

Expertise at the Intersection: How Teams Develop Cross-Domain Expertise in Transdisciplinary Capstone Projects

USC Iovine and Young Academy

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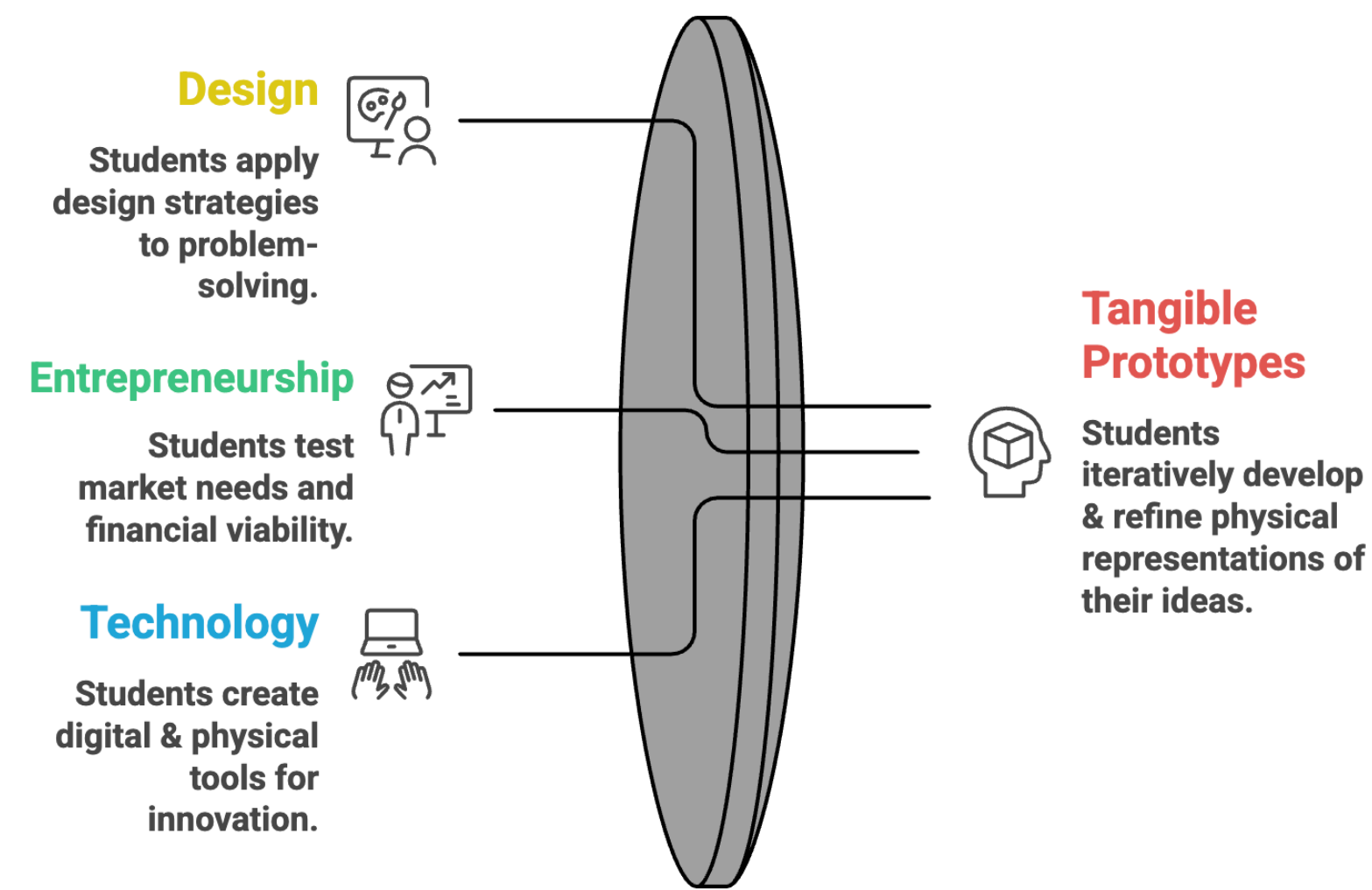
Introduction

Complex problems increasingly span multiple domains. More integrated learning approaches are essential to foster innovation across boundaries.

This study examines how students develop expertise across **design, technology, and entrepreneurship** within a transdisciplinary capstone, adopting **Challenge-Based Reflective Learning (CBRL)**.

Findings reveal two collaborative patterns among teams: 1) *coordinated*, role-based expertise refinement, and 2) *fluid* expansion & redistribution of expertise.

Transdisciplinary innovation at IYA:

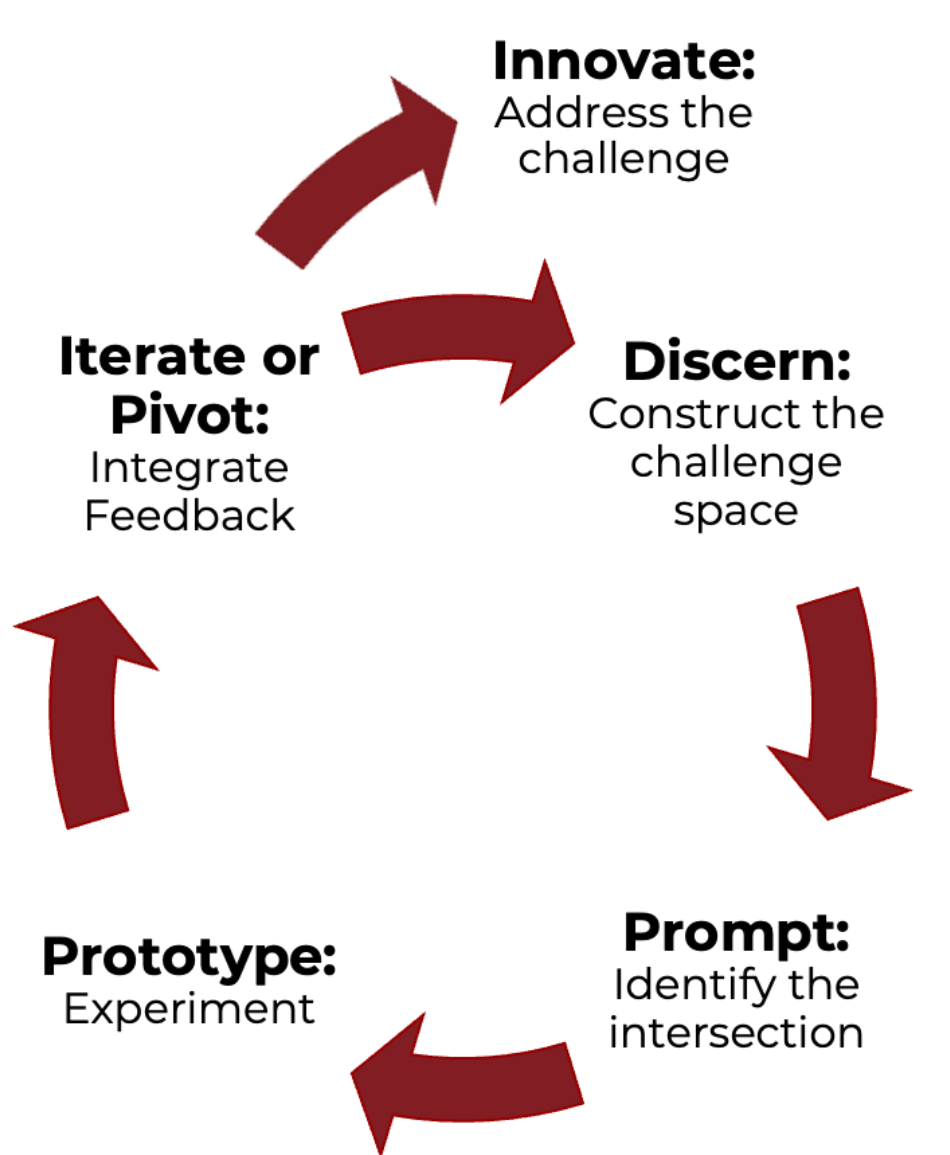
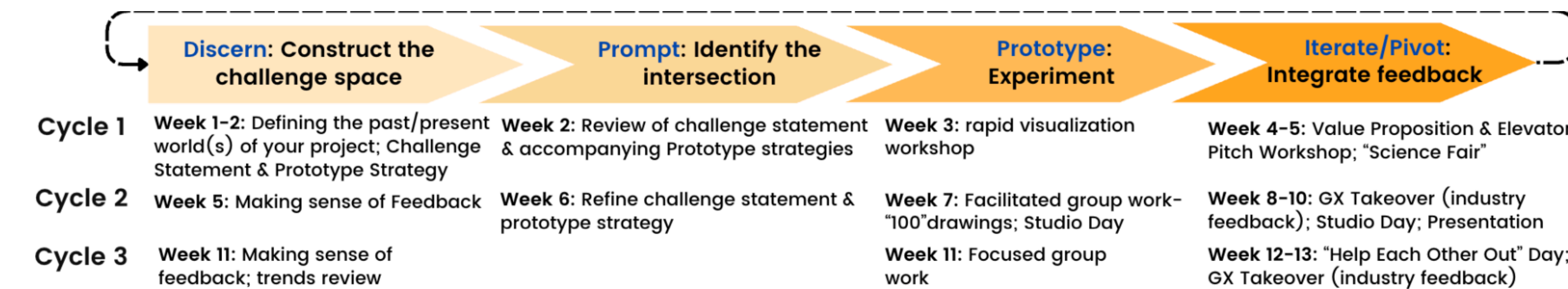


CBRL enables students to practice skills across design, business, and technology to define & transform ideas into tangible prototypes. It is done through iterative real-world challenges to develop solutions.

The Challenge-Based Reflective Learning (CBRL) Cycle

The Garage Experience Capstone Structure (1st Semester, 4th yr):

GX emphasizes action-oriented learning: beyond client or classroom deliverables, students launch ventures, test MVPs, and implement real-world initiatives through iterative experimentation and reflective practice.



Methodology:

- Field-based case study methodology, 1st semester of senior *Garage Experience* (n=34, 11 teams) capstone
- Surveys, interviews, observations, & workshop artifacts to examine cross-domain collaboration & expertise development
- Highlights two teams (Team 1, n=4; Team 2, n=5) from pre/post surveys, interviews, & artifacts

Study Highlights:

- Survey measured students' perceived expertise on: 1) project topic, 2) technology, 3) business/entrepreneurship, and 4) design
- Team 1 (physical product, smart thermometer) and Team 2 (digital service, AI-driven sentiment analysis) strategized strengths and **addressed expertise gaps in different ways**
- Team 1, with clearer role distribution, emphasized cross-functional coordination to maintain high engineering expertise while **incrementally exploring new knowledge** in design and digital marketing. Modest gains in Business & Design
- Team 2, with shared design expertise, **redistributed roles** and sought to build technical capacity across members. Made **broader project pivots** into adjacent business domains. Higher gains in Tech & Business

GX Project Examples

Physical Products

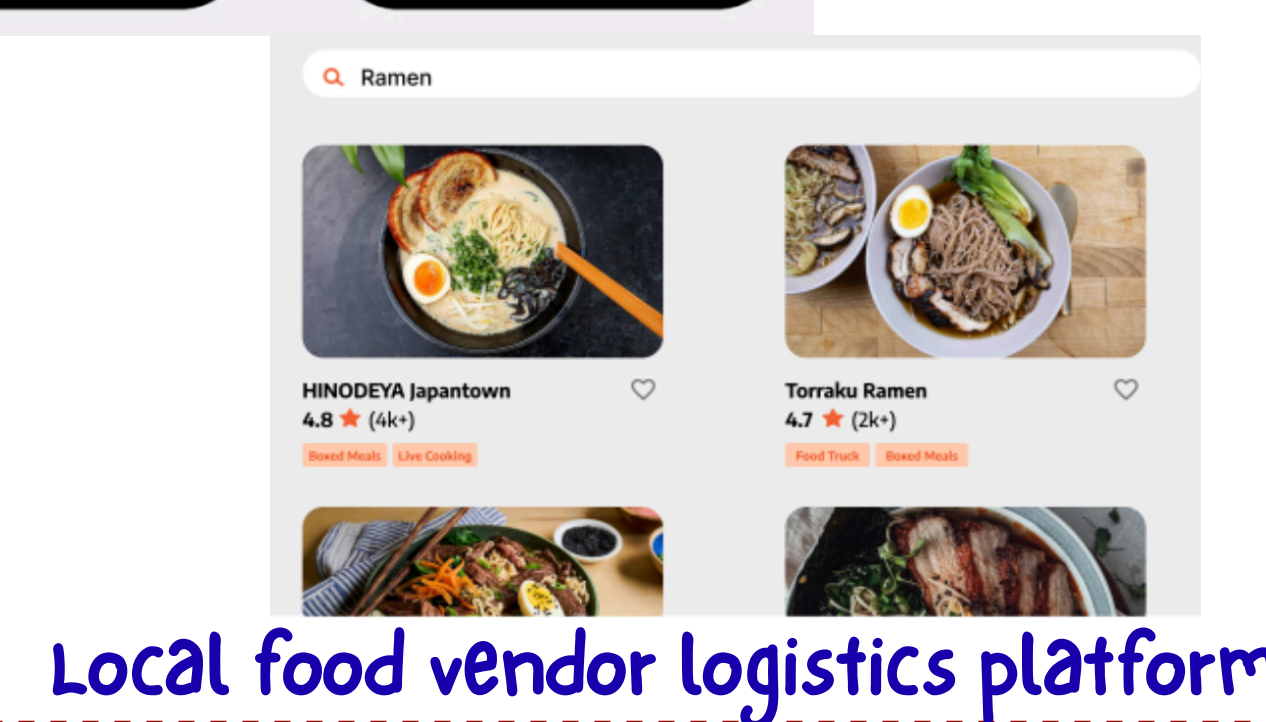
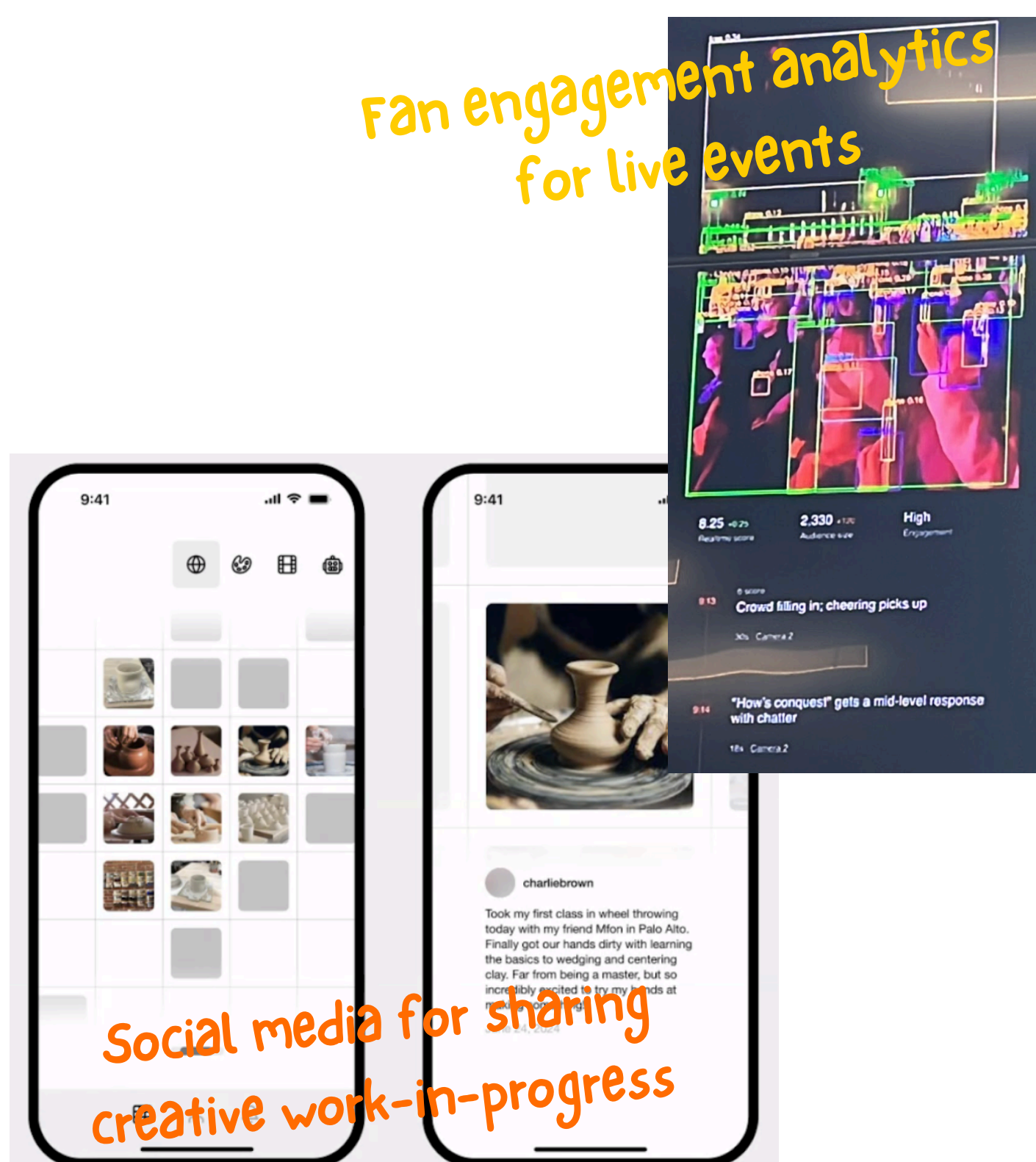
Visual Q&A Read This Video Stream Voice Activation



Inclusive hair care device & education

Digital Service (e.g. SaaS)

Fan engagement analytics for live events



	Team 1: Physical product	Team 2: Digital service
Team composition	4 members (4 male)	5 members (3 male, 2 female)
Challenge space	Accelerating product design cycle through a smart meat thermometer	AI-driven tools to analyze fan sentiment in live events
Action goal	Physical product innovation and venture	Digital service development
Initial expertise	Tech (n=3-4; prototyping, hardware, CAD) Business (n=1-2; agile process; marketing)	Design (n= 4-5; UI/UX, experiential design)
Key knowledge gap	Design (digital branding) Business (digital marketing)	Technology (data processing, computer vision)
Initial collaboration	Cross-functional coordination (clear division of functional roles)	Shared functional orientation
Collaboration strategy	Leveraged existing technical strengths to advance MVP; addressed tech/design gaps through self-directed resources and prior product launch experiences	Assigned members to explore technical development; others acquired technical skills (e.g., no-code, AI) through collaboration, coursework, and self-learning
Outcome	Stronger coordination; role-based expertise development; conservative pivots into other domains	Fluid expertise sharing and shared learning; greater expansion into other domains; higher effort to build role-based coordination

Table 1. Cross-case comparison of team characteristics, expertise gaps, & collaboration strategies

Future Work:

- Students learned to discern perspectives across domains and position their skillsets accordingly. GX course provided structured opportunities for teams to externalize knowledge differences and align work
- Future work will conduct in-depth qualitative analyses to better understand cross-domain interactions and how teams navigate their evolving expertise boundaries over time

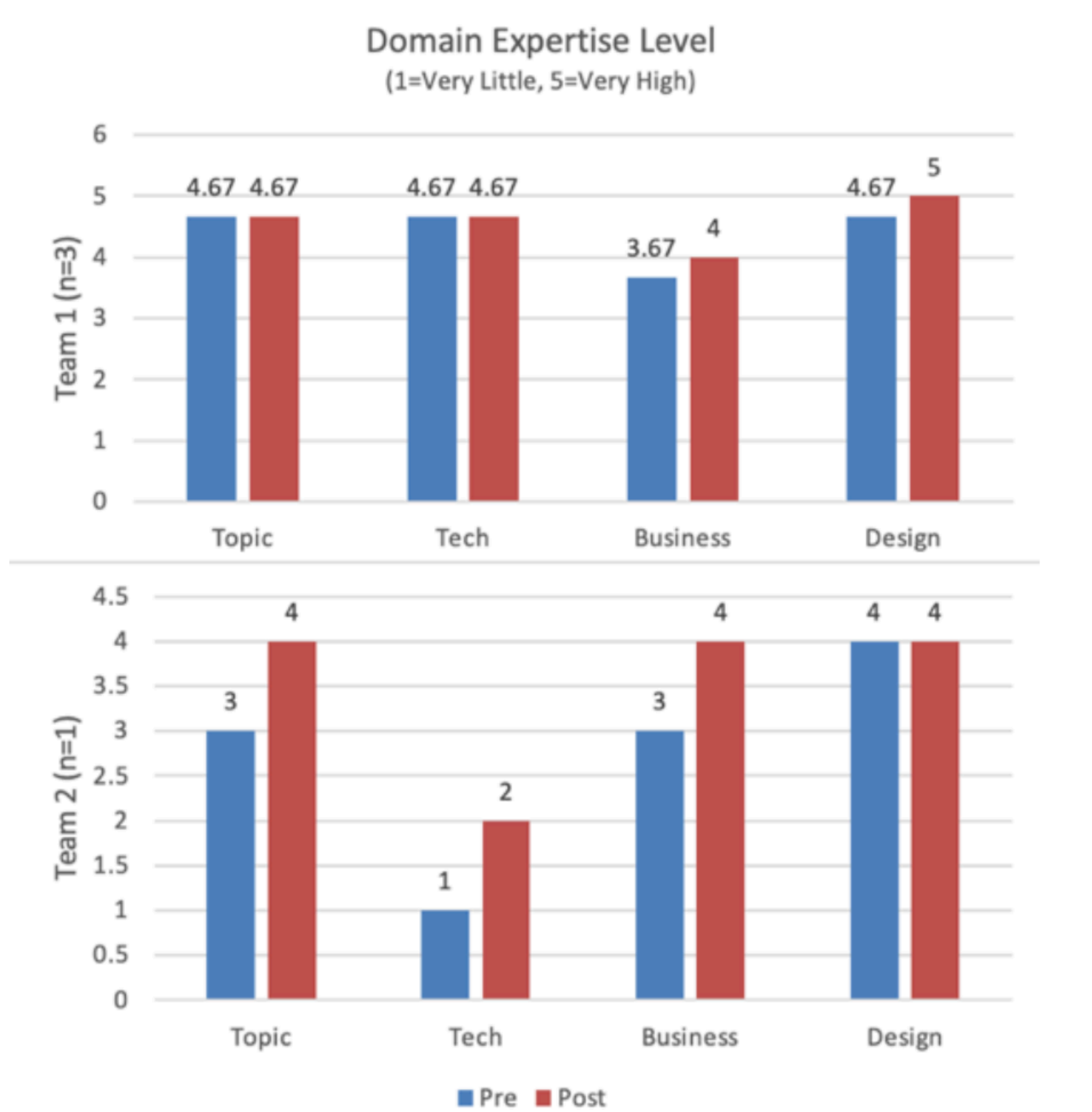


Fig.1 Pre/post expertise ratings across four domains for Teams 1 and 2 (1-5 scale)

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More CBRL Resources:



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