support LL activities such as data visualization (e.g., Power BI), collaborative mapping (e.g., Miro), and real-time feedback mechanisms (Salmon, 2013).

Engagement in cross-institutional and interdisciplinary collaboration: Participation in cross-border and multidisciplinary LL networks can broaden lecturers' pedagogical and research perspectives.

Documentation and dissemination of LL practices: Faculty should contribute to scholarly discourse by publishing case studies, reflecting on LL methodologies, and engaging in communities of practice focused on educational innovation.

Recommendations for Students

Proactive participation in LL activities: Students should embrace their roles as co-creators in LL projects, engaging in all stages of problem identification, solution design, and implementation. In addition, feedback and reflective learning practices by participating in reflective journaling, peer evaluation, and project reviews enhances metacognition and learning effectiveness.

Development of core 21st-century skills: LL participation supports the development of critical competencies, including problem-solving, collaboration, and creativity. Students should actively seek opportunities to enhance these skills through experiential learning. They also should leverage LL experiences to understand how global challenges manifest locally and contribute to their resolution using context-sensitive approaches. It means, they should learn to get global citizenship and glocal thinking:

Academic time management and integration: Students must learn to manage LL commitments alongside traditional coursework. Institutions should support this through flexible scheduling and academic advising.

Recommendations for educational policymakers and authorities

Incorporation of LLs in National education policies: Policymakers should officially recognize Living Labs as pedagogical innovations aligned with Industry 4.0 competencies and Education for Sustainable Development (UNESCO, 2021). National frameworks should encourage their adoption in curriculum standards and institutional quality benchmarks. Besides, educational authorities must ensure LL activities adhere to ethical standards and data privacy regulations. Guidelines should be developed for consent procedures, stakeholder inclusion, and public accountability.

Funding and resource allocation: Authorities should provide targeted funding mechanisms (e.g., innovation grants, public-private partnerships) to support the development and scaling of LLs within universities, especially in rural or under-resourced regions. Then, policymakers should promote transnational LL projects that foster cooperation among universities, contributing to global knowledge exchange and institutional capacity-building.

Development of evaluation and accreditation standards: National education agencies should design evaluation metrics that capture LL outcomes, including community impact, student skill development, and pedagogical innovation.

Although this study makes several meaningful contributions, a number of limitations should be acknowledged. First, the size and scope of the sample are limited, which constrains the generalizability of the findings. The study was conducted at three universities, with only one institution representing each country, which cannot adequately represent the higher education systems of those countries. Therefore, the findings should be regarded as exploratory and interpreted within their specific contextual settings. Second, although the study adopts a mixed-methods research design, the empirical analysis relies primarily on quantitative survey data. The qualitative component is mainly used to provide contextual support and to aid the interpretation of quantitative results, rather than serving as an in-depth qualitative analysis in its own right. Third, the study employs a cross-sectional design, capturing perceptions and relationships among variables at a single point in time. As a result, it is not possible to establish causal relationships or to examine changes in the effects of Living Labs on teaching innovation and student creativity over time.

Based on these limitations, several directions for future research are proposed. Future studies should expand the sample size and scope by including more universities within each country and across different regions, thereby enabling comparative analyses among different types of higher education institutions (e.g., public versus private, research-oriented versus teaching-oriented). Further research should also strengthen in-depth qualitative approaches, such as longitudinal interviews, classroom observations, and detailed case studies of Living Lab projects. In addition, longitudinal research designs are recommended to assess the long-term impacts of Living Labs on teaching practices, student competencies, and institutional transformation. Subsequently, future studies may examine mediating and moderating variables, such as lecturers' pedagogical beliefs, digital competencies, student learning motivation, or institutional governance models, in order to further refine theoretical models of Living Lab implementation in higher education. Finally, future research could focus on the policy and governance dimensions of Living Labs, particularly the role of national education policies, funding mechanisms, and quality assurance systems in facilitating or constraining the adoption and scaling of Living Lab models in higher education.

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고등교육에서의 리빙랩(Living Labs): 교수법 혁신과 학습 창의성에 영향을 미치는 요인 탐색

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교육 4.0과 디지털 전환의 시대에 고등교육기관(HEIs)은 창의성을 촉진하고 현대 사회의 요구에 부응하기 위해 교수·학습 방법의 혁신을 점점 더 요구받고 있다. 본 연구는 대학에서 리빙랩(Living Lab, LL) 접근법의 도입에 영향을 미치는 요인을 분석하여, 교수자의 교수법 혁신과 학생들의 학습 창의성 증진을 살펴보고자 한다. 이를 위해 혼합연구방법(mixed-methods)을 적용하였으며, 베트남, 한국, 르완다의 3개 대학 소속 교수자와 학생을 대상으로 한 구조화 설문조사와 심층 인터뷰를 실시하였다. 총 204부의 유효 응답 자료를 바탕으로 기술통계분석, 탐색적 요인분석, 다중선형회귀분석을 수행하였다. 연구 결과, 외생적 요인과 조직적 요인 모두가 교수법 혁신과 학생 창의성에 유의미한 영향을 미치는 것으로 나타났으며, 특히 조직 문화, 리더십, 인프라, 실행 메커니즘과 같은 내부 조직 요인이 더 강한 영향을 미치는 것으로 확인되었다. 또한 교수법 혁신과 학습 창의성 간에 높은 상관관계가 존재함을 밝혀냈다. 이러한 결과를 바탕으로 본 연구는 내부 역량 강화, 협력적 문화 조성, 교수자 역량 개발 프로그램 제공, 실제 문제 기반 프로젝트를 통한 학생 참여 확대, 외부 이해관계자와의 협력 강화 등과 같은 구체적인 개선 방안을 제안한다. 본 연구의 시사점은 교육 분야에서의 리빙랩 연구를 확장하는 데 기여하며, 고등교육 정책 및 기관 전략 수립에 실질적인 함의를 제공한다.

주제어: 리빙랩, 혁신, 교수법, 학습 창의성, 고등교육, 영향 요인

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