Shifts in Student Attitudes in the Biology Program

MALIN HANSEN[1] AND GÜLNUR BIROL[1,2]

[1]LIFE SCIENCES CWSEI AND [2]SCIENCE CENTRE FOR LEARNING & TEACHING

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INTRODUCTION

A student's attitude toward a particular discipline may affect his or her motivation to excel (Osborne et al. 2003). In order to facilitate learning, it is therefore important that educators familiarize themselves with students' attitudes and associated behavior (e.g. effort, reasoning and problem solving skills) as well as the factors that may influence students' attitudes.

Student attitudes toward science have been investigated since the mid 1960s (Munby 1981; Ramsden 1998; Osborne et al. 2003; Reid 2006), when educators started seeing a decrease in enrollment in science courses and decreased interest in science and technology related disciplines among youth. As the association between attitudes and learning recently has become more clear new instruments and methods to measure the impact of courses on students' attitudes have been developed (Baldwin et al. 1999; Coll et al. 2002; Quinnell et al, 2005; Adams et al. 2006; Barbera et al. 2008).

In order to explore the shifts in students' attitudes towards biology from first year to fourth year of the Biology program at the UBC we used a validated Biology Attitudinal Survey recently developed at UBC and University of Colorado.

METHODS

The Survey

The survey consisted of 31 statements (seven categories determined by statistical factor analysis) that use a 5-point Likert scale (strongly agree to strongly disagree). See hand-out for a list of all questions and categories. The survey was completed by students online (see the data collection section below for more information how the survey was administrated).

Data Collection

The survey was first administered in a couple of first year biology majors courses (Biol 112 and 121) in the beginning of the fall of 2009. Biol 121 is a requirement for the Biology program. 1840 students completed the survey.

The survey was administered a second time on two occasions (in the winter of 2012 and fall of 2013). This time we encouraged fourth year students to take the survey on-line. Participation was optional. 280 students completed the survey. The administration of the survey adhered to the Approved Board of Ethics protocol at UBC.

METHODS (CONT.)

Data analysis

Matched students

In order to explore shifts in student attitudes from first year to fourth year, we searched for matched students, i.e. students who were found in both the first year data set in 2009 and the fourth year data set in 2012 or 2013. We found 46 matched students.

We converted the responses to all questions to favorable (1, in agreement with experts) or unfavorable (0, in disagreement with experts).

We compared % favourable (agreeing with the expert) for all statements combined (overall) and for each category between (PRE (first year) and POST (fourth year) using paired Student’s t-test. We also compared the pre and post scores of the matched students to the average scores.

RESULTS

- There was an overall significant positive shift in student attitudes from first year to fourth year (students in fourth year demonstrating more expert-like thinking) (**Figure 1**), i.e. when all questions were included, students agreed with expert responses on more questions at the end of their fourth year fourth year than they did at the beginning of the biology program.

- When questions were divided into categories, there were significant positive shifts (towards expert-like thinking) for four (enjoyment, use/enjoy in everyday life, problem solving sophistication, and conceptual understanding) out of seven categories. No categories showed negative shifts (away from expert-like thinking) (**Figure 1**).

- When the responses of the matched students were compared to the average student response, there was a significant difference in the overall PRE score as well as two categories (the enjoyment category)(**Figure 2 and 3**).

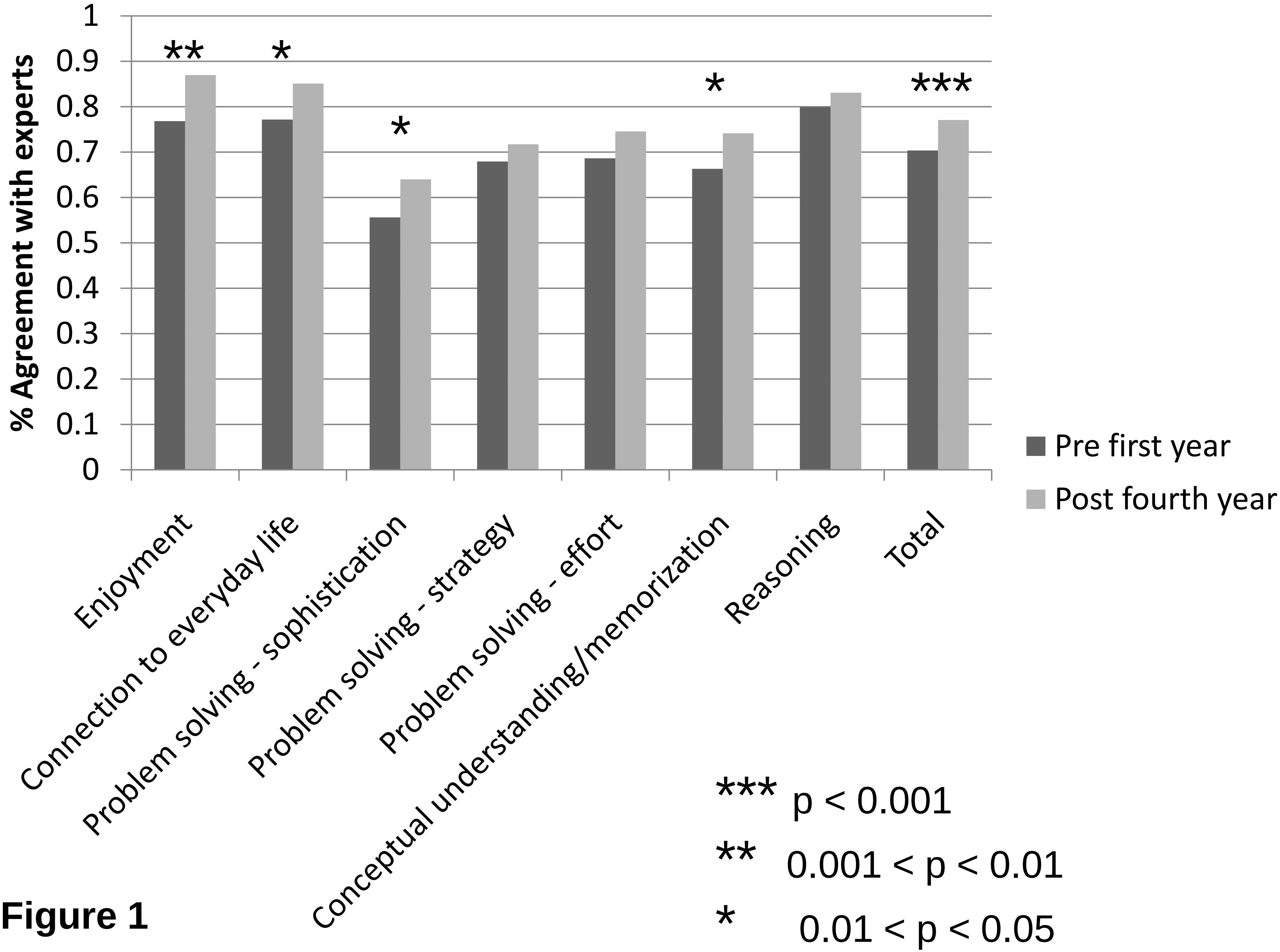
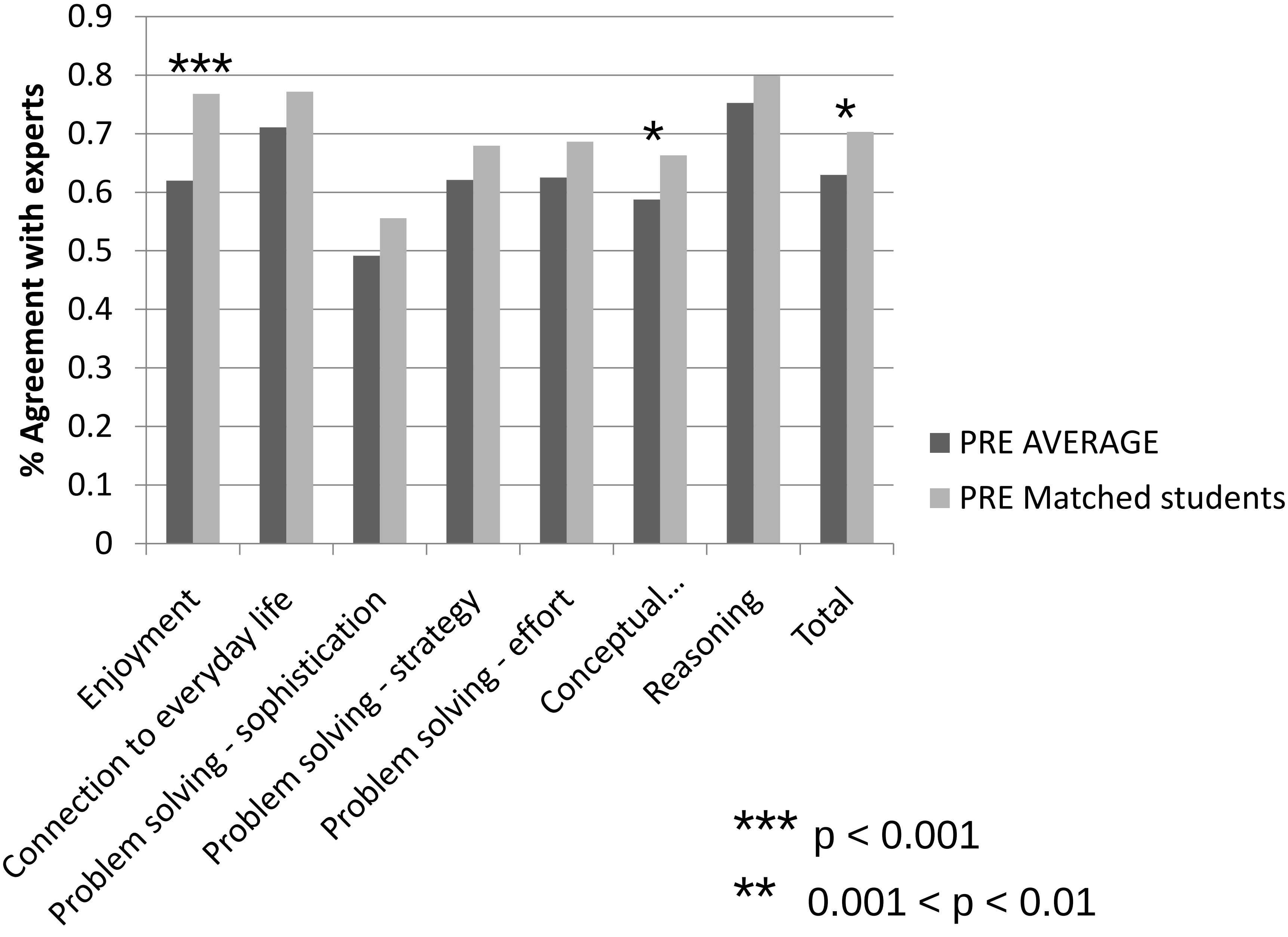

% Agreement with experts
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
**
*
*
*
***
Enjoyment
Connection to everyday life
Problem solving - sophistication
Problem solving - strategy
Problem solving - effort
Conceptual understanding/memorization
Reasoning
Total
Pre first year
Post fourth year
*** p < 0.001
** 0.001 < p < 0.01
* 0.01 < p < 0.05

Figure 1


0.9
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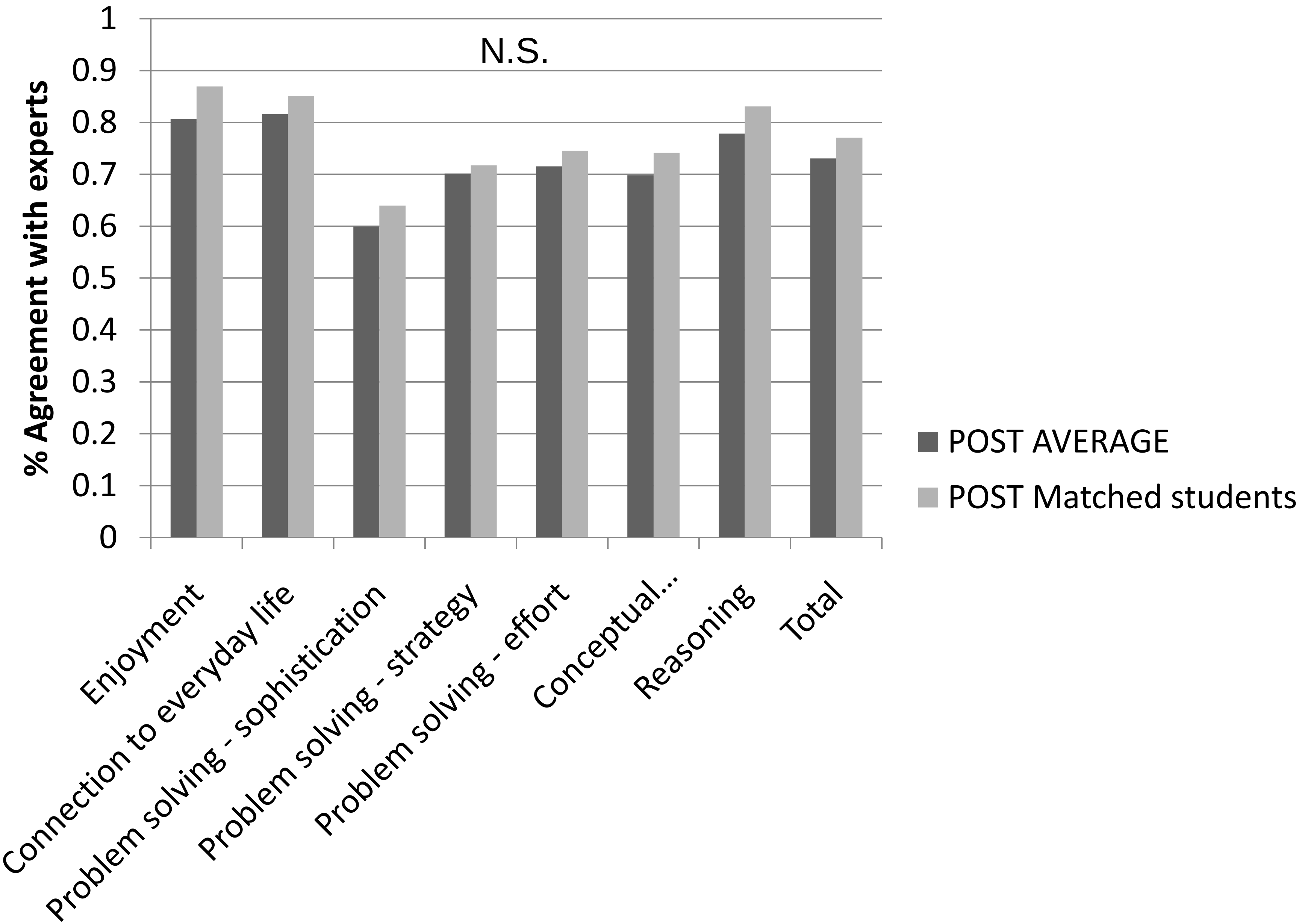
% Agreement with experts
***
*
*
Enjoyment
Connection to everyday life
Problem solving - sophistication
Problem solving - strategy
Problem solving - effort
Conceptual...
Reasoning
Total
PRE AVERAGE
PRE Matched students
*** p < 0.001
** 0.001 < p < 0.01
* 0.01 < p < 0.05

Figure 2



N.S.
% Agreement with experts
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Enjoyment
Connection to everyday life
Problem solving - sophistication
Problem solving - strategy
Problem solving - effort
Conceptual...
Reasoning
Total
POST AVERAGE
POST Matched students

Figure 3

DISCUSSION

While it is encouraging to see significant shifts for four of the categories: enjoyment, use/enjoy in everyday life, problem solving - sophistication, and conceptual understanding, it is discouraging not to see a significant difference in other categories (i.e., problem solving - effort, problem solving - strategy, reasoning). Furthermore, fourth year students scored 75% or lower on problem solving and conceptual understanding/memorization categories , while they scored well over 80% in Reasoning, Enjoyment and Connection to everyday life categories.

These results suggest that this university program may increases students' enthusiasm for biology, but it does not make them very confident problem solvers.

Many authors hypothesize that a change in teaching methods to include interactive classroom activities will improve students' attitudes toward science, i.e. that an increase in student engagement during class will result in a larger number of students having favourable attitudes.

DISCUSSION (CONT.)

For example, Brewe et al. (2009) used inquiry laboratories and class activities that focused on conceptual reasoning and problem solving, Erdemir (2009) and Adesoji (2008) implemented activities that focused on problem solving techniques, Ewing et al. (1987) implemented small group discussions and associated short readings outside the textbook , Redish and Hammer (2009) redesigned an entire course in order to focus classroom activities on conceptual change, and Otero and Gray (2008) implemented inquiry-based learning activities and activities where students were asked to reflect on their own learning. These studies all found positive attitudinal shifts in categories such as problem solving, conceptual connections, sophistication and applied conceptual understanding.

It is however important to note that significant changes in attitudes often do not happen within the short term of a semester. Instead, programs that succeed to improve students' attitudes toward a discipline may experience small changes within courses, while significant changes occur over the course of the program. We therefore emphasize the benefit of assessing student attitudes in as many courses as possible in order to track changes.

DISCUSSION (CONT.)

How does our matched student group differ from the average student in the biology program?

This study suggests that students who completed the biology program started the program with more favorable attitudes towards biology than students who did not complete the program. However, it seems that attitudes towards enjoyment of biology and conceptual understanding/memorization were most important, while attitudes towards problem solving did not matter.

Suggestions for further analysis:

Does GPAs differ between matched student group and the average students?
Does GPA determine attitudinal shifts within the matched student group?

IMPLICATIONS FOR TEACHING AND LEARNING

• Assessment of changes in student attitudes facilitates the evaluation of course material and classroom activities.

• The benefit of assessing student attitudes is maximized if changes for each student can be tracked throughout a program, i.e. attitudinal surveys should be given in as many courses as possible.

• The number of students who adopt “expert-like” attitudes towards biology is expected to increase if:

1) Clear learning goals are set up for each course
2) Classroom activities that provide students with ample opportunities to practice problem solving are designed and implemented for each learning goal, and
3) Assessments are designed to measure the impact of such activities.

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