Making interdisciplinary thinking visible with rubrics and actionable through exemplars

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INTRODUCTION

Biotechnology Innovation is interdisciplinary in nature

- Involves **ill structured problems** across science, clinical need, regulation, and business
- Interacting and **conflicting disciplinary perspectives**

Interdisciplinary learning is the capacity to integrate knowledge and modes of thinking in two or more disciplines to produce a cognitive advancement.

Interdisciplinary Learning Outcomes

I. Disciplinary grounding
II. Integration
III. Critical awareness
IV. Communication

Teaching Challenges

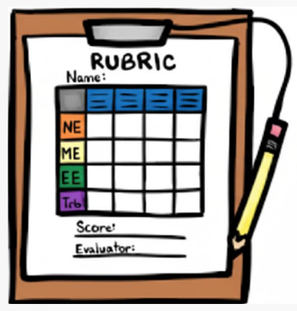
- Students exhibit **strong disciplinary knowledge**, but limited interdisciplinary integration
- **Difficulty connecting science and business perspectives** in innovation contexts

Pedagogical Approach

Making learning visible and using Formative Analytic Rubrics

1. Transparency in interdisciplinary expectations
2. Support **evaluative judgement, alignment, and feedback use** in complex tasks.
3. **Clarifies how science and business should be integrated**, reducing siloed and contradictory reasoning.

A formative assessment approach to supporting interdisciplinary learning in biotechnology innovation



"**Definition of a relevant problem**" is most critical.

A vague problem makes even strong strategies/products unconvincing.

Without clarifying pain points, strategies and products lose their problem-solution logic.

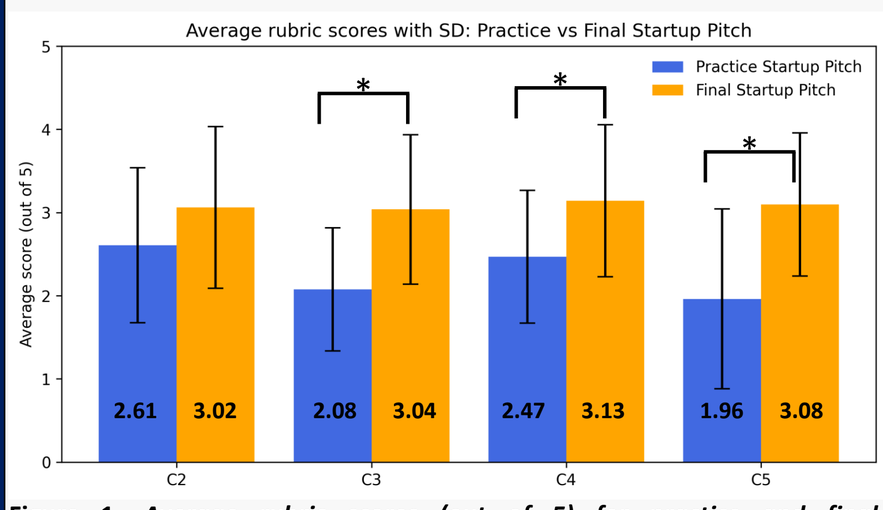


Figure 1. ***Average rubric scores (out of 5) for practice and final biotechnology startup pitches across four criteria (C2–C5).*** Bars show mean scores with standard deviation error bars for Practice Startup Pitch (blue) and Final Startup Pitch (orange). Mean values are labeled on each bar. * indicate statistical significance ($p<0.05$) from pair-test comparison between practice and final startup pitch scores.

Table 1. Practice–Final Comparisons of Startup Pitch Rubric Scores

Rubrics Criterion	Cohen's dz	Gains
C2	0.36	–
C3	1.18	↑↑↑
C4	0.75	↑
C5	0.93	↑↑

Table 1. *Paired t-test results comparing practice and final startup pitch scores across rubric criteria (C2–C5), including mean differences, Cohen's dz effect sizes, and statistical significance.*

METHODS

Participants: 87 graduate Biotechnology students

1. **Capturing Interdisciplinary Understanding Baseline**
   Students first developed **practice startup pitch slides**, representing their initial interdisciplinary reasoning.
2. Introduced **shared analytic rubric for startup pitch evaluation**

Rubric Key Criteria

C2: Definition of a relevant problem
Critical Awareness

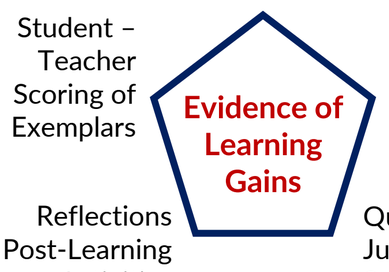
C3: Identification of strategies
Disciplinary Grounding

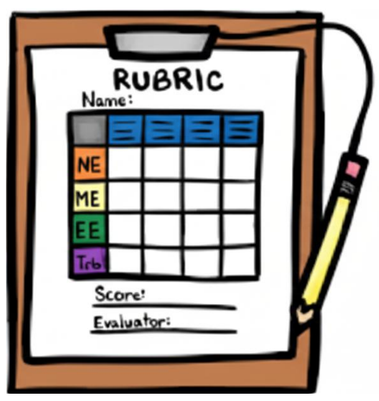
C4: Explanation of potential products
Disciplinary Grounding

C5: Industry and technology analysis
Integration

3. Students **evaluated one strong and one weak biotechnology startup pitch exemplar**, assigning rubric scores and providing qualitative justifications.
4. Reflected on rubric criteria and identified revisions to their own practice slides.
5. **Final startup pitch presentations**, assessed using the same rubric.
6. **Data Analysis**

Practice Startup Pitch Score
Vs
Final Startup Pitch Score





EXEMPLARS

Strong

Weak

Support student gains in Disciplinary Grounding and Integration

CLARITY

- Make Interdisciplinary Expectations explicit and visible
- how scientific, strategic, and market considerations should align

EVALUATIVE JUDGMENT

- Exemplars help distinguish between credible execution and aspirational claims

Integration and execution are structurally scaffoldable outcome

- Rely on relational coherence and procedural reasoning that can be modeled
- Translated rubric criteria into concrete revisions such as clearer workflows, and competitor analyses

Limited gains in Critical Awareness reflect authentic cognitive difficulty

EPISTEMOLOGICAL FRAMING

- Students interrogate assumptions, define relevance, and construct problems rather than execute solutions.
- Student–teacher judgement diverged
- Students applied categorical evaluations while teacher recognized nuance and partial quality

LESS VISIBLE

- Resistant to improvement through rubrics and exemplars alone
- Developmentally advanced interdisciplinary outcome

Pedagogical implications

- Problem identification treated as a core learning outcome
- Rubrics and exemplars should be complemented with guided problem-framing exercises, and critique of problem statements

- **Pedagogical design should be developmentally sequenced**
  - ✓ Introduce integration and execution earlier
  - ✓ Supporting critical awareness across repeated learning opportunities
- **Exemplar-based formative assessment remains powerful** but also require other instructional strategies to achieve comprehensive interdisciplinary learning outcomes.