Shifting Department Culture to Re-Situate Learning

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Project Goal:
We seek revolutionary change in the CBEE School through construction of a culture of inclusion and a shift in our learning environments from sequestered activities to realistic, consequential work.
Overview

Engineering World

School World

Curriculum
Thinking & acting like engineers is more likely if students are immersed in professional contexts (engineering world) rather than thinking like engineering students (school world).
Studio Courses: Enabling Small Group Learning
(Enrollment 150-300)

• Studio instruction is intended to be “facilitative” with a GTA or instructor circulating around the room and interacting with students and student teams
• Designed to engage all students; help them learn that it is ok to be “stuck” and help them develop strategies to get “unstuck.”
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### Studio 1.0 vs Studio 2.0 Design

Studio "2.0" reform in eleven core courses from “work sheeting” to “group-worthy” problems complex enough to benefit from multiple perspectives and understanding.

<table>
<thead>
<tr>
<th>Description</th>
<th>Studio 1.0</th>
<th>Studio 2.0</th>
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<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Steer learners to follow a specific path to get to a “final answer.” Learners have limited opportunity to express their creativity and problem solving skills.</td>
<td>Learners are presented with professionally contextualized problems. Activities are more open ended. Learners are encouraged to work with their group to come up with their own path.</td>
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<table>
<thead>
<tr>
<th>Framing</th>
<th>Bounded</th>
<th>Expansive</th>
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<tbody>
<tr>
<td>Moves</td>
<td>Mostly forced</td>
<td>Free and forced</td>
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<tr>
<td>Involved</td>
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Studio 2.0 Community of Practice

GTA - Reflections (GTA Panel)

Support for LAs so that they are engaged

Pre-studio meetings - working on problem + post studio to comment on "problems of practice"

Formal meet-the-day after the studio to reflect + plan

Instructor attends only 1 meeting if 2

Open-ended problems

GTA/LA prep important

Assigning & switching groups (once, perhaps)

(leads to learning skills)

Benefits to Intl students

(culture > language)

Just doing calculations (+ recipe studios)

Time pressure leads to rushing through

Get comfy/ok with friends go into auto

Experiences with studio (honors)?

Reminders of teaming norms
Quad Design Tool

<table>
<thead>
<tr>
<th>Context</th>
<th>Engineer’s Role / Task</th>
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<tbody>
<tr>
<td>Concepts (Conceptual Tools)</td>
<td>Engineering Practices</td>
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**Components of Disciplinary Knowledge**

<table>
<thead>
<tr>
<th>Open-ended design</th>
<th>Conceptual tools</th>
<th>Computational tools</th>
<th>Communication and writing</th>
<th>Inclusive teamwork</th>
<th>Industrial (Professional) relevance</th>
<th>Hands-on experience</th>
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Energy Balance Studio 2.0 (Adam Higgins)

- Development of Microfluidic Device for Diagnostic Testing Using Polymerase Chain Reaction (PCR)
- Point of care device
- Design Heater length / microchannel configuration (flow rates; max temp; ...)

PCR Reaction:

1. Heat to ~95°C to melt double stranded DNA
2. Cool to ~68°C to anneal primer
3. Heat to ~72°C for growth of new DNA strand

Reactions to sequentially copy the original DNA sequence

Heaters (2 cycles)
ALT-Studio 2.0
Alternate Leads (ALT) Studio Model

• Assign pairs of faculty to each major studio course.
• Each faculty member takes the lead in alternative years with the other working on activity development, student support, and being available when the lead travels. The alternative will also be available to contribute to longitudinal curricular.
• While this structure would apply to each course, individual pairs have autonomy to work out detail as appropriate for their course and teaching practices.
• We recommend a four-year match period with potential renewal so that each pair can lead twice during each rotation period.
• Part of the annual performance reviews will contain a meeting between the School Head and the faculty pair where the activity and accomplishments of each member will assessed and evaluated.
• New faculty will be paired with more experienced instructors. There will be documented development plans for new faculty that can become part of their teaching portfolio for P&T.
• There will be 1-2 optional meetings per term for studio faculty to share innovative practices and work through persistent problems.
ALT Studio 2.0 Development

Meaningful, Consequential Learning

- Studio Activities
  - Instructional Design Principles
  - Collaborative Teaching

- Instructional Practices
  - GTA Prof. Dev.
  - New LA Program
Video Data Collection – Team Interactions

[Diagram showing team interactions and video camera icons]
Team Interaction Data

Elapsed Time (sec)

Student 1
Student 2
Student 3
Facilitator 1
Facilitator 2
Facilitated Construction
Collaborative Engagement
Self Construction
School World
Engineering World
Hybrid World
Abstract Math

Team 2
Engagement
Figured World
Analysis of Team Interactions

- Collaborative engagement in engineering world almost always represents desired talk where team members are arguing, defending, explaining, and elaborating using reasoning based in engineering norms and practices
- For Team 1, key opportunities to collaborative engage in engineering world were rebuked
Model of Team Interactions

<table>
<thead>
<tr>
<th>Collaborative Engagement Talk Time (sec)</th>
<th>School World</th>
<th>Engineering World</th>
<th>Hybrid World</th>
<th>Abstract Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team 1</td>
<td>159 (11%)</td>
<td><strong>190 (13%)</strong></td>
<td>76 (5%)</td>
<td>878 (62%)</td>
</tr>
<tr>
<td>Team 2</td>
<td>106 (8%)</td>
<td><strong>562 (42%)</strong></td>
<td>109 (8%)</td>
<td>519 (39%)</td>
</tr>
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</table>

Abstract
Math

Solution

Translation

School World

Engineering World

Engineering World

School World

Collaborative Engagement

problem

answer