



InterCLASS: Measuring interdisciplinary attitudes in science students

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Summary

Science One claims to offer students a rich and interdisciplinary experience as they learn fundamental concepts and the links between biology, chemistry, mathematics and physics.

Key Questions:

1. Can we measure the impact on student attitudes about the interdisciplinary experience in UBC Science?
2. Does the teaching environment (Science One, CSP, Standard first year) have any effect on these attitudes?
3. Are the students in special programs initially prone to being more interested in interdisciplinary sciences ?

Methods:

The InterCLASS survey is a sequence of 9 questions that are appended to the Colorado Learning Attitudes about Science Survey. We administered the survey to several first year classes and students were able to fill out the survey using a 5 point Likert Scale. Responses were collapsed to -1,-1,0,1,1 and then analyzed.

Survey Questions

1. Concepts from biology, chemistry, and physics are all required to fully understand any of these disciplines individually.
2. I find the overlap between different branches of science (such as biology, chemistry, and physics) interesting.
3. When completing a task in the sciences I draw upon knowledge from more than one of biology, chemistry, and physics.

Examples and concepts from:

4. ... **biology** are important when learning **physics**.
5. ... **biology** are important when learning **chemistry**.
6. ... **chemistry** are important when learning **biology**.
7. ... **chemistry** are important when learning **physics**.
8. ... **physics** are important when learning **biology**.
9. ... **physics** are important when learning **chemistry**.

Results

1. Attitude shift over one academic term

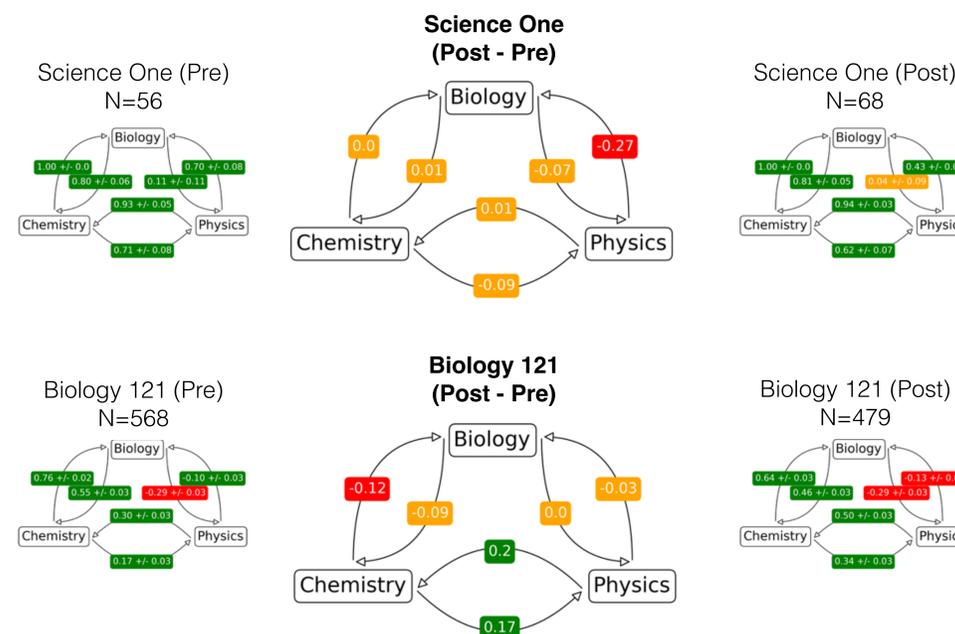


Figure 1. Visual representation of the collapsed Likert scale data from the InterCLASS questions for both Science One (top row) and Biology 121 (bottom row). The two outer columns display the data at the beginning of the term (first column) and just prior to the December exam session (third column). The central column shows the difference between the two time points, and in all circumstances, green represents a score greater than 0.1, red represents a score less than -0.1, and all values in between are shown in yellow.

2. Repeatability Analysis

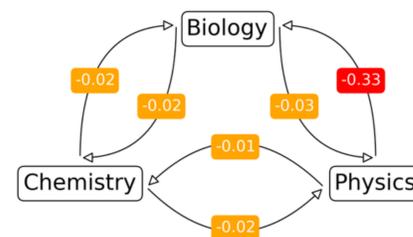


Figure 2. The Science One class completed the same survey one week apart in both the physics laboratory as well as in class; because the two target populations were the same and not enough material was covered to explain any attitude shifts, any differences in the results are due to the variability in student interpretation of questions.

3. Discipline Comparisons

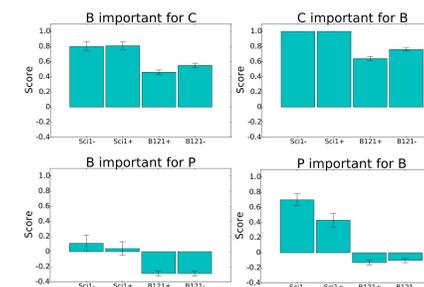


Figure 3. Averaged survey responses for student populations in Science One and Biology 121 are shown both before and after the academic term with error bars representing the standard error of the mean. In these four cases, the dramatic differences between the student populations is most evident.

Interesting Trends

1. Both initially and after one academic term, students in both Science One and Biology 121 classes do not believe physics is very important for biology and vice versa.
2. In general, compared to other populations, Science One students do not have much room for improvement in their interdisciplinary attitudes as they tend to have higher scores on our survey (in its current implementation).
3. Our repeatability analysis (result 2) suggests that we need to be cognizant of the "Silo Effect"; the same students, one week apart seemed to have radically different attitudes about whether or not physics was important for biology.
4. Students in Science One exhibited fewer attitude shifts compared to Biology 121 over one academic term.
5. Science One students had higher scores on question 1 and 2; they found the overlap between the three main disciplines interesting, and believed that all three disciplines were required to fully understand the concepts.

Conclusions & Future Work

1. As expected, Science One students initially scored higher on most InterCLASS questions, including their attitudes on the level of importance of one discipline for another.
2. Measurable shifts were observed in both student populations over the academic term, some positive and some negative.
3. Validation of the survey is necessary and we intend to measure expert-like behaviour by administering the survey to faculty members at UBC.
4. We hope that the InterCLASS questions will help us assess the interdisciplinarity of both the students we teach, as well as the Science One program itself.

