

Co-Evolving Design Entrepreneurship: An AI Agent for New Venture Creation

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Abstract

Hong Kong requires its design graduates to combine creative problem-solving with entrepreneurial thinking to drive innovation. Traditional design education often lacks practical guidance on entrepreneurship, creating a significant challenge for students starting new ventures. This ongoing project addresses this gap by developing a conversational AI agent (chatbot) that integrates expert entrepreneurs' cognitive patterns with design theory. The AI agent's effectiveness will be rigorously tested via a three-arm randomised controlled trial comparing a control group, a standard foundational AI agent, and the expertise-enhanced AI agent. The anticipated outcome is a scalable pedagogical tool that significantly improves the quality of design students' decisions in venture creation, thereby supporting Hong Kong's innovation economy.

Keywords: Design Cognition, Effectual Entrepreneurship, Conversational AI, Pedagogy, Venture Creation

1. Introduction

To build an innovative economy, Hong Kong needs graduates who can successfully merge creative design with entrepreneurial action. A critical challenge is the disconnect between traditional design education, which emphasises creative problem-solving, and the adaptive, resource-based thinking required to create new ventures. While classical design cognition provides powerful accounts of creative problem-solving through mechanisms such as problem-solution co-evolution (Dorst & Cross, 2001), it often underspecifies the situational factors—such as finance and labour—that are central to entrepreneurial practice. Conversely, entrepreneurship research offers robust models for action under uncertainty, such as effectuation (Sarasvathy, 2022), but pays limited attention to the creative process of designing new products.

This paper details an ongoing research project that aims to bridge this theoretical-practical gap by integrating designerly and entrepreneurial thinking into a unified framework. The project's ultimate contribution to higher education is the development and validation of an expertise-enhanced conversational

AI agent. This tool is intended to provide design students with just-in-time, customised guidance for new venture creation, effectively scaling the cognitive expertise of successful entrepreneurs (Christensen et al., 2023).

Our goal is to answer the question: *Does a conversational AI agent trained on expert entrepreneurial transcripts improve design students' ability to create new ventures?* This project represents a pedagogical innovation with the potential to transform entrepreneurship education from mentor-dependent, resource-intensive teaching to scalable, AI-mediated cognitive scaffolding that maintains the richness of expert guidance while enabling personalised learning at scale.

2. Methodology

The project employs a three-phase methodology that progresses from theory development to empirical evidence and, finally, to technological application.

2.1. Theory Development and Operationalisation

First, we have developed a theoretical framework that integrates design cognition, specifically problem-solution co-evolution (Dorst & Cross, 2001), with effectual entrepreneurship (Sarasvathy, 2022; Sarasvathy & Venkataraman, 2021). This framework explains how entrepreneurs actively reshape the business context by leveraging resources, reframing problems, and committing to ventures despite uncertainty. The theory will be operationalised into a rigorous coding manual that translates theoretical concepts into observable behaviours for analysis.

2.2. Comparative Cognitive Study

Second, the main study will compare the cognitive and decision-making patterns of 20 expert entrepreneurs and 20 experienced designers. This sample size is consistent with established standards in think-aloud protocol research (Cross, 2023). A concurrent think-aloud protocol will be used, in which participants verbalise their thoughts while solving standardised, realistic venture-creation scenarios. Audio recordings will be transcribed and anonymised, with two independent coders annotating the transcripts using the developed coding manual. MANOVA will identify significant quantitative differences between the groups' cognitive patterns. The outcome will be a high-quality dataset of annotated transcripts and validated cognitive profiles that differentiate entrepreneurial thinking.

2.3. AI Agent Development and Testing

Third, the cognitive insights from the comparative study will be used to build and test the AI agent. The conversational AI agent will be built on a state-of-the-art foundation model and will use Retrieval-Augmented Generation (RAG). The annotated expert transcripts will form a domain corpus, embedding expert reasoning patterns into a vector store, allowing the agent to supplement its responses with contextualised retrievals of specialist thinking.

The agent will be evaluated through a three-arm randomised controlled trial involving 120 design students (40 per condition), stratified by prior experience:

- (a) **Control:** Participants use worksheets and standardised guidelines;
- (b) **Baseline:** Participants interact with a standard foundational AI agent;
- (c) **Treatment:** Participants interact with the expertise-enhanced AI agent.

The primary outcome measure is a Decision Quality Score (DQS), determined by an expert panel rating written responses to entrepreneurial scenarios on a 7-point scale using standardised rubrics. Crucially, the trial includes a dedicated transfer phase designed to assess authentic learning.

2.4. Transfer Phase: Design and Rationale

A fundamental methodological concern in AI-assisted learning research is distinguishing genuine cognitive development from performance gains attributable solely to the availability of tools. To address this, the RCT incorporates a transfer phase in which all participants complete novel entrepreneurial scenarios without any AI assistance. This phase occurs after the main intervention period and presents participants with scenarios that are structurally similar but contextually distinct from training materials.

Authentic learning will be evidenced by Treatment group participants maintaining significantly higher DQS scores during this unassisted phase compared to the Control and Baseline groups. Such maintenance would indicate that expert cognitive patterns have been internalised rather than merely accessed. Conversely, if the treatment group scores decline to Baseline levels during transfer, this would suggest the AI functioned primarily as a performance scaffold rather than a learning tool. The transfer scenarios are calibrated to require the same decision-making competencies as the training scenarios—resource identification, adaptive problem framing, and stakeholder negotiation—thereby enabling a direct comparison between assisted and unassisted performance.

3. Anticipated Results and Discussion

As this is an ongoing study, the following discusses hypothesised findings and their anticipated implications. The project hypothesises that the expertise-enhanced AI agent (Treatment) will significantly outperform both the Control and Baseline conditions. ANCOVA will compare post-test DQS scores across the three arms, controlling for baseline performance. Key pairwise contrasts will test the utility of general AI (Baseline vs. Control), the value of expert knowledge integration (Treatment vs. Baseline), and overall system effectiveness (Treatment vs. Control).

We anticipate that the cognitive study will support H1 (Expert entrepreneurs prefer adaptive approaches consistent with effectual logic) and H2 (Expert entrepreneurs prefer resource-based approaches over goal-driven planning), aligning with established effectuation theory (Sarasvathy, 2022). The subsequent AI trial is expected to show measurable gains in DQS for the Treatment group. Specifically, we hypothesise that expert experiential knowledge can be successfully codified and integrated into a conversational AI agent, and that AI-assisted learning informed by expert cognitive patterns will significantly enhance student performance beyond what is achieved with a generic AI tool or no tool.

Most critically, we anticipate that performance improvements will be maintained during the unassisted transfer phase. This finding would provide evidence of authentic skill transfer and internalisation of expert reasoning patterns, rather than mere dependence on the system during use.

4. Pedagogical Implications

Should the anticipated results be confirmed, this study will offer significant implications for educational practice and curriculum design within higher education.

Regarding curriculum transformation, the validated AI agent could be integrated into design entrepreneurship courses as a scalable mentorship supplement. Rather than replacing human instruction, the tool would provide students with 24/7 access to guidance informed by expert cognitive patterns, enabling instructors to focus classroom time on higher-order collaborative activities while the AI handles individualised concept reinforcement.

For teaching practice, the methodology demonstrates how tacit expert knowledge can be systematically captured, annotated, and embedded into pedagogical tools. This RAG-based approach offers a replicable blueprint for other disciplines seeking to scale expertise-informed instruction and address the per-

sistent challenge of providing high-quality mentorship in resource-constrained environments.

In assessment design, the transfer phase methodology provides educators with a rigorous approach to evaluating whether AI-assisted learning leads to genuine competency development. This distinction is essential for responsible AI integration, ensuring that educational technologies enhance rather than substitute for authentic cognitive growth.

For the broader adoption of expert-informed GenAI tools in higher education, demonstrated effectiveness would support institutional investment in domain-specific AI development rather than reliance on generic tools. The project's open science commitment—making anonymised datasets, the theoretical framework, and coding manual publicly available through the Design Thinking Research Symposium community—would facilitate international replication and adaptation.

Finally, by equipping Hong Kong's design students with more effective entrepreneurial thinking skills, the project directly supports the innovation economy (Sarasvathy & Venkataraman, 2021), thereby enhancing graduate employability and venture-creation capacity.

Ethical Declaration Statement

The PolyU Institutional Review Board has approved the ethics application related to this project. All procedures will adhere to strict ethical standards, including informed consent, anonymisation, and secure data storage. The transfer phase design prevents AI dependency by measuring unassisted performance; the expert corpus will be audited for bias, and all participants will receive access to the enhanced agent after the study.

Generative AI Policy

The author used Gemini 3 and Claude Opus 4.5 during the preparation of this work to assist in rephrasing sentences for clarity and adherence to formatting guidelines. After utilising the tool, the author thoroughly reviewed and edited the content and assumed full responsibility for the publication's content.

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