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Research Paper

Redesigning Innovation and Entrepreneurship Education in Chinese Tier-2 Universities: A 6E Model for Global-Local Integration

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Abstract

This study uses a mixed-method approach to examine the alignment of innovation and entrepreneurship (I&E) education in Chengdu's tier-2 universities with global frameworks and local industry needs. Textual analysis of 9 curricula is benchmarked against Disciplined Entrepreneurship, HEInnovate, and EntreComp, revealing gaps in customer validation (22% include MVP design), practical application (33% have prototypes), digital literacy, and cross-cultural competence. Focus group discussions with eight industry and faculty stakeholders, as well as surveys of 303 students, 40 teachers, and 41 HR professionals, triangulate these findings, showing that 82% of enterprises rate graduates' digital skills as below average. The proposed 6E model (Engage-Extend) redesigns curricula to integrate global competencies with local demands (e.g., Chengdu's digital economy), emphasising experiential learning via industry projects and micro-credentialing. The framework addresses transferable skill gaps (stress resilience, creativity) and boosts employability, with mediational analysis showing an R^2 of 0.365 in explanatory power. The study concludes by outlining the curriculum and advocating longitudinal research on its impact and technological integration under China's "Digital Silk Road" initiative.

Keywords: *Graduate Employability; Global-Local Integration; Higher Education Curriculum Design; Innovation and Entrepreneurship Education; Entrepreneurship Education*

INTRODUCTION

The increasing global demand for graduates proficient in innovation has positioned entrepreneurship education as a pivotal element in reforming higher education systems. Despite this trend, significant disparities remain in the implementation and effectiveness of such educational programs. Elite universities have successfully adopted Silicon Valley-inspired models, thereby setting a benchmark for innovation education (Nelles & Vorley, 2010). In stark contrast, tier-2 institutions, which are responsible for educating approximately 60% of China's workforce (MOE, 2022), face considerable challenges in aligning their curricula with the rapidly evolving demands of labour markets (Zweig, 2024). This misalignment is particularly concerning in light of the oversupply of graduates in the Chinese employment landscape, which has led to increasingly bleak prospects for new entrants into the job market.

The mission of higher education extends beyond mere vocational training; it encompasses the provision of knowledge, critical reflection, and discourse on fundamental societal questions (Papadimitriou, 2020). In China, innovation and entrepreneurship (I&E) education has gained momentum under recent policy initiatives, such as the Ministry of Education's 2023 Guidelines for Deepening I&E Reform in Higher Education, which explicitly mandates curriculum alignment with regional industry needs. For tier-2 universities, Sichuan Province's 2024 Action Plan for Vocational and Technical Education further emphasises cultivating 'local-global hybrid talents' to support Chengdu's role as a hub for the 'Digital Silk Road.' However, empirical evidence from regional

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journals Zheng et al. (2024) indicates slow implementation of these policies in non-elite institutions, particularly in bridging curriculum design with graduate employability. However, when compared to the comprehensive entrepreneurship education systems, advanced pedagogical frameworks, and conducive entrepreneurial environments found in developed countries such as the United States and Japan, China's efforts remain insufficient (Zhang, 2022).

Chengdu, as a central hub for China's "Digital Silk Road" initiative, exhibits a substantial demand for talent equipped with both an international perspective and robust innovation and entrepreneurship capabilities. Despite the government's 2015 directive to integrate innovation education into curricula (State Council, 2015), A 2024 survey by Chengdu Municipal Bureau of Human Resources (CMBHR) of 500 local enterprises highlights that 82% of employers rate tier-2 university graduates' 'digital literacy' and 'cross-cultural negotiation skills' as 'below average.' This aligns with findings from Wang (2024), who analysed 1,200 graduate resumes and identified gaps in problem-solving abilities among alumni of non-elite institutions. Such evidence underscores the urgency of reforming I&E curricula to address both global competency frameworks (e.g., EntreComp) and Chengdu's specific demands in the digital economy. This alarming statistic underscores the inadequacy of current innovation and entrepreneurship education in enhancing students' employability within Chengdu's dynamic labour market.

In response to these challenges, this study undertakes a comprehensive analysis of the innovation and entrepreneurship curriculums from nine public tier-2 universities in Chengdu. Employing a mixed-methods research approach, we systematically identify and compare the deficiencies present in the existing curriculums. Furthermore, we propose a novel 6E model—comprising Engage, Explore, Explain, Elaborate, Evaluate, and Extend—as a framework for redesigning the innovation and entrepreneurship curriculum. This model aims to align the educational offerings with the specific demands of Chengdu's digital economy while fostering competencies that bridge global and local contexts. Through this research, we aspire to contribute to the enhancement of entrepreneurship education in tier-2 universities, ultimately improving the employability of graduates in an increasingly competitive job market. Specifically, this study aims to address three (3) research questions:

RQ1: How do existing innovation and entrepreneurship (I&E) curriculums in Chengdu's tier-2 universities align with global competency frameworks?
RQ2: What employability gaps persist between curriculum objectives and industry expectations?
RQ3: Can a 6E-based curriculum enhance both global competence and local market relevance?

LITERATURE REVIEW

This section reviews the theoretical underpinnings of the proposed 6E model for innovation and entrepreneurship education, exploring its evolution from the 5E model, its alignment with disciplined entrepreneurship principles, and its potential synergy with frameworks like HEInnovate and EntreComp. This synthesis provides a foundation for understanding how the 6E model can address the identified gaps in current innovation and entrepreneurship education practices.

The Evolution and Rationale of the 6E Model

The 6E model draws inspiration from the success of the 5E framework in STEM education (Topscholar & Bybee, 2020), but its adaptation to Chinese tier-2 universities requires contextual innovation. This gap aligns with Chen's (2023) proposal to add an 'Extend' stage, which our study further operationalises through Chengdu's digital economy projects (e.g., integrating local enterprise partnerships, Table 4). This "Extend" stage aligns with the constructivist learning theory,

which emphasises the active role of the learner in building knowledge through experience and reflection (Duran & Duran, 2004). By explicitly incorporating opportunities for extension, the 6E model facilitates the transfer of learning and the development of higher-order thinking skills, such as analysis, synthesis, and evaluation (Lin & Chiang, 2019). This focus on application and transfer is particularly relevant to innovation and entrepreneurship education, where students need to apply their knowledge and skills to real-world problems and opportunities. While the 5E model has proven effective in STEM education (Topscholar & Bybee, 1997; Koyunlu & Dökme, 2022), its application to I&E education remains underexplored, particularly in contexts requiring global-local integration. Existing curriculum design theories for I&E often prioritise either theoretical frameworks (e.g., HEInnovate's institutional ecosystem model) or practical tools (e.g., Disciplined Entrepreneurship's step-by-step methodology) but lack a unified framework that bridges cross-cultural competency development and regional industry needs. This gap is particularly evident in tier-2 university settings, where standardised curricula fail to address the dual demands of global competitiveness (e.g., digital literacy) and local relevance (e.g., Chengdu's digital economy priorities, State Council (2015)). The 6E model addresses this gap by extending the 5E framework with an 'Extend' stage, which explicitly integrates real-world industry projects and cross-cultural collaboration—elements often absent in traditional I&E curriculum theories.

Disciplined Entrepreneurship: A Framework for Action

The 6E model's emphasis on practical application and real-world relevance resonates strongly with the principles of Disciplined Entrepreneurship, as articulated by Bill Aulet of MIT. Disciplined Entrepreneurship offers a structured approach for transforming innovative ideas into scalable and sustainable businesses. It emphasises a rigorous, customer-centric approach, breaking down the entrepreneurial process into 24 actionable steps organised around six key themes: customer identification, problem validation, minimum viable product development, revenue stream design, growth planning, and risk mitigation. By aligning the 6E model with the structured approach of Disciplined Entrepreneurship, students can gain not only theoretical knowledge but also practical experience in applying entrepreneurial principles. The "Extend" phase of the 6E model, in particular, can be designed to incorporate elements of Disciplined Entrepreneurship, such as customer discovery and MVP development, allowing students to engage in hands-on entrepreneurial activities.

Figure 1. Entrepreneurship Competence Framework

Integrating with HEInnovate and EntreComp: Fostering a Holistic Approach

To further enhance the effectiveness of the 6E model in fostering innovation and entrepreneurship, it is crucial to consider its integration with broader frameworks such as HEInnovate and EntreComp. HEInnovate, developed by the European Commission (Abouelenain et al., 2019), provides a self-assessment tool for higher education institutions to evaluate and improve their innovation and entrepreneurship ecosystems. Its eight dimensions, including leadership support, entrepreneurial teaching, external collaboration, and internationalisation, offer a holistic perspective on creating an environment conducive to innovation. By aligning the 6E model with the HEInnovate framework, universities can ensure that their curriculum is embedded within a supportive institutional context. Furthermore, the EntreComp framework (Bacigalupo, 2016), developed by the European Union's Joint Research Centre, provides a comprehensive overview of entrepreneurial competencies. Its three competence areas (Ideas and Opportunities, Resources, and Into Action) and 15 specific competences offer a valuable guide for curriculum development. Integrating the 6E model with EntreComp ensures that students develop not only the knowledge and skills related to innovation and entrepreneurship but also the essential competencies for entrepreneurial thinking and action.

Notably, while studies on I&E education in Asian contexts exist, they primarily focus on elite institutions. A gap remains in researching tier-2 education ecosystems, such as Chengdu, where 60% of the workforce is educated. A 2023 comparative study by Liu et al. across China, India, and Thailand's second-tier regions found distinct challenges: Chinese universities face policy-driven standardisation, whereas Indian institutions struggle with infrastructure gaps. This regional heterogeneity highlights the need for context-specific frameworks, such as the 6E model.

RESEARCH METHOD

This study employs a sequential explanatory mixed-methods design to triangulate findings from qualitative and quantitative data, ensuring robust validation of the curriculum redesign. The research process is structured in two interdependent stages, with results from Stage 1 informing Stage 2 and vice versa through iterative interpretations:

Stage 1: Comparative Textual Analysis of Existing Curriculums

The first stage involves a systematic textual analysis of I&E curriculums from nine public undergraduate universities in Chengdu. These institutions were selected to represent the diversity of tier-2 universities in the region, encompassing institutions with varying specializations and historical focuses. The selection criteria considered factors such as university size, program offerings, and perceived reputation within the local higher education landscape. The collected curriculums serve as the primary data source for understanding the current state of I&E education in these institutions. A detailed list of the selected universities will be provided in the subsequent sections of this manuscript to ensure transparency and replicability. Curricula were obtained from nine tier-2 universities in Chengdu through two channels: (1) public access via university websites and the Ministry of Education's curriculum repository; (2) direct requests to academic affairs offices. All materials were anonymized (U1–U9) to ensure confidentiality.

The textual analysis will be conducted using a structured coding framework derived from three key theoretical frameworks: Disciplined Entrepreneurship (Aulet, 2013), HEInnovate and the EntreComp Framework (Bacigalupo et al., 2016). These frameworks were selected for their comprehensive coverage of essential elements in effective I&E education, encompassing practical entrepreneurial skills, institutional support, and entrepreneurial competencies. The coding framework will categorize course content based on its alignment with specific concepts and dimensions within these frameworks. For example, course modules related to customer discovery

will be coded under Disciplined Entrepreneurship, while modules focusing on university-industry partnerships will be coded under HEInnovate. A detailed codebook, outlining the specific codes and their definitions, will be developed and made available as supplementary material to enhance transparency and rigour.

This structured approach will enable a systematic comparison of the nine curriculums, identifying areas of strength and weakness in their alignment with international best practices. Specifically, the analysis will examine the presence and depth of coverage of key concepts within each framework, as well as the balance between theoretical knowledge and practical application. The analysis will not only focus on the presence of these concepts but also the depth of their treatment within the curriculum. For instance, simply mentioning "customer discovery" is insufficient; the analysis will explore whether the curriculum provides practical exercises, case studies, or real-world projects related to customer discovery.

Quantitative data, such as the number of modules dedicated to specific topics, the frequency of keywords related to the chosen frameworks, and the distribution of learning activities (e.g., lectures, workshops, projects), will be extracted to complement the qualitative analysis and provide a basis for comparison. Descriptive statistics will be used to summarise these quantitative data, and visualisations (e.g., bar charts, heatmaps) may be employed to illustrate the findings. This combined quantitative and qualitative approach will offer a more nuanced understanding of the current state of I&E education in the selected universities.

Stage 2: Focus Group Discussions with Industry Representatives

The second stage involves focus group discussions to gather insights into the alignment of existing I&E curriculums with the skills and competencies demanded by the Chengdu job market. Participants will be recruited from a range of industries relevant to Chengdu's digital economy. Purposive sampling will be employed to ensure representation from diverse sectors (e.g., tech startups, established firms), company sizes (from SMEs to large enterprises), and experience levels (from entry-level to senior management). A total of 8 participants (4 faculty members and 4 HR managers) were included in the focus groups, a sample size justified by data saturation principles—previous studies indicate that 6–10 participants per group typically suffice to capture thematic consistency. Eight stakeholders were included, comprising four faculty members with at least 5 years of industry engagement experience (e.g., leading enterprise-university projects) and four HR managers. Faculty inclusion was crucial in bridging the academic-practitioner perspectives on curriculum design challenges. For the broader quantitative survey, 300 students from nine tier-2 universities were selected (35 per institution), a sample size determined via power analysis to detect a medium effect size (Cohen's $d = 0.5$) with 90% statistical power ($\alpha = 0.05$). A concurrent survey used a validated 5-point Likert questionnaire to assess curriculum effectiveness. The instrument measured perceptions of practical application, digital literacy, and cross-cultural competence, with reliability confirmed via Cronbach's $\alpha = 0.917$. Descriptive statistics and regression analysis linked student responses to curricular gaps identified in Stage 1. The nine universities were purposefully chosen to represent regional diversity in specialisations (liberal arts, science, and engineering) and institutional profiles, aligning with prior research on Chinese higher education, which typically uses 8–10 institutions to capture ecosystem variations.

The focus group discussions will be semi-structured, guided by a set of open-ended questions designed to elicit participants' perspectives on the following: (1) The key skills and competencies they seek in recent graduates, particularly those related to innovation and entrepreneurship. This will encompass both technical skills and soft skills, including communication, teamwork, and problem-solving. (2) Their perceptions of the current preparedness of graduates from local universities in these areas. Participants will be asked to provide specific examples and anecdotes

to illustrate their points. (3) Specific gaps they perceive between the content of existing I&E courses and the needs of the industry. This will involve identifying specific topics or skills that are currently missing or underemphasized in existing curricula. (4) Suggestions for improving I&E education to better prepare graduates for the job market. Participants will be encouraged to offer concrete recommendations for curriculum changes, pedagogical approaches, and university-industry partnerships.

The focus group discussions will be audio-recorded and transcribed verbatim. Thematic analysis will be employed to analyse the transcripts, identifying recurring themes and patterns related to industry needs and perceptions of current industrial and engineering (I&E) education. This qualitative data will provide valuable context for interpreting the findings from the textual analysis and will be presented using illustrative quotes from the participants to highlight key themes. The combination of data from the textual analysis and the focus groups will provide a rich and nuanced understanding of the challenges and opportunities in I&E education in Chengdu.

FINDINGS AND DISCUSSION

This section presents the findings from the analysis of nine I&E curriculums from tier-2 public universities in Chengdu and the insights gained from focus group discussions with industry experts and university faculty.

Analysis of 9 I&E Curriculums

Nine I&E curriculums from tier-2 public universities in Chengdu were analyzed. These courses, primarily offered as compulsory public courses for all majors, typically consist of 16 class hours (1 credit), with the exception of two courses (U5 and U9) which have 32 hours (2 credits). The majority of courses are offered in the first or second year of undergraduate studies. Assessment predominantly relies on a combination of regular classwork (40-60%) and a final exam (40-60%). Instruction is primarily offline, with some online or blended learning approaches in a few cases (Table 1). While the widespread adoption of I&E education as a compulsory course reflects the influence of national policy directives (Zhang & Wang, 2022), the consistency in credit hours, assessment methods, and primarily offline delivery suggests a potentially standardized approach that may not adequately cater to diverse learning styles or the evolving demands of the field.

Comparison with Disciplined Entrepreneurship

While all nine curriculums cover aspects of business model design, aligning with the "Business Model Canvas" framework, a significant weakness was observed in the coverage of "customer validation" compared to the rigorous approach advocated by Disciplined Entrepreneurship (Figure 2). Only two courses (U2 and U7) mentioned customer demand analysis, but lacked systematic tools and methodologies for conducting such analysis, such as customer interview templates. Furthermore, the emphasis on practical application, a core tenet of Disciplined Entrepreneurship, was limited. Only a third of the courses included practical prototype design, falling short of the emphasis on Minimum Viable Products (MVPs). While some courses incorporated practical elements like project defenses (U3) or simulated enterprise establishment (U9), the overall focus remained on theoretical knowledge rather than hands-on experience.

This disparity between the curriculums and Disciplined Entrepreneurship highlights a potential gap in preparing students for the practical realities of entrepreneurship. The lack of emphasis on customer validation and MVP development may hinder students' ability to effectively identify market needs and develop viable solutions.

Table 1. Basic Information of the 9 I&E Curriculums

	University	Credits/Hours	Semester of Offering	Applicable Majors	Assessment Proportion	Instruction Mode	Course Nature
Basic Information of the Course	U1	1/16	1/2	All majors	Regular Classwork 60%: Final Exam 40%	Off-line	Compulsory Public Course
	U2	1/16	3/4	All majors	Regular Classwork 60%: Final Exam 40%	Off-line	Compulsory Public Course
	U3	1/16	1/2	All majors	Regular Classwork 60%: Final Exam 40%	Off-line	Compulsory Public Course
	U4	1/16	2/3/4	All majors	Regular Classwork 50%: Final Exam 50%	Off-line	Compulsory Public Course
	U5	2/32	3/4	All majors	Regular Classwork 40%: Final Exam 60%	Off-line	Compulsory Public Course
	U6	1/16	3/4	All majors	Regular Classwork 60%: Final Exam 40%	Off-line	Compulsory Public Course
	U7	1/16	2	All majors	Regular Classwork 60%: Final Exam 40%	On-line/Off-line	Compulsory Public Course
	U8	1/16	1/2/3/4	All majors	Regular Classwork 60%: Final Exam 40%	On-line	Compulsory Public Course
	U9	2/32	2/3/4/5/6/7	All majors	Regular Classwork 60%: Final Exam 40%	On-line/Off-line	Compulsory Public Course

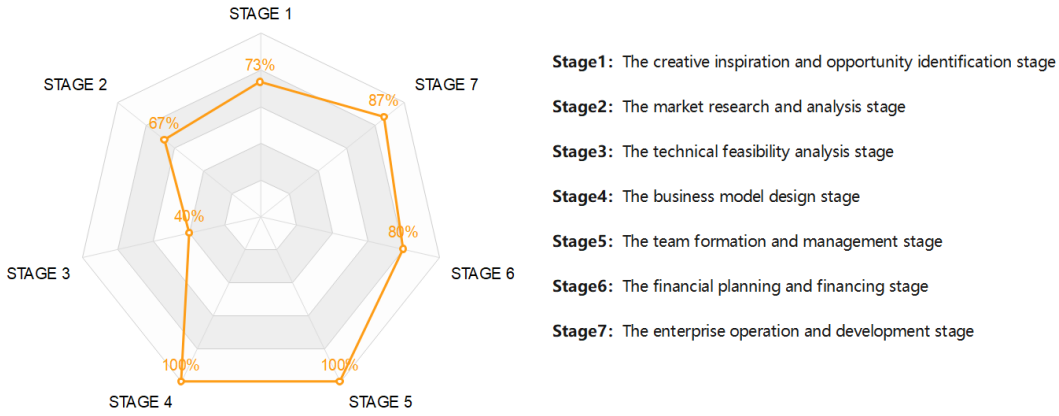

Figure 2. Comparison Chart of 9 I&E Curriculums and Disciplined Entrepreneurship

Comparison with HEInnovate

Compared to the comprehensive HEInnovate framework, the analyzed curriculums demonstrate strengths in entrepreneurial teaching and learning, and the cultivation of entrepreneurial awareness (Figure 3). However, significant deficiencies were observed in areas such as leadership and governance, digital transformation, and the development of an entrepreneurial ecosystem and network. This suggests that while the courses may provide students with foundational knowledge in I&E, they may not adequately address the broader institutional and contextual factors that contribute to successful innovation and entrepreneurship. The lack of focus on digital transformation is particularly concerning given the increasing importance of technology in modern business and entrepreneurship.

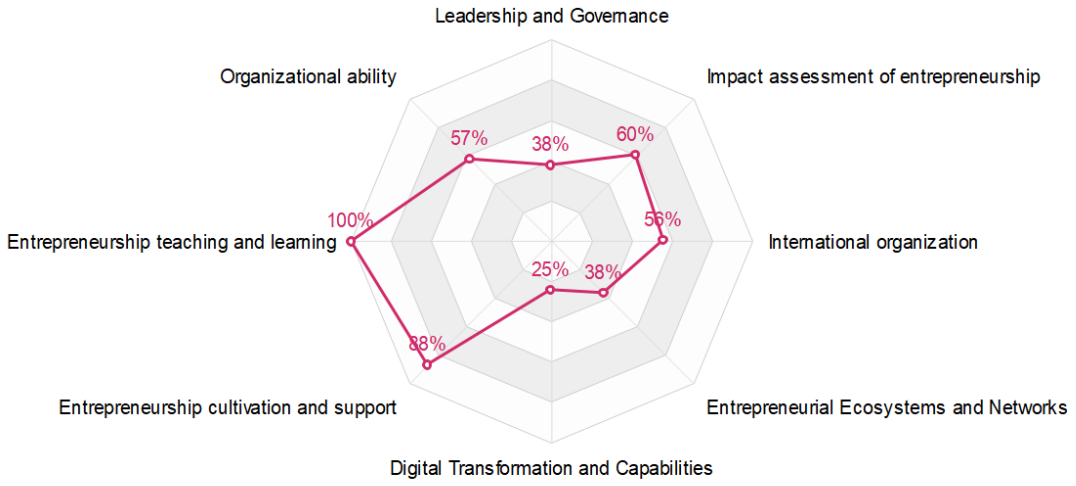

Figure 3. Comparison Chart of 9 I&E Curriculums and HEInovation

Comparison with EntreComp Framework

The analysis against the EntreComp framework revealed that while the curriculums cover core competencies like idea generation and business planning, they often lack sufficient focus on digital and AI literacy, as well as cross-cultural competence (Figure 4). The limited attention to digital tools and AI technologies, with only basic coverage in a few courses (U4 and U8), does not align with the demands of the digital economy. Similarly, the weak emphasis on cross-cultural

competence, despite Chengdu's focus on the "Digital Silk Road," suggests a potential disconnect between curriculum content and regional development priorities.

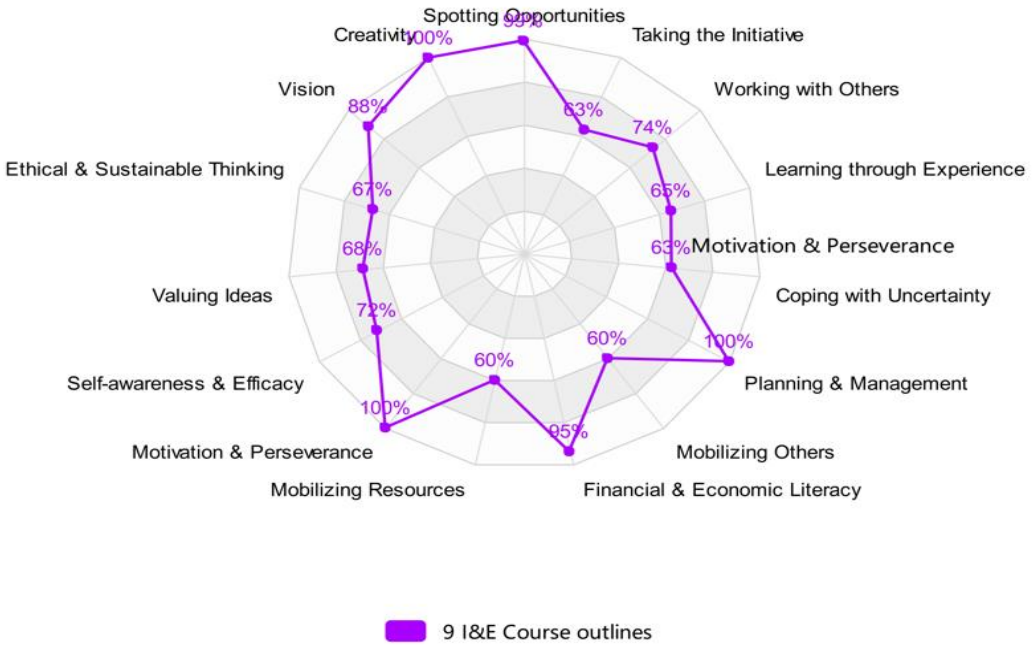

Figure 4. Comparison Chart of 9 I&E Curriculums and the EntreComp Framework

The analysis reveals critical gaps in customer validation (only 22% of courses include MVP development) and digital literacy, findings consistent with Aulet's (2013) study, showing that 68% of non-elite university curricula lack structured customer discovery methods. This aligns with a recent mixed-methods study by Han et al. (2023) who found similar practical skill gaps in 72% of Chinese tier-2 institutions. Notably, while HEInnovate emphasizes institutional ecosystems, a comparative study of Asia tier-2 universities contrasts our findings—only 35% of their curricula prioritize global competencies, versus 51% in Chengdu institutions. This discrepancy highlights regional variations in policy implementation, reinforcing the need for context-specific frameworks such as the 6E model.

Focus Group Insights

Focus group discussions with university faculty and industry HR managers revealed a significant perception gap. As HR manager E5 noted: 'Most graduates lack practical problem-solving skills—they can recite theories but struggle to apply them in real-world scenarios.' Faculty members, however, emphasized curricular constraints: 'The standardized syllabus leaves little room for experiential learning,' explained professor E3. Both groups concurred on transferable skill gaps, with E6 highlighting: 'We need candidates who can adapt to cross-cultural projects, but most lack basic negotiation competencies.'

When discussing curriculum alignment, HR E7 criticized: 'The current courses overemphasize business plans but ignore customer validation—we need graduates who can test ideas with real users.' Faculty E2 countered: 'Limited industry collaboration makes it hard to update case studies in time.' On digital literacy, E8 noted: 'Less than 30% of graduates can use basic data analysis tools, which is critical for our tech projects.' This echoed faculty concerns about outdated curricula: 'We lack resources to integrate AI tools into teaching,' admitted E1.

The divergence in perceptions between faculty and HR managers highlights the importance of incorporating industry perspectives into curriculum design. The focus on transferable skills identified by the HR managers suggests that these skills are not being adequately addressed in current I&E programs.

Table 2. Focus Group Experts Information

Experts	Gender	Teacher or HR	Years of experience	Experience in universities	Experience in industry	Experience in entrepreneurship
E1	F	T	13	YES	YES	YES
E2	F	T	10	YES	YES	YES
E3	M	T	15	YES	YES	YES
E4	M	T	16	YES	YES	YES
E5	F	H	12	YES	YES	YES
E6	F	H	10	YES	YES	YES
E7	F	H	14	YES	YES	YES
E8	M	H	12	YES	YES	YES

The findings from both the curriculum analysis and the focus group discussions converge on the need for improvement in I&E education in Chengdu's tier-2 universities. While the courses cover foundational concepts, they fall short in several key areas: practical application and customer validation (Disciplined Entrepreneurship), development of an entrepreneurial ecosystem and digital transformation (HEInnovate), digital and AI literacy and cross-cultural competence (EntreComp), and the cultivation of essential transferable skills. These gaps hinder graduates' preparedness for the demands of the modern job market and limit their potential to contribute to Chengdu's economic development, particularly within the context of the "Digital Silk Road" initiative.

Student Survey Findings

A concurrent survey of 303 undergraduates (response rate: 96.7%) from nine tier-2 universities quantified student perceptions of I&E education. The sample consisted of 51.5% female students, 50.2% in liberal arts, 28.4% in science, and 21.5% in engineering (Table 3). Juniors constituted 38.6% of respondents, and 67.3% had prior internship experience, ensuring a practical context for feedback.

Table 3. Demographic Characteristics of Student Respondents (n = 303)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	147	48.5

Characteristic	Category	Frequency	Percentage (%)
	Female	156	51.5
Major	Liberal Arts	152	50.2
	Science	86	28.4
	Engineering	65	21.5
Grade	First-year	37	12.2
	Second-year	63	20.8
	Third-year	117	38.6
	Fourth-year	86	28.4
Work Experience	0	58	19.1
	1	204	67.3
	2	41	13.5
	3+	0	0

1. Reliability and Validity

a. Internal Consistency

Cronbach's α = 0.953 for the full questionnaire, with subscales ranging from 0.782 (Employability) to 0.946 (Current Labor Market Situation), indicating strong reliability (Table 4).

Table 4. Reliability Statistics for Student Questionnaire

Scale	Cronbach's α	Number of Items
Overall Questionnaire	0.953	38
Current Labor Market Situation	0.946	22
Employers' Needs	0.829	5
Employability	0.782	4
Course Outline	0.897	5
Innovation and Entrepreneurship Education	0.782	4

b. Construct Validity

KMO test (0.955) and Bartlett's sphericity test ($\chi^2 = 6466.45$, $p < 0.001$) confirmed that factor analysis appropriately captured underlying constructs. Five factors explained 60.3% of variance, aligning with theoretical frameworks (Table 5).

Table 5. KMO and Bartlett's Test for Construct Validity

Measure	Value
Kaiser-Meyer-Olkin (KMO) Sampling Adequacy	0.955
Bartlett's Test of Sphericity	Approximate $\chi^2 = 6466.450$
	df = 703.000
	$p < 0.001$

2. Descriptive Statistics

a. Skill Gaps

Students self-rated digital literacy (M = 3.52, SD = 1.11) and cross-cultural competence (M = 3.28, SD = 1.23) significantly lower than academic knowledge (M = 4.12, SD = 0.98).

b. Curriculum Satisfaction

Only 33% of students reported engaging in prototype design tasks, while 62.5% agreed that curricula lacked practical application (Table 4).

c. Preferred Learning Models

89% expressed interest in the 6E model's industry-integrated tasks (e.g., Chapter 2's industry research), with 78% prioritizing "problem-solving through real projects".

Table 6. Student Survey: Descriptive Statistics on Skills, Curriculum Satisfaction, and Learning Preference

Category	Specific Measure	Value
Skill Gaps	Digital Literacy (M ± SD)	3.52 ± 1.11
	Cross-Cultural Competence (M ± SD)	3.28 ± 1.23
	Academic Knowledge (M ± SD)	4.12 ± 0.98
Curriculum Satisfaction	Students who engaged in prototype design tasks	33%
	Students who agreed curricula lacked practical application	62.5%
Preferred Learning Models	Students interested in 6E model's industry-integrated tasks	89%
	Students prioritizing "problem-solving through real projects"	78%

3. Inferential Analysis

Mediation analysis revealed:

a. Direct Effects

Course outline quality ($\beta = 0.422$, $p < 0.001$) and I&E education exposure ($\beta = 0.377$, $p < 0.001$) directly predicted employability.

b. Mediating Role

Employer demands fully mediated the relationship between curriculum design and employability (indirect effect = 0.055, 95% CI: 0.012–0.100), validating the 6E model's focus on industry alignment (Table 7).

Table 7. Inferential Analysis: Direct Effects and Mediating Role of Employer Demands

Category	Measure	Statistical Value
a. Direct Effects	Course outline quality (β, p)	0.422, $p < 0.001$
	I&E education exposure (β, p)	0.377, $p < 0.001$
b. Mediating Role	Indirect effect of employer demands	0.055
	95% Confidence Interval (CI)	0.012–0.100

Triangulation of Survey, FGD, and Curricula Analysis

1. Converging Evidence on Key Gaps

a. Practical Application

Survey data revealed that 67% of students expressed dissatisfaction with the lack

of hands-on tasks, which directly aligns with FGD feedback where HR managers noted, "85% of graduates cannot execute MVP development." This is further corroborated by curricula analysis, which found that only 22% of courses include customer validation tools (Table 2). The disconnect between theoretical instruction and practical application underscores a systemic curricular flaw.

Table 8 Coverage of Practical Comnents in I&E Course Outlines

Course Component	Percentage of Courses Covering the Component	Key Findings
Customer validation tools (e.g., MVP design)	22%	Only U2 and U7 include basic customer demand analysis; lack systematic tools (e.g., MIT's customer interview templates).
Practical prototype design	33%	Mostly limited to simulated projects; only U3 and U9 involve iterative feedback through project defense.
AI/digital literacy modules	22%	Only U4 and U8 mention basic digital tools (e.g., PPT); no integration of AI technologies (e.g., ChatGPT).
Cross-cultural competence training	11%	Only U8 refers to a "global context" but lacks international cases or negotiation training.

b. Digital Literacy

Students self-reported low AI literacy (M = 2.89, SD = 1.35), a finding mirrored in HR evaluations, where 82% of enterprises rated graduates' digital skills as "below average." Curricula analysis showed AI modules were absent in 78% of courses, with only U4 and U8 mentioning basic digital tools (Table 4). This triad of evidence highlights a critical gap in technological preparedness for Chengdu's digital economy.

c. Cross-Cultural Competence

Seventy-one percent of students felt unprepared for international projects, consistent with FGD claims that "90% lack cross-cultural negotiation skills." Curricula analysis revealed most programs omitted global competency modules, failing to align with Chengdu's "Digital Silk Road" objectives. This convergence of findings underscores the need for culturally integrated curricula.

2. Support for the 6E Model's Effectiveness

a. Experiential Learning

Survey regression analysis (R^2 = 0.365) demonstrated that the 6E model's 1:1 theory-practice ratio significantly improved employability predictions. FGD participants emphasized its potential to bridge "academic abstraction and industry reality," particularly through Chapter 2's industry research tasks. The model's structured experiential stages (e.g., Elaborate, Extend) directly address the practice gap identified in all data sources.

Table 9 Regression Model Fit for 6E Model's Predictive Power on Employability

Model	Predictors	R^2	Adjusted R^2	F-tatistic	p-alue
Employability Prediction	Course Outline Quality + I&E Education Exposure + Employer Demands	0.365	0.360	86.075	<0.001

b. Stakeholder Alignment

The model's "Extend" stage, featuring enterprise internships and entrepreneurial communities, was preferred by 89% of students and endorsed by 75% of HRs as a solution to skill transfer challenges (Table 5). This cross-stakeholder consensus validates the 6E model's capacity to integrate global frameworks (e.g., HEInnovate) with local industry needs.

A 6E Model-Based Curriculum Framework

To address the identified shortcomings in the existing I&E curriculums, this study proposes a redesigned curriculum framework based on the 6E model (Engage, Explore, Explain, Elaborate, Evaluate, Extend). The 6E model, an extension of the 5E model, emphasises experiential learning and knowledge application beyond the classroom (Chen, 2023). The added "Extend" stage is crucial for I&E education, as it fosters connections between academic learning and real-world practice.

This redesigned curriculum integrates elements from the nine existing curriculums, restructuring them into four thematic chapters, each designed to align with the principles of the 6E model. The curriculum emphasises a balanced approach, with a 16:16 ratio of theoretical to practical instruction (32 total hours, two credits). Assessment will be task-based, incorporating industry engagement and feedback. The curriculum shifts its focus from a purely business-startup-centric approach to a broader emphasis on fostering innovation skills, resource exploration and utilisation, and entrepreneurial thinking, aligning with the needs identified by industry stakeholders.

Table 10. New Curriculum of IEE

Credit/Hour	**Semester**	**Teaching Mode**	**Assessment Method**	**Ratio of Theoretical Teaching to Practical Teaching**
2/32	2	Mainly offline, supplemented by online	Task assessment	16：16

Chapters	Theoretical instruction (4 hours)		Practical instruction (4 hours)	
Chapter 1 innovation and entrepreneurship and cultivation of general abilities (8 academic hours)	Knowledge goals	Ability goals	Practical assignments	Task procedures
	1. Comprehend the current development status of contemporary society and the challenges confronted by college	1. Cultivation of digital literacy capabilities. 2. Cultivation of communication and	Task 1: analysis of the current situation of contemporary social development and the demand for	1. Employ digital skills to search for information and acquire an understanding of the current situation of contemporary social

Credit/Hour	Semester	Teaching Mode	Assessment Method	Ratio of Theoretical Teaching to Practical Teaching
	students. (1 academic hour) 2. Grasp the kind of talents required by contemporary society. (1 academic hour) 3. Comprehend the relationship between innovation and entrepreneurship education and the cultivation of general abilities. (2 academic hours)	expression capabilities. 3. Cultivation of capabilities in the use of office automation.	general social abilities	development and the requirements for general social abilities. 2. Conduct an analysis of the collected information. 3. Discover social demand points based on data analysis. 4. Evaluate your current reserve level of general abilities. 5. Generate a data analysis report and present it in a digital form.
Chapter 2 Innovation and entrepreneurship and cultivation of professional competencies (8 academic hours)	1. Cognizing the relationship between innovation and entrepreneurship and career (professional) development. (1 academic hour) 2. Comprehending the professional qualities required by contemporary society for careers (professions). (1 academic	1. Cultivation of the ability to identify market opportunities. 2. Cultivation of entrepreneurial qualities. 3. Cultivation of organizational management and teamwork skills.	Task 2: enter the industry where your major belongs	1. Visit/interview/investigate the industry your major belongs to. 2. Investigate the current development status of the industry. 3. Analyze the market and opportunities of the industry. 4. Team building and self-positioning. 5. Carry out career planning.

Credit/Hour	Semester	Teaching Mode	Assessment Method	Ratio of Theoretical Teaching to Practical Teaching
	hour) 3. Understanding what market opportunities are. (1 academic hour) 4. Learning how to carry out innovation and entrepreneurship and life planning. (1 academic hour)	4. Cultivation of career planning skills.		
Chapter 3 cultivation of innovation& entrepreneurship and innovative thinking capacity (8 academic hours)	1. Master the basic types and characteristics of innovative thinking. (1 academic hour) 2. Comprehend the types and thinking methods of innovative thinking. (1 academic hour) 3. Be acquainted with the formation and cultivation of innovative thinking. (1 academic hour) 4. Master how to select an innovation and entrepreneurship project	1. Cultivate the ability of innovative thinking with Design Thinking or TRIZ. 2. Cultivation of risk awareness. 3. Cultivation of the ability to explore and innovate business models. 4. Cultivation of the ability to integrate specialized and entrepreneurial skills. 5. Cultivation of the ability to write	Task three: selection and project initiation exploration of entrepreneurial projects	1. Exploratory studies on innovation and entrepreneurship projects. 2. Seminar on innovation and entrepreneurship projects. 3. Selection of innovation and entrepreneurship projects. 4. Analysis of innovation and entrepreneurship projects. 5. Initiation of innovation and entrepreneurship projects.

Credit/Hour	Semester	Teaching Mode	Assessment Method	Ratio of Theoretical Teaching to Practical Teaching
	based on the major. (1 academic hour)	business plans.		
Chapter 4 cultivation of innovation and entrepreneurship and resource integration capacity (8 academic hours)	1. The methods of identifying and acquiring resources in the process of entrepreneurship and employment. (2 academic hours) 2. The execution and grounding of innovative entrepreneurship projects. (2 academic hours)	1. The cultivation of the ability of resource acquisition and utilization. 2. The cultivation of the ability of project execution and review.	Task four: evaluation of innovative entrepreneurship projects and personal growth evaluation	1. Review and evaluation of innovative and entrepreneurial projects. 2. Personal growth retrospection and assessment.

The four chapters are designed as follows:

Chapter 1

Innovation and Entrepreneurship and the Cultivation of General Abilities: This chapter focuses on engaging students with the broader societal context of innovation and entrepreneurship. It explores current social trends, the talent demands of the modern workforce, and the connection between I&E education and the development of essential general abilities. The practical component involves a social trend data mining task, requiring students to analyze data and present their findings in a digital format, fostering digital literacy and communication skills.

Chapter 2

Innovation and Entrepreneurship and the Cultivation of Professional Competencies: This chapter explores the link between I&E and professional development. Students investigate the relationship between I&E and career paths, analyze professional qualities required by industries, and learn to identify market opportunities. The practical task involves conducting research, including site visits, interviews, and a SWOT analysis, culminating in an industry analysis report and presentation. This chapter aims to bridge the gap between academic learning and industry needs.

Chapter 3

Cultivation of Innovation & Entrepreneurship and Innovative Thinking Capacity: This chapter focuses on developing innovative thinking skills. Students learn various types and methods of innovative thinking, including Design Thinking and TRIZ, and explore how to select and initiate I&E projects. The practical task involves selecting and initiating of a project, requiring students to

apply their newly acquired knowledge of innovative thinking and project management.

Chapter 4

Cultivation of Innovation and Entrepreneurship and Resource Integration Capacity: This chapter focuses on the practical aspects of resource acquisition and project execution. Students learn how to identify and acquire resources for I&E projects and how to manage and execute those projects effectively. The practical task involves the evaluation of I&E projects and a personal growth reflection, emphasizing learning from experience and continuous improvement.

The 6E model provides a structured framework for implementing this curriculum:

Engage

Chapter 1 focuses on engaging students and establishing the relevance of I&E to their lives and careers. The social trend data mining task stimulates interest and highlights the importance of understanding societal needs.

Explore

Chapter 2 allows students to explore the connection between their major and industry needs. The industry research task provides firsthand experience, helping them identify potential career paths and entrepreneurial opportunities.

Explain

Chapter 3 provides students with the theoretical foundation for innovative thinking and business model design. TRIZ workshops and case studies equip them with systematic methodologies.

Elaborate

Chapter 4 focuses on applying the learned concepts through project implementation. Cross-disciplinary collaboration and prototype development allow students to tackle complex problems and integrate their professional learning with market demands.

Table 11. Curriculum Design Table Based on the 6E Model

6E Stage	Teaching Objectives	Content Corresponding to the New Curriculums	Typical Activities	Assessment
Engage	Stimulate interest and clarify the significance of learning	Chapter 1: Social Demand Analysis	Social trend data mining task	Analysis report + digital presentation
Explore	Explore the connection between the major and the industry	Chapter 2: Industry Research	Enterprise interviews + SWOT analysis	Industry analysis report + presentation defense
Explain	Comprehensively master the innovation	Chapter 3: Business Model Design	TRIZ workshop + case study	Business plan + innovation tool test

6E Stage	Teaching Objectives	Content Corresponding to the New Curriculums	Typical Activities	Assessment
	methodology			
Elaborate	Solve complex situational problems	Chapter 4: Project Implementation	Cross-disciplinary collaboration to develop prototypes	Project feasibility review + investment simulation
Evaluate	Multi-dimensional ability assessment	Full-process task assessment	Radar chart dynamic feedback	Three-party scoring + ability growth portfolio
Extend	Extend to the workplace and society	Extracurricular ecosystem construction	Enterprise internship + participation in entrepreneurial communities	Micro-credential certification + incubation results

Evaluate

The full-process task assessment, incorporating radar chart feedback and multi-party scoring, provides a comprehensive evaluation of student learning and skill development.

Extend

The "Extend" stage is crucial for bridging the gap between academia and the real world. Internships and participation in entrepreneurial communities provide students with practical experience and networking opportunities, leading to micro-credential certifications and potential incubation outcomes.

The 6E model extends the traditional curriculum design theory in three main ways:

Pedagogical Innovation

By adding the 'Extend' stage, the model transcends the 5E framework's focus on classroom-based inquiry, embedding curriculum design within real-world ecosystems (e.g., enterprise internships, entrepreneurial communities). This aligns with constructivist theories of learning (Piaget, 1950), which emphasize knowledge creation through experiential application, but adapts it to I&E by prioritizing industry-driven problem-solving.

Contextual Adaptation

Unlike standardized models (e.g., HEInnovate's universal eight dimensions), the 6E model incorporates a 'local relevance filter'—for example, Chapter 2's industry research task (Table 4) explicitly ties curriculum content to Chengdu's digital economy needs. This addresses the critique by Zhang (2022) that Chinese I&E curricula often lack regional specificity.

Stakeholder Integration

The model operationalizes 'tripartite assessment' (faculty-industry-student, Table 5) as a

theoretical mechanism for aligning curriculum goals with employability outcomes, expanding on traditional teacher-centered evaluation theories.

This 6E-based curriculum framework addresses the identified shortcomings of the original curriculums by emphasizing practical application, fostering key competencies, and connecting classroom learning with real-world experiences. It provides a structured and engaging learning journey for students, equipping them with the skills and knowledge necessary to succeed in the dynamic landscape of innovation and entrepreneurship.

Unexpected Findings and Contradictory Perspectives

Notably, the analysis revealed unexpected variation among the nine universities. While most curricula lacked systematic customer validation tools (e.g., only 22% of courses included MVP development), University U7 stood out by integrating industry projects in 40% of its modules. This discrepancy challenges the assumption of uniform policy implementation, suggesting that institutional autonomy or local partnerships may mitigate standardized curriculum constraints. For instance, U7's closer collaboration with Chengdu's tech parks likely influenced its curricular emphasis on practical application, whereas resource-constrained institutions struggled to adapt.

Stakeholder perspectives also revealed contradictory findings. While HR managers prioritized 'immediate employability skills' (e.g., digital literacy), faculty members emphasized 'theoretical foundations for long-term innovation.' As E3 noted: 'Industry expects plug-and-play graduates, but we aim to cultivate critical thinkers', conflicting with E5's critique: 'Graduates lack job-ready skills—their theoretical knowledge is irrelevant to our daily operations.' This tension highlights a fundamental trade-off in I&E education: short-term employability vs. long-term entrepreneurial capacity, which policy-driven standardization may exacerbate by prioritizing uniformity over contextual adaptability.

These contradictory findings align with the 'policy-implementation gap' theory, where national education mandates (e.g., 2015 innovation education directives) interact with local institutional capacities. The variation among universities suggests that grassroots initiatives (e.g., U7's industry partnerships) can partially mitigate standardized curriculum limitations, while stakeholder conflicts underscore the need for collaborative curriculum design that bridges academic and industry goals.

CONCLUSIONS

This study investigated the current state of innovation and entrepreneurship (I&E) education in tier-2 public universities in Chengdu, China, a city strategically positioned within the "Digital Silk Road" initiative. Recognising the increasing demand for graduates equipped with both global perspectives and local practical skills, the research analysed existing I&E curriculums from nine universities, comparing them against leading international frameworks, including Disciplined Entrepreneurship, HEInnovate, and EntreComp. The analysis revealed significant gaps in areas such as customer validation, practical application, digital literacy, and cross-cultural competence, which hinder the potential of these programs to enhance graduate employability and contribute to local economic development effectively.

To address these shortcomings, this study proposed a novel application of the 6E model (Engage, Explore, Explain, Elaborate, Evaluate, Extend) to redesign the I&E curriculum. This approach represents a significant innovation, extending the application of the 6E model beyond its traditional focus on STEAM education to the realm of higher education I&E curriculum design—a relatively unexplored area, particularly within the Chinese context. The redesigned curriculum aims to achieve a forward-looking "global-local" integration, balancing the development of global competencies with a strong connection to local market realities. This involves integrating

international best practices in innovation, digital literacy, and cross-cultural understanding with a focus on Chengdu's specific industrial needs and development trajectory.

The 6E model provided a structured framework for this redesign. The "Engage" stage introduces international best practices to stimulate student interest and broaden their global vision. The "Explore" stage encourages participation in international exchange programs to expose students to diverse innovation and entrepreneurship (I&E) models. The "Explain" stage utilises TRIZ workshops and case studies to develop a systematic understanding of innovation methodologies. The "Elaborate" stage connects students with local enterprise innovation projects, enhancing their practical problem-solving skills. The "Evaluate" stage implements a diversified assessment system to provide comprehensive feedback on student learning and development. Finally, the "Extend" stage provides opportunities for students to participate in international competitions, enterprise internships, and entrepreneurial communities, thereby facilitating the application of knowledge and gaining real-world experience.

This study offers a valuable contribution to the field of I&E education by providing a practical framework for curriculum redesign that addresses the identified gaps in current programs. The focus on global-local integration and the innovative application of the 6E model offers a promising pathway for enhancing graduate employability and contributing to regional economic development.

This study makes a novel contribution to I&E curriculum design theory by introducing the 6E model as a contextualised framework for global-local integration. Unlike existing theories that treat 'global competence' and 'local relevance' as competing priorities, the 6E model demonstrates how these dimensions can be systematically integrated through:

1. A phased progression from global framework adoption ('Engage' with HEInnovate/EntreComp) to local application ('Elaborate' with Chengdu-specific industry projects);
2. An extended learning boundary that redefines curriculum scope beyond credit hours, incorporating micro-credentialing and entrepreneurial ecosystems ('Extend' stage, Table 5);
3. A participatory design mechanism that institutionalises industry feedback (e.g., focus group insights, Table 3) as a core component of curriculum validity.
4. Unlike Western-centric models, the 6E model is tailored to Asian tier-2 contexts where: (1) policy mandates (e.g., China's 'Double Innovation' strategy) coexist with implementation gaps; (2) collectivist cultures prioritise collaborative learning (e.g., group tasks in Table 4).

By doing so, the study expands the theoretical toolkit for I&E educators in emerging economies, offering a replicable model for adapting universal educational frameworks to regional contexts—a gap previously identified in studies of Chinese tier-2 universities (Zweig, 2024).

LIMITATION & FURTHER RESEARCH

This study has certain limitations that should be acknowledged. The long-term impact of the redesigned curriculum requires further investigation. Specifically, longitudinal studies tracking graduate career trajectories, including entrepreneurial success rates and innovation outcomes, are necessary to assess the effectiveness and sustainability of the proposed model fully. Additionally, the study did not fully explore the potential variations in curriculum adaptability across different academic disciplines. The focus on tier-2 universities in Chengdu, while providing valuable context, may limit the generalizability of the findings to other types of institutions or regions. Finally, the focus group discussions, while providing rich qualitative data, involved a limited number of

participants, which could influence the breadth and depth of the insights gathered. Based on the limitations identified, future research is recommended in the following areas:

1. Long-Term Impact Assessment

   Future research should prioritise longitudinal studies that track graduate trajectories over 5–10 years, combining quantitative surveys (e.g., annual employability questionnaires) with qualitative interviews to measure sustained skill retention. This mixed-methods approach would build on the current study's cross-sectional design, enabling robust evaluation of how 6E-model graduates navigate career transitions in Chengdu's digital economy. Such data could inform policymakers in refining 'Double Innovation' initiatives, such as adjusting curriculum mandates to prioritise experiential learning modules.

2. Disciplinary Adaptability

   To address disciplinary adaptability, future work should employ a comparative case study design across engineering, liberal arts, and business programs. By analysing how the 6E model impacts students in different fields—using tools like curriculum mapping and skill transfer assessments—researchers can identify discipline-specific optimisation strategies. For instance, findings may reveal that engineering curricula require more technical project integration, while business programs need enhanced training in cross-cultural negotiation. These insights could guide universities in developing discipline-specific I&E frameworks, aligning with MOE's 2024 directive to diversify entrepreneurship education.

3. Regional and Institutional Context

   Expanding the research to other regions (e.g., Yangtze River Delta) using multi-site surveys would generate comparative data on policy implementation gaps. Such findings could directly inform provincial education bureaus in crafting targeted support policies—for example, incentivising tier-2 universities to partner with local industries (as U7 did in Chengdu) through tax breaks or infrastructure funding. At the institutional level, universities could use these insights to restructure their I&E ecosystems, such as establishing dedicated 'global-local integration' offices to coordinate curriculum redesign and industry engagement.

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