



# AI as a Metacognitive Scaffold: Enhancing Entrepreneurial Learning Pathways

**Marcos Balmaceda**

KU Leuven

*Joint work with:*

**Thomas Åstebro**

HEC Paris

**Bruno Crépon**

ENSAE-CREST

**Mathis Schulte**

HEC Paris

**Andrew Funck**

HEC Paris

**Mona Mensmann**

University of Cologne

**Naja Pape**

INSEAD

# The Scale-Quality Tradeoff in Entrepreneurship Training

## Traditional Training

**Quality:** Skills training works

- Personal initiative: **+30%** profits vs. business practices: +11% (n.s.) (Campos et al., 2017)
- Negotiation: **+4 p.p.** enrollment (Ashraf et al., 2020)

**Scale:** Doesn't scale

- Small profit gains don't justify training costs for policy (McKenzie, 2021)

## Online Training

**Scale:** Reaches many

- Low cost, accessible

**Quality:** Poor learning

- **<10%** MOOC completion (Claflin et al., 2021)
- Low knowledge gains despite incentives for increased study time (Asanov et al., 2023)

**Could AI Bridge the Gap?** Bastani et al. (2025)

- Standard ChatGPT: **↑ with AI, ↓ without** → dependency
- AI with guardrails: **↑↑ with AI, no harm without**

⇒ **However:** Guardrails need teacher-designed, problem-specific hints  
*Learning when taken away? Skills transfer? Flexibility across contexts?*

# Our Approach: SRL-Based AI Coaching

## Our Innovation

### SRL-based AI coaching for:

- No (human) teacher supervision
  - Heterogeneous skills/knowledge levels
  - Self-directed learning
- Flexible to context & population
- Generalizable framework

## Framework

### SRL Three-Phase Cyclical Model

Zimmerman et al. (2000)

1. **Forethought:** Planning & goal-setting
2. **Performance:** Monitoring & strategies
3. **Reflection:** Evaluation & adaptation

→ Applicable to AI Coaching (Jin et al., 2023)

## Research Questions

**RQ1:** Can an SRL-based chatbot foster entrepreneurial skills that *persist after AI removal?*

**RQ2:** Does this reduce learning inequality for those with lower initial skills?

# Setting & Experimental Design

## Partnership & Population

### France Travail

National employment agency

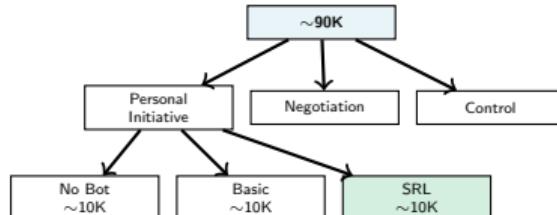
- **460,000** eligible
- **~90,000** expected
- 12-18m follow-up

## Courses

- ▶ **Personal Initiative** (e.g. Campos et al., 2017)
- ▶ **Negotiation Skills** (e.g. Ashraf et al., 2020)

Both: mental models, not practices

## Stratified Cross-Randomization



## Three Conditions

**Control:** No chatbot  
Standard content only

### Basic: Reactive Assistant

User: "Explain personal initiative?"

Bot: "It involves self-starting..."

- Responds when asked (no answers to tests) - Minimal guardrails
- Explains concepts, summarizes, etc.

### SRL: Proactive Coach

Bot: "What learning habits will you use for session 2?  
(e.g., will you spend more time on it, take notes  
differently, summarize contents, or try to avoid  
distractions?)"

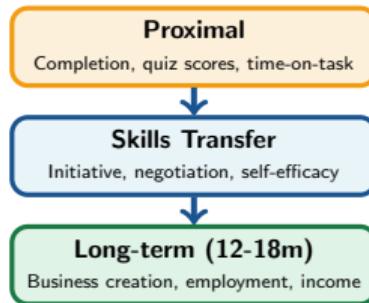
User: "Explain anchoring?"

Bot: "What have you tried? Let's work through it."

- Prompts metacognition
- Coaches process

# Outcomes & Mechanism

## Outcome Measures

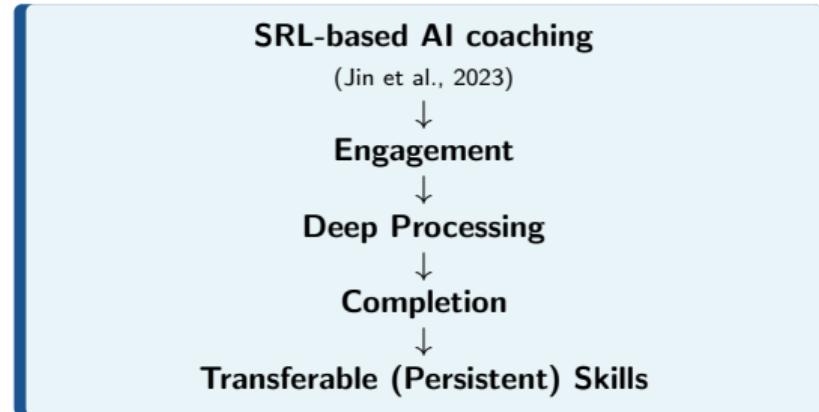


## Methods

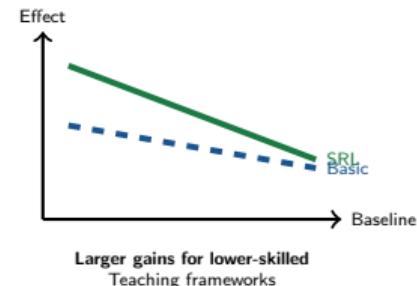
- ▶ Factorial ANCOVA
- ▶ Causal forests for heterogeneity

**Critical Test:** Effects persist after AI removal?

## Mechanism



## Expected Heterogeneity



# What We Learn & What We Need From You

## Three Contributions

### 1. Mechanism

Is SRL-based AI coaching a solution for unsupervised learners?  
First insights to context

### 2. Scale

Can we reach (potentially) millions with quality?  
Cost-effective training

### 3. Equity

Does AI reduce skill/knowledge gaps?  
Design for democratization

Pilot: November 1, 2025  
Full launch: Early 2026

## Questions for You

### 1. Baseline Measures

Ideas for exploring heterogeneity?

### 2. External Validity

Generalizability concerns?

### 3. Outcomes

Beyond our list?

## Contact

[marcos.balmaceda@kuleuven.be](mailto:marcos.balmaceda@kuleuven.be)

*Your feedback is invaluable*