

Notes from the Life Sciences Carl Wieman Science Education Initiative

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Upcoming CWSEI events:

Wednesday, February 11, 2009. 11:00am – 12:00pm Michael Smith Lab 102

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A Balance – Effective Levels of Guidance for Student Engagement and Learning

Educators have found that use of heavily guided activities do not elicit the deep thinking and learning from students that we desire. In response many have tried pure discovery learning and found that students were not able to “discover” the science for themselves. Further studies reveal that appropriate scaffolding of the material is needed to help students build a mental framework about the concept. Then students can construct their own understanding within this framework. We will present a recent study of the effect levels of guidance have on students’ use of interactive computer simulations. We have conducted hundreds of individual student interviews during which the students described what they were thinking as they interacted with simulations. After comparing the results of several different levels of guidance, we found that the nature of guidance influences the amount of student engagement. Minimal, but nonzero guidance with many of these simulations promotes optimum engaged exploration and learning.

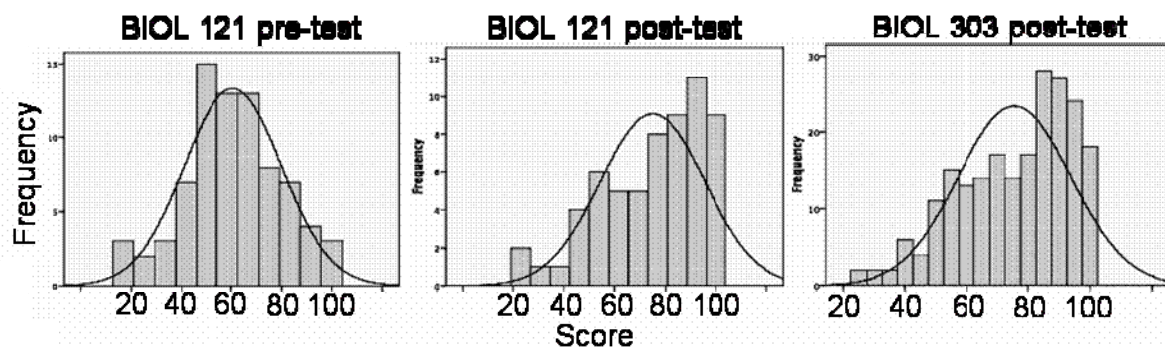
Investigating Conceptual Understanding of Natural Selection

Harald Yurk has been assessing conceptual understanding of natural selection in 1st and 3rd year students before and after instruction, using a multiple choice survey (Conceptual Inventory of Natural Selection, CINS developed at the San Diego State University, Anderson, Fisher, & Norman 2002). The survey tests key principles of natural selection with a total of 20 questions, based on three scenarios. No specific knowledge of the scenarios is necessary to understand the questions.

In this report we show preliminary data collected from Biology 121 and Biology 303. In Biology 121, the 20 survey questions were split into two tests: Test 1 (13 questions) and Test 2 (12 questions) had some overlap of questions. Half of the students completed either Test 1 or Test 2 at the beginning of the course, and completed the alternate test at the end. Biology 303 students completed the 20-question test after instruction on natural selection.

There appeared to be significant improvement in conceptual understanding of natural selection after taking BIOL 121, based on a mean improvement in maximum score between pre and post assessment (14% more correct answers; paired t-test, $t=-5.493$, $p<0.005$). The difference between the two score distributions remains significant even when normality is not assumed (Mann Whitney U-Test; $p<0.005$). Interestingly the gap in students’ understanding appeared to increase during the term in BIOL 121. Investigation into correlating factors and potential differences between Test 1 and Test 2 is ongoing and we are repeating the test this term. (*continued overleaf*)

Conceptual understanding in 1st and 3rd year students (after instruction) did not show any significant differences in mean values. We caution that this result compares the mean values of Test 1, (13 of the 20 questions) and the whole assessment (all 20 questions). However, when only responses to questions 1 to 13 were compared between students in Biology 121 and Biology 303 there still was no significant difference based on Student's T-test or Mann Whitney U-test. If the probability distributions instead of the real distributions are considered, the score difference becomes significant (Kolmogorov Smirnov z; $p=0.001$). This could mean that the gap between low and high scoring students widened further while the number of average scorers stayed proportionally similar. All tests were two-tailed although upper tail differences would have been overestimated due to the maximum possible score. More analysis of potential influences on the scores will be conducted in the coming weeks.



Please note that the y-axis scale differs between graphs. The difference between high and low scorers in Biol 303 is much greater than the difference in Biol 121 post test.

We're around.

If you're interested in talking to us about your course(s), or teaching /learning, or have a potential project, feel free to contact anyone of your LS-CWSEI team: Jared Taylor <jtaylor@zoology.ubc.ca>, Harald Yurk <yurk@zoology.ubc.ca>, Gulnur Birol <Birol@science.ubc.ca>, George Spiegelman <spie@interchange.ubc.ca>.