### Revitalizing Labs: Lessons from 2.5 Years of Iterative Development and Assessment of Digital Logic Labs

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#### A case study of change: evolution of the first two circuitry labs

<table>
<thead>
<tr>
<th>Fall 2008</th>
<th>Spring 2009</th>
<th>Summer 2010</th>
<th>Fall 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What we inherited</strong></td>
<td><strong>Let there be discovery...</strong></td>
<td><strong>...social motivation...</strong></td>
<td><strong>...and time for creativity.</strong></td>
</tr>
</tbody>
</table>

**Fall 2008**

In this term, the introduction sequence was:
- Test a gate (pictured above)
- Build a priority chain

**Spring 2009**

In this term, the introduction sequence was:
- **Mystery chip exercise** (pictured above)
- Build a priority chain

**Summer 2010**

In this term, the introduction sequence was:
- Mystery chip exercise
- **Group debugging** (pictured above)
- Build a priority chain

**Fall 2010**

In this term, the introduction sequence was:
- **Flashing lights exploration** (pictured above)
- Mystery chip exercise
- Group debugging

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### After six terms of incremental change

**The labs are now:**
- Doable in the allotted time – reducing stress on students and TAs in lab;
- Engaging, featuring more visual, immediate feedback from the equipment;
- Contextualized, with opportunities for creativity and discussion;
- Complete with clear and consistent grading.

**New lab activities include:**
- The addition of activities on scalability, multiplexing and limitations of theoretical models.
- An effective introduction to sequential circuitry.
- Open-ended “project labs” on cryptography, coding theory, and PRNG.

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### The process: drafting a lab

- **Instructors** review the lab
- **Lab Coordinator** drafts and refines the lab
- **TA's** test run the lab
- **Teaching assistants** teach
- **Students** survey feedback

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### Survey results: overall findings

- Increased TA satisfaction
- Increased student satisfaction
- Increased student-reported learning

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### Factors for lasting change

Jones [2] lists five conditions that promote and sustain changes in the curriculum [1], all of which are satisfied in our work:
- Mutual trust amongst stakeholders;
- Commitment and consistent leadership;
- Proceeding with a non-threatening, incremental pace of change;
- Professional development for academic staff; and
- The use of purposeful incentives for curriculum developers.

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### References


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