Learning Through Teaching –
a Collaborative Learning Strategy

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Outline

• Background

• Learning Through Teaching Implementation
  – Prior experience
  – Current practices

• Assessment

• Future plan
ME Integrated Curriculum

- Initiate the curriculum change in 1997
- Consolidate relevant classes into a class sequence to emphasize connectivity between topics, design considerations, team work, etc.
  - Ex: Thermodynamics + Heat Transfer + Fluid Mechanics \( \Rightarrow \) Thermal/Fluids I & II
- Add a 3-hour weekly workshop to every ME core course promoting group work, laboratory development, and collaborative learning
- Enhance hands-on components in all core courses
Learning Through Teaching

- LTT was originally introduced (Summer 2001) to engage students in establishing a demonstration laboratory in Dynamics (suggested to NSF as a cost-effective strategy to get instant feedback and improvements in lab development)
- Each group concentrates on one experiment and is responsible for introducing the experiment to all other groups, including TA
- Recognize this practice as a success (collaborative learning) and a disappointment (lab development)
Collaborative Learning Strategy

• **Definition:** an instructional methodology through which students work interactively in groups to achieve common academic goals
  
  - Shared knowledge: knowledge is created through interaction not by simply transferring
  
  - Shared responsibility and learn as a group: role-playing for all participants
  
  - Teacher as a facilitator: students take center stage
  
  - Nurture environment for collaboration: motivation, at own pace, learn from feedback, feel in control
Learning Through Teaching

• Teaching is the ultimate learning tool
  – Personal experience
  – Higher order skills: data collection, organization, analysis, integration, self-reflection..
  – Enhance communication and personal skills
  – Confidence building, better understanding of teachers’ perspective

• Tell me and I may forget, show me and I may remember, involve me and I will understand

⇒ Ask me to teach and I learn
# Prior Experience

<table>
<thead>
<tr>
<th>Course title, semester taught</th>
<th>LTT Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Systems I, Summer ‘01</td>
<td>Laboratory Demonstration</td>
</tr>
<tr>
<td>Propulsion Systems, Fall ‘01</td>
<td>Advanced beyond-textbook topics</td>
</tr>
<tr>
<td>Thermal/Fluids Lab, Spring ‘02</td>
<td>Experiment preparation, report writing, lab TA responsibilities</td>
</tr>
<tr>
<td>Analytical Tools in ME, Fall ’02, Spring ’03, Fall ’03</td>
<td>Advanced topics (Finite Element Analysis, FFT and Music)</td>
</tr>
<tr>
<td>Intro. to ME, Fall ‘03</td>
<td>Mini-symposium on issues such as engineer as a profession, ethics, globalization, etc..</td>
</tr>
<tr>
<td>Thermal/Fluids Lab, Spring ‘04</td>
<td>Experiment preparation, report writing, lab TA responsibilities</td>
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Implementation

- **Lecture:**
  - Students in group prepare 30 minutes lecture on assigned subjects
  - Serve as TAs in weekly workshop

- **Laboratory Course:**
  - Conduct and learn experiments before fellow students
  - Present theory, background, experimental procedures, data presentation, and all relevant information for report writing in formal lectures
  - Serve as TAs in assigned experiment periods
Other Responsibilities

• Working with faculty, each group is responsible for preparing an assignment relevant to the topic taught

• Arrange with Graduate TA and faculty to go over teaching materials ahead of class time

• Prepare a web page for information dissemination to class

• Submit a final report to discuss experience learned in LTT practice; feedback and suggest improvement; vote for the best LTT group
Assessment

- End-of-semester, anonymous questionnaires, personal interviews, and self-assessment reports
- Quantitative:
  - Question 1 (Q1): whether it is a good idea to implement LTT throughout the curriculum
  - Question 2 (Q2): whether LTT is useful to their overall educational experience
  - Scale 1 to 5; 1 being strongly agree and 5 strongly disagree (3 or lower is considered positive)
## Quantitative Assessment Results

<table>
<thead>
<tr>
<th>Course title, semester taught</th>
<th>Q1</th>
<th>Q2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Systems I, Summer ‘01</td>
<td>2.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Intro. Propulsion Systems, Fall ‘01</td>
<td>1.7</td>
<td>1.6</td>
</tr>
<tr>
<td>Thermal/Fluids Lab, Spring ‘02</td>
<td>2.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Analytical Tools in ME, Fall ‘02</td>
<td>1.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Analytical Tools in ME, Spring ‘03</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Analytical Tools in ME, Fall ‘03</td>
<td>1.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Thermal/Fluids Lab, Spring ‘04</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Average</td>
<td>1.9 (1.7)</td>
<td>1.9</td>
</tr>
<tr>
<td>SA, A: 75%</td>
<td>SA, A: 81%</td>
<td></td>
</tr>
<tr>
<td>D, SD: 10%</td>
<td>D, SD: 10%</td>
<td></td>
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</tbody>
</table>
Qualitative Response

www.eng.fsu.edu/LTT

- Group and individual self-evaluation reports
- In general are quite positive:
  - Great learning experience, stronger motivation, feel active the first time in a class, understand teacher’s perspective, confidence building, the importance of time management, self-reflection, etc..
- Negatives:
  - Too time-consuming, poor preparation by student instructor, lack interaction with lecturer, uneven load distribution, unfair assignment, resentment for extra work
Other observations

• Need to clearly explain the objectives of the LTT concept to students first.

• Provide timely feedback during presentation, but refrain from frequent interruptions - students making mistakes is part of the learning process.

• Make sure critical concepts be covered accurately

• Make the effort accountable to all participants to enforce the learning experience.

• Don’t be too ambitious at the beginning – learn from mistakes and don’t hesitate to drop unsuccessful practices.
Future Plan

• Systematic integration into the core curriculum
  – Engage students early (freshman) with the concept
  – Start with easy assignments and gradually build up capability and confidence
  – Involve students in different LTT practices: laboratory TA, lecturer, tutoring, mentoring

• Conduct longitudinal analysis for long-term assessment/improvement
  – Annual LTT forum (students), workshop (faculty)

• Expand horizontally to other disciplines
Summary

• “Learning Through Teaching” is an effective strategy to promote collaborative learning.

• Systematic implementation to the entire program is possible
  – Integration at a gradual pace
  – Coordinate throughout the curriculum at different levels

• A more rigorous evaluation process is needed for further expansion and broader dissemination