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Design of Inquiry-Oriented Science Labs: Impacts on Students' Attitudes

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Design of Inquiry-Oriented Science Labs: Impacts on Students’ Attitudes

By

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Assessment. I utilized an end-of-semester survey to assess students’ attitudes toward lab. Reliability and validity of the survey were well supported (Basker et al. 2008). In the survey students rated the following on a scale of 1 to 10 as the best: the overall lab, how much the lab helped with lecture (lecture), how exciting the lab was (exciting), how much they learned for the time they invested (time efficiency) and how easy the lab was (difficulty)

Observations in 2008 indicated TAs were not all implementing PB labs as they were intended. So I utilized a questionnaire for the TAs to determine the extent that PB labs were implemented as PB and not GI.

Results and Discussion. When labs were not changed between years (control labs), student ratings did not change for any parameter (Table 2). Thus, the validity of a study design that changes lab styles between years is supported for a sample this large.

In 2 of 3 cases, students significantly preferred the GI format to the PB format (Figure 1). For the case in which students did not show a preference (Cell Phys.), level of difficulty and time efficiency were not significantly different (Table 3). Upon review of the Cell Phys. lab, the GI version had a challenging extension question designed specifically to understand the level of material. Students rated lecture help significantly higher for the GI version (Table 3). Thus, lab style (PB vs. GI) appears to have an influence on students’ attitudes, however, other lab characteristics (i.e. time efficiency and difficulty) associated with lab style may be the cause rather than lab style itself.

When lab style (PB vs. GI) changed difficulty and/or time efficiency, students rated the less difficult and more time-efficient version significantly higher (Figure 1). In 2 of 3 cases students found the PB version significantly more difficult and significantly less time efficient than the GI version, and level of difficulty was the factor that exhibited the greatest change in PB vs. GI labs.

In 2 of 3 cases, students found lecture help for the GI version to be significantly greater than for the PB version. Interestingly, in all three cases, the change between a PB and GI lab did not significantly influence excitement for the students. This indicates that excitement may be more related to characteristics other than lab style.

Table 3. Mean overall ratings for labs in the GI format vs. the PB format. A t-test was used to compare mean ratings. Error bars indicate standard error.

<table>
<thead>
<tr>
<th>Lab</th>
<th>Overall</th>
<th>Lecture Help</th>
<th>Exciting</th>
<th>Time Efficient</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmosis</td>
<td>0.235*</td>
<td>0.318*</td>
<td>0.198</td>
<td>0.302*</td>
<td>0.497***</td>
</tr>
<tr>
<td>Cell Phys.</td>
<td>-0.005</td>
<td>0.491**</td>
<td>0.015</td>
<td>-0.030</td>
<td>-0.298</td>
</tr>
<tr>
<td>Mend. Gen</td>
<td>0.451**</td>
<td>-0.117</td>
<td>0.110</td>
<td>0.462**</td>
<td>0.899***</td>
</tr>
</tbody>
</table>

Conclusions

- Lab style has an impact on students’ attitudes toward lab. However, the impact appears to be heavily influenced by how lab style alters difficulty and time efficiency.
- When level of difficulty is low, students’ attitudes are the same for PB and GI labs, but when level of difficulty is high, students prefer GI labs to PB labs.
- Lecture help does not appear to have a substantial influence on students’ attitudes toward lab.
- Lab style does not appear to influence students’ perceptions of lab excitement.

Acknowledgements. I thank the President’s Teaching and Learning Collaborative, and the various graduate students and undergraduates who participated in this project.

Literature Cited


Table 2. Mean student ratings in 2007 vs. 2008 for the two control labs (Scientific Method and Plant Physiology). A t-test demonstrated there were no significant differences between years in any parameter (P > 0.05).

<table>
<thead>
<tr>
<th>Lab</th>
<th>Year</th>
<th>Overall</th>
<th>Lecture Help</th>
<th>Exciting</th>
<th>Time Efficient</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ske. Meth</td>
<td>07</td>
<td>6.53</td>
<td>4.18</td>
<td>5.47</td>
<td>5.54</td>
<td>7.54</td>
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<tr>
<td></td>
<td>08</td>
<td>6.70</td>
<td>4.14</td>
<td>5.56</td>
<td>5.55</td>
<td>7.57</td>
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<tr>
<td>Diff</td>
<td></td>
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<td>0.04</td>
<td>-0.09</td>
<td>-0.01</td>
<td>-0.03</td>
</tr>
<tr>
<td>Plant Phys</td>
<td>07</td>
<td>6.75</td>
<td>6.23</td>
<td>5.46</td>
<td>6.01</td>
<td>6.65</td>
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<tr>
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<td>6.10</td>
<td>5.46</td>
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<tr>
<td>Diff</td>
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<td>0.14</td>
<td>0.13</td>
<td>0.17</td>
<td>0.09</td>
<td>0.01</td>
</tr>
</tbody>
</table>

* Computer simulations are exceptions because the performance is simulated, then results are provided by the computer.