“The impact of design thinking on entrepreneurial competencies among university students in Peru”

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THE IMPACT OF DESIGN THINKING ON ENTREPRENEURIAL COMPETENCIES AMONG UNIVERSITY STUDENTS IN PERU

Abstract

In emerging economies, youth unemployment and limited entrepreneurial education remain persistent challenges for higher education institutions. This study aims to examine how the dimensions of design thinking (empathy, creativity, and problem-solving) influence the development of entrepreneurial competencies among university students in Peru. A structured questionnaire was administered to 385 undergraduates enrolled in business programs at two private universities in Metropolitan Lima between August and November 2024. Business undergraduates were selected because they represent the segment most actively involved in university-based entrepreneurial initiatives in Peru. Data were analyzed using covariance-based structural equation modeling (CB-SEM) to assess the structural relationships between design thinking dimensions and entrepreneurial competencies. The results reveal strong and statistically significant associations across all constructs. Problem-solving exerted the strongest effect on willingness to innovate (β = 0.42), followed by entrepreneurial motivation (β = 0.37) and creativity (β = 0.33). Empathy demonstrated positive effects on motivation (β = 0.35) and resilience (β = 0.28), with all coefficients significant at $p < .001$. Model fit indicators confirmed robust adequacy (CFI = 0.94; GFI = 0.92; NFI = 0.91; RMSEA = 0.06). These findings indicate that design thinking strengthens the cognitive and behavioral foundations of entrepreneurial performance, particularly adaptability, creative ideation, and user-centered problem-solving. Integrating this human-centered iterative methodology into higher education represents an effective strategy for enhancing students' innovation capacity and resilience. The study advances theory by empirically validating design thinking as a pedagogical mechanism for entrepreneurship education, and advances practice by offering evidence-based guidance for universities operating in emerging economies.

Keywords design thinking, entrepreneurial competencies, willingness to innovate, entrepreneurial motivation, resilience, higher education, Peru

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INTRODUCTION

Youth entrepreneurship plays a crucial role in fostering economic resilience, social mobility, and innovation in emerging economies. In Peru, youth unemployment continues to exceed the national average, reflecting persistent structural barriers that hinder the transition from university education to productive employment. These conditions underscore the importance of strengthening entrepreneurial capabilities among university students, who increasingly require adaptive, creative, and innovation-oriented competencies to navigate uncertain and rapidly changing environments (Acs et al., 2014).

Higher education institutions are expected to develop these competencies; however, the effectiveness of traditional pedagogical approaches remains contested. Conventional instruction often fails to cultivate the cognitive, creative, and behavioral abilities needed for entrepreneurial action, particularly in contexts where innovation eco-

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systems are still emerging and institutional support structures are limited (Davidsson, 2016; Kuratko, 2021). This has intensified academic interest in educational methodologies that promote creativity, user-centered thinking, experimentation, and problem-solving skills considered essential for opportunity recognition and entrepreneurial performance.

Design thinking has gained prominence as a methodology that fosters these abilities through iterative, human-centered, and experiential learning processes (Chatterjee et al., 2020; Zollo & Winter, 2002). Nevertheless, despite its global recognition, its integration into entrepreneurship education in Peru is still limited. Empirical evidence on how design thinking contributes to the development of entrepreneurial competencies such as motivation, resilience, and willingness to innovate remains limited and fragmented, particularly in emerging economies (Chatterjee et al., 2020; Montes et al., 2023).

This situation reveals the lack of systematic empirical understanding of how, and to what extent, the core dimensions of design thinking influence the formation of entrepreneurial competencies among university students in emerging economies. Existing studies provide only partial insights and frequently rely on evidence generated in different educational or institutional contexts, reducing their applicability to countries with less mature innovation environments (Anderson & Gerbing, 1988; Montes et al., 2023). Consequently, the mechanisms through which experiential, human-centered methodologies may contribute to entrepreneurial competency development within Peruvian higher education remain analytically underexplored.

1. LITERATURE REVIEW AND HYPOTHESES

Entrepreneurship has been conceptualized as a dynamic process of identifying and exploiting opportunities in complex and changing environments. The scientific literature approaches it from multiple perspectives, such as behavioral, strategic, and systemic, highlighting core competencies such as motivation, resilience, and willingness to innovate as essential for sustaining initiatives under uncertainty (Barney, 2001; Baron & Shane, 2007; Bygrave, 2004; Moroz & Hindle, 2012). Moreover, national contexts and institutional environments have been shown to influence entrepreneurial capabilities, as evidenced in the models of national entrepreneurship systems and innovation policies (Acs et al., 2014; Autio et al., 2014).

Design thinking is a human-centered and iterative methodology that integrates empathy, creativity, and analytical problem-solving through processes of ideation, prototyping, and evaluation to reframe complex challenges and generate innovative solutions. Its experiential and participatory orientation fosters collaborative learning, critical thinking, and evidence-based decision-making, positioning design thinking as an effective pedagogical approach for addressing complex and uncertain environments. Moreover, design thinking strengthens transversal competencies associated with sustainability, adaptability, and innovation, which are increasingly recognized as essential for entrepreneurial and organizational performance (Chatterjee et al., 2020; Cunneen et al., 2007; Arnold & Wade, 2015; Tidd & Bessant, 2020; Von Hippel, 2005; Arranz et al., 2019; Belz & Binder, 2017; Maritz & Donovan, 2013).

Within the innovation literature, the open innovation perspective emphasizes the integration of internal and external knowledge to enhance competitiveness (Bogers et al., 2018; Chesbrough, 2003; Liedtka et al., 2017). This perspective aligns with the concept of innovation ecosystems, where collaboration and digital transformation function as enablers of organizational performance (Audretsch & Belitski, 2023; Hanelt et al., 2021; Tether & Tajar, 2008). Under this framework, design thinking operates as a bridge between creativity and innovation, translating human-centered ideas into applicable economic and social solutions (Fagerberg et al., 2012; Gunday et al., 2011; Parida et al., 2019).

Entrepreneurial competencies are also grounded in theories such as effectuation, which emphasizes the importance of flexibility and adaptation in decision-making (Sarasvathy, 2001). In this frame-

work, resilience, motivation, and willingness to innovate are presented as factors that strengthen the sustainability of business ecosystems (Ribeiro-Navarrete et al., 2021; Zahra & Nambisan, 2012). Furthermore, in the context of digital transformation, innovation is linked to both the integration of technologies and the generation of new business models (Liu et al., 2021; Hernandez-Padilla et al., 2023; Yoo et al., 2010).

Entrepreneurial education requires innovative approaches that surpass traditional methods. Design thinking offers a framework associated with improvements in creativity, empathy, and problem-solving as transferable skills in professional contexts (Assink, 2006; Caloffi et al., 2023; Howells, 2006). Authors who study ideation and prototyping processes show that these practices strengthen autonomy, experimentation, and active learning (Cooper, 2008; Miles, 2005; Phadke & Vyakarnam, 2017). Consequently, the integration of design thinking into university programs is a key resource for linking individual skills to broader innovation environments.

The scientific literature documents extensive evidence on entrepreneurship and innovation in Latin America. Heredia et al. (2019) analyzed manufacturing sectors in Chile and Peru, concluding that resilience is essential for ecosystems under intense competitive pressure. Beyond Latin America, Kumar et al. (2016) showed that ICT adoption is positively associated with output per worker in the Chinese economy, underscoring how digital capabilities can enhance performance in emerging contexts. This aligns with our emphasis on capability-building for innovation. In the Peruvian higher education context, recent studies on students' competencies and financial capabilities (Asparrent Revollar et al., 2023; Cordova-Buiza et al., 2022) also highlight the need for innovative pedagogical approaches that strengthen motivation, adaptability, and decision-making.

In the national context, Del Carpio and Seclen-Luna (2022) examined technological innovation in Peruvian manufacturing; it is cited here as sectoral evidence on innovation, not as a design thinking intervention in education. Bazán Borja (2022), on the other hand, analyzed regional innovation systems in Peru and found that individual design and collaboration capabilities carry more weight than institutional networks, posing a challenge for the integration of sustainable entrepreneurial ecosystems.

Internationally, Gunday et al. (2011) confirmed that innovation in products and processes strengthens organizational competitiveness, while Benitez et al. (2020) confirmed, using structural models, the relationship between innovation and entrepreneurial disposition. Both articles prove that creativity is a crucial factor in the development of entrepreneurial competencies among university students.

Cooperation has also been identified as a key driver of innovation. Caloffi et al. (2023) showed that cooperation increases the performance of European ventures, while Markovic et al. (2021) highlighted the role of open innovation in academic projects. These conclusions contrast with those of Bazán Borja (2022), who found that institutional networks in Peru have not yet achieved a significant association, underscoring discrepancies between emerging and developed contexts.

Finally, Alvarez-Salazar and Seclen-Luna (2023) showed that organizational resources are crucial for the survival of startups, highlighting motivation as a strategic factor. These findings are complemented by those of Autio et al. (2014), who pointed out that contextual conditions influence innovative processes. Taken together, national and international evidence justifies evaluating how design thinking contributes to strengthening entrepreneurial competencies in higher education.

The connection between design thinking and entrepreneurial competencies lies in the cognitive and behavioral skills required for entrepreneurial action. Empathy enhances opportunity recognition and strengthens motivation by enabling individuals to understand user needs and contextual challenges. Creativity supports the generation of novel solutions, while problem-solving promotes resilience and informed decision-making in uncertain environments. Prior research suggests that these three dimensions of design thinking underpin key entrepreneurial competencies such as perseverance, innovative behavior, and the willingness to take risks (Belz & Binder, 2017; Maritz & Donovan, 2013). Thus, design thinking offers a

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pedagogical mechanism capable of developing the motivational, cognitive, and adaptive capacities essential for entrepreneurial performance.

Empathy supports entrepreneurial motivation and resilience by strengthening user-oriented opportunity recognition, collaboration, and commitment in uncertain contexts (Cunneen et al., 2007; Belz & Binder, 2017). Creativity strengthens willingness to innovate by expanding the range of alternative solutions and encouraging experimentation (Chatterjee et al., 2020; Gunday et al., 2011). Problem-solving strengthens willingness to innovate by enabling analytical framing, evidence-based decisions, and iterative refinement of solutions (Tidd & Bessant, 2020; Von Hippel, 2005).

In addition, entrepreneurial motivation increases willingness to innovate by energizing risk-taking and sustained experimentation, particularly in contexts where institutional support is limited (Sarasvathy, 2001; Zahra & Nambisan, 2012).

Despite growing evidence on design thinking and entrepreneurship, empirical findings remain fragmented in emerging economies, justifying a systematic examination of how its core dimensions influence entrepreneurial competencies among university students.

Therefore, the purpose of this study is to examine how the dimensions of design thinking (empathy, creativity, and problem-solving) influence the development of entrepreneurial competencies among university students in Peru. The hypotheses are as follows:

H1: Empathy positively influences entrepreneurial motivation.

H2: Empathy positively influences entrepreneurial resilience.

H3: Creativity positively influences willingness to innovate.

H4: Problem-solving positively influences willingness to innovate.

H5: Entrepreneurial motivation positively influences willingness to innovate.

2. METHODOLOGY

This study adopted a quantitative, non-experimental, correlational, and cross-sectional design, consistent with methodological guidelines for behavioral and social sciences (Hernández-Sampieri et al., 2018). The design aimed to examine the structural relationships among latent constructs of design thinking and entrepreneurial competencies without experimental manipulation. The dependent variables in this study are the three entrepreneurial competencies: motivation, resilience, and willingness to innovate. These are consistently treated as outcome constructs in both the measurement and structural models.

To this end, covariance-based structural equation modeling (CB-SEM) was employed to examine relationships between latent variables associated with design thinking (creativity, empathy, and problem-solving) and entrepreneurial competencies (motivation, resilience, and willingness to innovate). This approach was appropriate because it allowed the estimation of associations at a single point in time without experimental manipulation and provided robust analytical tools for evaluating complex interactions.

Based on prior literature, the study focuses on five structural relationships that represent the strongest empirical linkages between design thinking dimensions and entrepreneurial competencies. Other potential relationships, such as those between creativity and resilience, were not included to maintain model parsimony and statistical clarity, following Anderson and Gerbing's (1988) recommendations for SEM design.

The study population consisted of undergraduate students enrolled in business-related academic programs at two private universities located in Metropolitan Lima, Peru. These institutions were selected because of their consolidated entrepreneurship programs and their active involvement in university-based innovation initiatives.

A total sample of 385 students was obtained using stratified random sampling to ensure proportional representation across academic programs, including business administration, accounting and finance, international business, and marketing.

To be eligible for participation, students were required to be at least 18 years old and enrolled in upper-level undergraduate courses during the second academic semester of 2024. Participation was voluntary and anonymous, and only fully completed questionnaires were retained for analysis (N = 385).

Program stratification ensured heterogeneity in academic training while maintaining conceptual alignment with the study objectives. Each student constituted a unit of analysis.

Table 1 summarizes the demographic and academic profiles of the respondents. The sample included male and female undergraduate students across business-related programs, with the majority aged 21 to 23 years. Participants were proportionally represented across business administration, accounting and finance, international business, and marketing programs, as well as across the two participating universities. This descriptive information provides context for interpreting the empirical results and supports the internal validity of the study.

The minimum required sample size was calculated using the standard formula for proportions in large populations:

$$n = \frac{Z^2 \cdot p \cdot q}{e^2}, \quad (1)$$

where $Z = 1.96$, $p = 0.50$, $q = 0.50$, and $e = 0.05$. This yields $n = 384.16$, which was rounded to 385.

The research was conducted between August and November 2024 in Metropolitan Lima, an area characterized by significant university-based entrepreneurial and innovation activity. This setting was deliberately selected because it combines consolidated incubation ecosystems with diverse emerging economic sectors, offering a relevant environment for analyzing entrepreneurship-related competencies. Two universities with established entrepreneurship and business programs, namely the Universidad Privada del Norte [Private University of the North] and the Universidad Autónoma del Perú [Autonomous University of Peru], granted access to updated enrollment lists, allowing the construction of an accurate sampling frame. The dataset was created exclusively for this project and has not been previously used or published, ensuring its originality and integrity.

Data were collected using a structured questionnaire based on five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument included fifteen items measuring design thinking across three dimensions (creativity, empathy, and problem-solving), each represented by five items. Twelve items assessed entrepreneurial competencies across three dimensions (motivation, resilience, and willingness to innovate), with each dimension measured by four items. All items were adapted to the Peruvian academic and cultural context to ensure clarity, relevance, and content validity. Internal consistency was evaluated using Cronbach's alpha and

Table 1. Participant characteristics

Characteristic	Category	n	%
Gender	Male	186	48
	Female	199	52
Age (years)	18–20	142	37
	21–23	181	47
	24 or older	62	16
Academic program	Business Administration	118	31
	Accounting and Finance	94	24
	International Business	83	22
	Marketing	90	23
University	Universidad Privada del Norte (UPN) [Private University of the North]	203	53
	Universidad Autónoma del Perú (UAP) [Autonomous University of Peru]	182	47
Total		385	100

Note: N = 385. Percentages may not total 100 due to rounding.

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composite reliability (CR), while convergent validity was assessed through the average variance extracted (AVE), with AVE ≥ .50 as the criterion.

Content validity was strengthened through expert review by three scholars specializing in entrepreneurship and innovation, who evaluated the clarity, relevance, and cultural appropriateness of the items. A pilot test with 20 students sharing the characteristics of the target population was conducted to confirm item comprehension and refine wording prior to full deployment. The complete questionnaire is included in Appendix A to ensure methodological transparency; a repository version may also be provided upon request.

The questionnaire was administered between August and November 2024 during the second academic semester, in coordination with faculty authorities to minimize disruptions to class activities. Participation was voluntary and anonymous, and all students provided informed consent before completing the survey. Average completion time was approximately twenty minutes. To minimize response bias, the questionnaire was self-administered online without instructor presence, no academic incentives were provided, and students were assured that their participation would not affect course performance. The selected period coincided with students' enrollment in advanced courses on innovation and entrepreneurship, enhancing the relevance and quality of the responses.

Data analysis was conducted using IBM SPSS AMOS 25. Initial descriptive analyses were performed to identify means, standard deviations, potential outliers, and missing data. When missing values did not exceed five percent, mean substitution was applied at the item level prior to SEM estimation. Reliability was evaluated using Cronbach's alpha and composite reliability, while convergent validity was assessed through AVE values. Discriminant validity was examined using the Fornell–Larcker criterion (Fornell & Larcker, 1981) to ensure that all constructs were conceptually distinct. The analysis followed the two-step approach proposed by Anderson and Gerbing (1988), emphasizing measurement model validation prior to testing structural relationships.

The study was conducted under the ethical standards of educational research and Peruvian regulatory guidelines. Approval was obtained from the university ethics committee. All data were anonymized and analyzed in aggregate form to prevent participant identification. Accuracy and integrity were ensured through complete data recording and strict adherence to voluntary participation procedures.

Finally, the study acknowledges its limitations, specifically its cross-sectional design and focus on two universities within a single metropolitan area, which may restrict the generalizability of the findings. Future research should incorporate longitudinal designs and more diverse samples to examine how design thinking influences entrepreneurial competencies across broader educational and cultural settings.

3. RESULTS

This section presents the empirical findings derived from the structural equation modeling analysis, focusing on the relationships between design

Table 2. Descriptive statistics and inter-construct correlations

Variable	Mean	Standard deviation (SD)	Empathy	Creativity	Problem-Solving	Entrepreneurial Motivation	Resilience	Willingness to Innovate
Empathy	4.32	0.68	1.00	0.58	0.62	0.54	0.45	0.52
Creativity	3.98	0.72	0.58	1.00	0.59	0.48	0.39	0.50
Problem-Solving	4.10	0.69	0.62	0.59	1.00	0.51	0.49	0.55
Entrepreneurial Motivation	4.05	0.65	0.54	0.48	0.51	1.00	0.56	0.57
Resilience	4.00	0.66	0.45	0.39	0.49	0.56	1.00	0.58
Willingness to Innovate	4.20	0.70	0.52	0.50	0.55	0.57	0.58	1.00

Note: Means and standard deviations are based on observed scale scores. Inter-construct correlations correspond to latent variable correlations obtained from the CB-SEM measurement model. N = 385. All correlations are significant at $p < .001$.

thinking dimensions and entrepreneurial competencies. The results are interpreted in relation to the proposed hypotheses, emphasizing the magnitude and direction of the observed effects.

Table 2 presents the descriptive statistics and inter-construct correlations. The results show relatively high mean values across all constructs, indicating that respondents report strong levels of both design thinking capabilities and entrepreneurial competencies. The correlation matrix reveals consistent positive relationships among the variables, suggesting that the constructs are conceptually related while remaining empirically distinct.

In particular, the strong association between empathy and problem-solving indicates that individuals who better understand user perspectives also tend to demonstrate stronger analytical abilities when addressing complex challenges. This pattern highlights the integration of cognitive and socio-emotional dimensions within design thinking, reinforcing its role as a multidimensional capability in entrepreneurial contexts.

The results presented in Table 3 confirm the reliability and convergent validity of the measurement model. All constructs exceed the recommended thresholds for internal consistency and variance extraction, indicating that the measurement items adequately represent their respective latent variables. These findings support the robustness of the measurement model and provide a reliable foundation for the subsequent evaluation of the structural relationships.

Table 4 provides evidence of discriminant validity, as the square roots of the average variance extracted exceed the inter construct correlations for all pairs of constructs. This result indicates that each construct captures a unique dimension within the model, with no evidence of significant overlap. Consequently, the distinctiveness of the constructs supports the accuracy of the estimated relationships in the structural model.

Table 5. Model fit indices

Index	Observed value	Reference value
Goodness-of-Fit Index (GFI)	0.92	> 0.90
Comparative Fit Index (CFI)	0.94	> 0.90
Root Mean Square Error of Approximation (RMSEA)	0.06	< 0.08
Normed Fit Index (NFI)	0.91	> 0.90

Note: CFI = comparative fit index; GFI = goodness-of-fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

Table 5 presents the model fit indices, which fall within the recommended thresholds, supporting the proposed structural model (Hu & Bentler,

Table 3. Reliability and convergent validity

Construct	Cronbach's alpha	Composite reliability (CR)	Average Variance Extracted (AVE)
Empathy	0.84	0.86	0.60
Creativity	0.82	0.85	0.57
Problem-Solving	0.88	0.89	0.62
Entrepreneurial Motivation	0.86	0.88	0.59
Resilience	0.80	0.83	0.55
Willingness to Innovate	0.85	0.87	0.58

Note: α = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted.

Table 4. Discriminant validity

Construct	Empathy	Creativity	Problem-Solving	Entrepreneurial Motivation	Resilience	Willingness to Innovate
Empathy	0.77	0.58	0.62	0.54	0.45	0.52
Creativity	0.58	0.75	0.59	0.48	0.39	0.50
Problem-Solving	0.62	0.59	0.79	0.51	0.49	0.55
Entrepreneurial Motivation	0.54	0.48	0.51	0.77	0.56	0.57
Resilience	0.45	0.39	0.49	0.56	0.74	0.58
Willingness to Innovate	0.52	0.50	0.55	0.57	0.58	0.76

Note: Diagonal values are the square roots of AVE; off-diagonal values are inter-construct correlations (N = 385).

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Table 6. Structural coefficients

Relationship	Standardized Coefficient (β)	*p*-value	Interpretation
Empathy → Entrepreneurial Motivation	0.35	< .001	Significant
Empathy → Resilience	0.28	< .001	Significant
Problem-Solving → Willingness to Innovate	0.42	< .001	Significant
Creativity → Willingness to Innovate	0.33	< .001	Significant
Entrepreneurial Motivation → Willingness to Innovate	0.37	< .001	Significant

1999). These results indicate a satisfactory alignment between the theoretical framework and the observed data, confirming that the model provides a reliable representation of the relationships among the constructs.

All hypothesized relationships are positive and statistically significant ($p < .001$), providing support for H1 through H5. Among the examined paths, problem-solving exhibits the strongest effect on willingness to innovate, followed by entrepreneurial motivation and creativity. Empathy shows significant effects on both entrepreneurial motivation and resilience, highlighting its role in shaping both engagement and persistence in entrepreneurial contexts.

Overall, the findings indicate that the dimensions of design thinking contribute in a complementary manner to the development of entrepreneurial competencies. While creativity and motivation support the generation and pursuit of innovative ideas, problem-solving emerges as the most influential factor in translating these ideas into actionable outcomes. These results reinforce the multidimensional nature of design thinking and its relevance as a mechanism for strengthening innovation-oriented behavior in higher education contexts.

4. DISCUSSION

The findings indicate that design thinking operates as a competence-building mechanism in higher education by strengthening students' capacity to frame problems, generate alternative solutions, and persist under conditions of uncertainty. In the Peruvian context, these capabilities are particularly relevant given institutional constraints and limited entrepreneurial support structures, which increase the importance of analytical adaptability and experiential learning.

Compared with the studies by Belz and Binder (2017) and Arranz et al. (2019), the results reinforce the view that empathy and creativity serve as mechanisms that support entrepreneurial behavior by fostering resilience, motivation, and innovation intent.

Empathy appears to operate upstream by strengthening entrepreneurial motivation and resilience, suggesting that user-centered orientation reinforces both goal-directed engagement and persistence under uncertainty.

Empathy functions as the capability that energizes both motivation and endurance, consistent with the perspectives of Sarasvathy (2001), Tidd and Bessant (2020), and Von Hippel (2005). The strong correlation between empathy and problem-solving ($r = 0.62$, $p < .001$) suggests that the ability to understand users' perspectives enhances the analytical ability to identify and frame problems, which is a recognized antecedent of opportunity recognition and innovative behavior (Chatterjee et al., 2020; Cunneen et al., 2007). This interaction highlights a distinctive contribution of the present study: empathy is not only an emotional skill but also an input into cognitive processes that enable innovation.

Empathy emerges as a foundational capability that strengthens both entrepreneurial motivation and resilience among university students. The positive effect of empathy on motivation aligns with Cunneen et al. (2007), who argue that understanding user needs enhances value creation and increases individuals' willingness to engage in entrepreneurial initiatives. The significant association between empathy and resilience represents a relevant contribution of this study, as prior research has rarely examined this relationship directly. Belz and Binder (2017) emphasize that empathy facilitates sustainable entrepreneurship by fostering collaboration and long-term commit-

ment, while Assink (2006) cautions that a lack of empathic understanding can undermine innovative potential. The present findings extend this literature by demonstrating that user-oriented learning experiences reinforce not only motivational drivers but also the perseverance and adaptability required to sustain entrepreneurial action in uncertain environments.

Creativity plays a central role in shaping students' willingness to innovate, confirming its position as a core dimension of design thinking. The positive effect observed supports Chatterjee et al. (2020), who identify creativity as the engine of ideation and experimentation in human-centered innovation processes. This result is also consistent with Belz and Binder (2017), who argue that creativity enables the exploration of alternative solutions in sustainability-oriented entrepreneurship. At the organizational level, Gunday et al. (2011) found that creativity-driven innovation enhances competitiveness, and the present study extends this logic to higher education by showing that creative capacity stimulates innovation among students. However, the moderate magnitude of the coefficient suggests that creativity alone may not be sufficient to translate ideas into innovation outcomes without complementary institutional support, such as mentoring, incubation programs, and interdisciplinary collaboration, as highlighted by Audretsch and Belitski (2023).

Problem-solving demonstrates the strongest association with willingness to innovate, positioning it as the most immediate driver of entrepreneurial behavior among the competencies examined. This finding is consistent with Tidd and Bessant (2020), who identify analytical and diagnostic skills as central to innovation management. Von Hippel (2005) similarly emphasizes that problem-solving enables individuals to transform user insights into actionable solutions through experimentation. Evidence from emerging economies reinforces this interpretation; Heredia et al. (2019) show that problem-solving capabilities are critical for innovation in Chilean and Peruvian manufacturing sectors. The convergence of findings across educational and industrial contexts underscores the robustness of problem-solving as a universal mechanism that translates uncertainty into opportunity, explaining its dominant effect on students' willingness to innovate.

Entrepreneurial motivation significantly influences students' willingness to innovate, underscoring its role as a psychological driver of opportunity exploration. This finding aligns with Zahra and Nambisan (2012), who argue that motivation energizes innovation processes within entrepreneurial ecosystems, and with Sarasvathy (2001), who identifies motivation as a central component of effectual action. While motivation alone may not guarantee innovation outcomes, particularly in emerging economies with less mature support structures, the present results suggest that motivated individuals are more likely to engage in experimentation and risk-taking behaviors. This reinforces the view of Tether and Tajar (2008) that individual intent must be supported by institutional and policy mechanisms to fully materialize innovative potential.

The methodological validation of the model confirmed strong fit indices, consistent with the recommendations of Byrne (2016) for structural equation modeling. These methodological results converge with Benitez et al. (2020), who validated similar structural models in innovative research, and with recent SEM-based evidence from Latin America highlighting the role of organizational resources and model robustness in entrepreneurial survival (Alvarez-Salazar & Seclen-Luna, 2023). The discriminant validity observed aligns with Moroz and Hindle (2012), who emphasize the importance of delimiting conceptual constructs, and with Alvarez-Salazar and Seclen-Luna (2023), who highlight methodological clarity in entrepreneurship studies within Latin America. Thus, this study contributes not only empirically but also methodologically by validating a comprehensive model of design thinking and entrepreneurial competencies in a context where such analyses remain scarce.

This contribution is particularly important for Peru, where empirical evidence linking design thinking to entrepreneurial education is limited. The findings support the integration of design thinking into curricular frameworks, echoing Bazán Borja (2022), who argues that Peruvian innovation systems require stronger collaboration among universities, industry, and government. Markovic et al. (2021) note that open innovation strengthens sustainable ecosystems, while Acs et

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al. (2014) emphasize that national entrepreneurship systems depend on educational institutions that cultivate creative and resilient talent. The present study provides empirical support for these claims by showing how design thinking strengthens competencies that are strategic for innovation-driven development.

Several limitations must be considered. First, the cross-sectional design prevents causal inference. Second, the sample is limited to two private universities located in a single metropolitan area, which may restrict the generalizability of the findings. Future studies should employ longitudinal designs, expand the sample across regions, and compare CB-SEM with PLS-SEM to assess model stability. Furthermore, examining moderators such as digital transformation, innovation policy, or entrepreneurial ecosystem maturity would enrich the understanding of how design thinking influences entrepreneurial competencies. The arguments of Autio et al. (2014), Djellal et al. (2013), and Fagerberg et al. (2012) support the need to explore these contextual factors. Despite these limitations, the study offers a strong foundation for future research and provides evidence-based insights for improving entrepreneurship education in Latin America.

Overall, the results confirm that empathy, creativity, and problem-solving contribute in complementary ways to the development of entrepreneurial motivation, resilience, and willingness to innovate among university students in an emerging-economy context.

CONCLUSION

The purpose of this study was to examine the positive association between the dimensions of design thinking (empathy, creativity, and problem-solving) and entrepreneurial competencies among university students in Peru. The findings showed that these human-centered and analytical capabilities contribute in differentiated ways to the formation of motivation, resilience, and willingness to innovate, confirming the pedagogical relevance of design thinking in entrepreneurship education.

Based on the evidence obtained, several conclusions can be drawn. First, design thinking strengthens essential entrepreneurial skills by fostering adaptive behavior, perseverance, and the capacity to generate innovative responses in dynamic environments. Second, the interplay of empathy, creativity, and problem-solving demonstrates that entrepreneurial competence emerges not from isolated skills but from the integration of cognitive and socio-emotional processes. This highlights the value of experiential and user-oriented learning for students operating in emerging-economy contexts where uncertainty is pervasive.

The study also contributes theoretically by reinforcing design thinking as a framework that links human-centered insight with innovation-oriented action, expanding its applicability in educational settings. Practically, the results suggest that universities should adopt iterative and user-centered pedagogies, supported by mentoring, incubation, and collaborative initiatives that enrich institutional innovation ecosystems.

Future research could deepen these insights through longitudinal approaches, comparisons across disciplines and regions, or the inclusion of behavioral performance indicators to better capture how design thinking translates into observable entrepreneurial outcomes.

AUTHOR CONTRIBUTIONS

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USE OF ARTIFICIAL INTELLIGENCE

The authors used artificial intelligence tools (language models) exclusively to improve the clarity and fluency of the English writing. The authors confirm that the study design, data collection, data analysis, interpretation of results, and conclusions were produced by the authors. The authors take full responsibility for the content of the manuscript.

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APPENDIX A

Table A1. Measurement instrument

Items	1	2	3	4	5
Empathy (E)					
E1. I try to understand others' perspectives when solving problems.					
E2. I actively listen to teammates and users when discussing solutions.					
E3. I identify the needs of users before defining a problem.					
E4. I can relate to the experiences of the people affected by the issue.					
E5. I show sensitivity toward the feelings of others during teamwork.					
Creativity (C)					
C1. I often suggest original ideas during class or group projects.					
C2. I combine information from different fields to propose innovative ideas.					
C3. I adapt existing ideas to create new solutions.					
C4. I am comfortable experimenting with multiple approaches.					
C5. I enjoy generating new concepts to improve products or services.					
Problem-Solving (PS)					
PS1. I analyze several options before making a decision.					
PS2. I break complex problems into smaller, manageable parts.					
PS3. I identify the root cause of a problem before acting.					
PS4. I use data and evidence to support decisions.					
PS5. I evaluate consequences before implementing a solution.					
Entrepreneurial Motivation (M)					
M1. I am motivated to start my own entrepreneurial project.					
M2. I set clear goals to develop new ventures.					
M3. I feel inspired to create solutions that generate value for others.					
M4. I am willing to invest time and effort to achieve entrepreneurial success.					
Resilience (R)					
R1. I recover quickly from difficulties encountered in a project.					
R2. I stay positive when facing challenges or failure.					
R3. I continue working toward my goals despite obstacles.					
R4. I adapt effectively when unexpected changes arise.					
Willingness to Innovate (WI)					
WI1. I am willing to take risks to create something new.					
WI2. I am open to testing unproven ideas to improve outcomes.					
WI3. I actively search for new methods to enhance processes.					
WI4. I like to challenge traditional approaches to obtain better results.					

Note: All items were measured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The constructs correspond to the variables included in the structural model evaluated through CB-SEM.