Quantifying student behavioral engagement based on teaching practices in a large class
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**Introduction:**
Due to high student enrollments and limited resources, large classes are common at many universities. In large lectures, students are likely to experience a sense of anonymity, passivity, and distraction leading to decreased behavioral engagement in class. It is therefore not surprising that one of the biggest concerns of many instructors is how to effectively teach large classes. The purpose of this work was to develop an objective, quantitative classroom observation protocol that evaluates how teaching practices affect student behavioral engagement in large classes.

**Observation protocol:**
1. Obtain lesson plan from instructor (e.g., PowerPoint file) ahead of time
2. Divide large classroom into sections
3. Sit among students, changing sections daily
4. Each day, select 10 students to observe. Criteria: an unobstructed view of each student’s face, communication, and materials
5. Every few minutes, observe each student for 2-10 seconds and record the following information directly in the instructor’s lesson plan (e.g., the “Notes” section of a PowerPoint file)
   - **Time**
   - **Number of students engaged, based on criteria in Table 1**
   - **Classroom activity at the time (e.g., clicker, in-class discussion, lecture)**
   - **Any relevant instructor actions (e.g., Socratic questioning, humor, real-world examples)**
   - **Any distracting circumstances (e.g., classroom temperature, technical issues)**
6. Record time of any instructor questions to the class and any student questions to the instructor, including from which section of the room the question/answer came
7. Provide observation data to instructor

**Table 1**

<table>
<thead>
<tr>
<th>Behavioral Engagement</th>
<th>Engaged</th>
<th>Disengaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening</td>
<td>Student is listening at the instructor and is responsive to the lecture (e.g., looking up, making eye contact)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student is not listening, distraction or talking about classroom/unrelated material</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Student is taking notes or reading class material, they are answering pre-printed notes or setting written instructor notes to important points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student is not writing notes, they are sleeping or day dreaming</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>Student is following along with lecture on computer or in-class discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student is off-task</td>
<td></td>
</tr>
<tr>
<td>Engaged computer use</td>
<td>Student is engaged with a computer (e.g., using keyboard, pointing at notes, or using a computer while discussing material)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student is not engaged with a computer</td>
<td></td>
</tr>
<tr>
<td>Engaged student interaction</td>
<td>Student is engaging with other students (e.g., answering questions, playing in-class discussion)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student is not engaging with other students</td>
<td></td>
</tr>
</tbody>
</table>

**Results from a large introductory oceanography course:**
Classroom observations were conducted during 27 lectures in a first year Oceanography course with an enrollment of 170 students and two course instructors. The observer sat in one of nine sections in the classroom, and obtained observations from each section at least three times in the semester. A total of 720 engagement observation points were recorded through the semester.

**Future Research:**

**What got student attention?**
- Clicker questions
- In-class discussion
- Instructor walking around
- Student question repeated by instructor
- Real-world examples

**What didn’t get student attention?**
- Summary slide
- Out of context goals
- Long periods of lecturing
- Student question that is not repeated by instructor

**Figure 1:** Student engagement over a lecture period based on teaching activities

Data from a typical class period reveal activities that are more and less engaging for students (Figure 1). The instructor also gets a snapshot of what student engagement looked like over the 50-minute lecture period and can easily see where to make changes.

**Figure 2:** Student engagement based on instructional activity averaged over the semester for each instructor

Overall observation data show that student engagement is strongly correlated to teaching practices. Two instructors with varying teaching experience show the same trends in student engagement based on teaching practices. On average, the most engaging activity is clicker questions and clicker question follow-up and the least engaging are student question that are not repeated by instructor.

**Further information:**
Please contact Erin Lane at elane@eos.ubc.ca for more information on this research.

Educational Research happening in Department of Earth and Ocean Sciences at the University of British Columbia can be found at www.eos.ubc.ca/research/cwsei/

For more information on The Carl Wieman Science Education Initiative (CWSIEI) at the University of British Columbia visit http://www.cwsei.ubc.ca/