General chemistry students' beliefs about chemistry and learning chemistry: An international comparison

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Beliefs/Attitudes & Learning

Researchers have found a number of student attitudes and beliefs that both influence and are influenced by learning experiences.(see 1) In addition, attitudes and beliefs about learning have been found to be important predictors of students' performance in post-secondary science coursework.(see 1) Moreover, improved attitudes have been shown to be correlated with improved learning outcomes.(2)

The Colorado Learning Attitudes about Science Survey (CLASS) was built upon existing attitudes/beliefs surveys (MPEX, VASS, EBAPS) to focus on students' beliefs about physics, learning physics and problem solving in physics instead of expectations for learning or perceptions of learning the discipline. The CLASS has been extensively validated with a wide variety of student populations, both science and non-science majors. In addition, most of the statements on the CLASS have consistent expert responses so that a comparison can be made between novice and expert beliefs. Expert-like beliefs/attitudes, as measured by the CLASS, are clearly correlated with future program of study.

The chemistry version of the CLASS, the CLASS-Chem, is largely similar to the original with some additional statements, such as those on the atomic-molecular perspective of chemistry.(3)

Both universities are large, 4-year or higher, and public with high research activity (Carnegie Classifications).

US School Mountain State Region

Student Population (Fall 2007):
25,080 undergraduate atudents
"Average" High School Rank = 79.5th percentile
~ 47% Female ~ 53% Male
~ 1% International students
~ 10% Minority students

1st-Year Chem Population (Fall 2008):
896 enrolled
~ 57% Female ~ 42% Male
~ <10% English as a Second Language
~ 55% Freshmen

Canadian School South-West Region

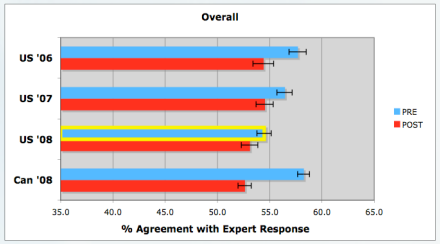
Student Population (Fall 2006):
35,860 undergraduate students
"Average" H.S. Rank (Sci)=94 (96 PISA adjusted)
~ 55% Female ~ 45% Male
~ 15% International students
No Ethnic Majority

1st-Year Chem Population (Fall 2008):
1,730 enrolled
59% Female 41% Male
~ 50% English as a Second Language
~ 90% Freshmen

1st Semester General Chemistry CLASS-Chem Results

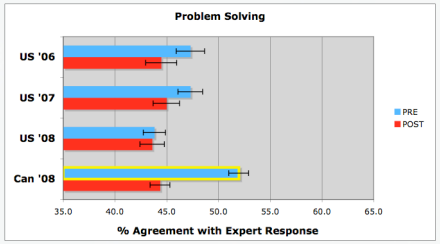
US '06 N=403, 49% participation, ~58% Freshmen. US '07 N=551, 62% participation, ~57% Freshmen. US '08 N=622, 70% participation, ~55% Freshmen.
Canada '08 N=885 , 51% participation, ~90% Freshmen. (Note: participation = matched pre/post participation)

Significantly different scores are highlighted in yellow.



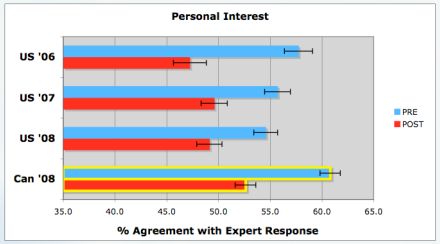
The Overall category is an average score for the 45 statements on the CLASS-chem for which there is a consistent expert response.

On average, both the US and Canadian schools have similar Pre and Post Overall scores, except Pre US '08. Typically, pre-CLASS scores are stable from year-to-year at a particular institution. *Note the higher participation level in US '08.



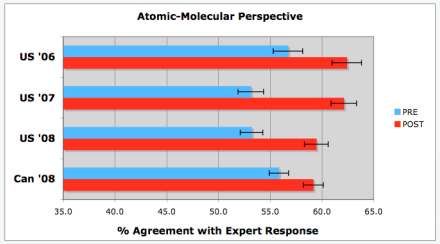
This Problem Solving category (one of three) includes 7 statements such as: "If I want to apply a method used for solving one chemistry problem to another problem, the problems must involve very similar situations."

The Canadian school has a significantly higher Problem Solving score at the beginning of the semester that falls substantially to be statistically equivalent to the Post scores seen at the US school by the end of the semester.



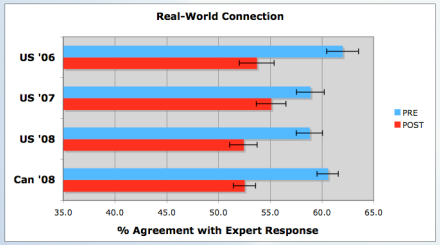
The Personal Interest category includes 6 statements such as: "I study chemistry to learn knowledge that will be useful in my life outside of school."

The students at the Canadian school have significantly higher Personal Interest scores both before and after the 1st semester of general chemistry.



The Atomic-Molecular Perspective category includes 6 statements such as: "Thinking about a molecule's three-dimensional structure is important for learning chemistry."

Both schools show gains in the Atomic-Molecular Perspective category, however, there are no significant differences between the schools' Pre and Post scores on average



The Real-World Connection category includes 4 statements such as: "The subject of chemistry has little relation to what I experience in the real world."

The Real-World Connection category also shows no significant differences between the two schools on average.

Discussion

- ❖ Despite different demographics, schools have similar CLASS-Chem scores.
  - ✦ Canadian Personal Interest scores: significantly higher Pre *and* Post.
  - ✦ Canadian Problem Solving scores: significantly higher Pre-CLASS-Chem
    - ✧ Negative shifts after gen-chem appear larger for Can students, esp. in:
      - ▪ Personal Interest and Problem Solving categories
- ❖ Both institutions suffer the largest negative shift in students':
  - ✦ Personal Interest
  - ✦ Real-World Connection

References
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