A Biology Placement Test for Introductory Majors Biology
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Background & Development

Biology 211, the gateway course for our major, covers cells, metabolism, and genetics. Prior to 2013, there were no prerequisites for this course and we observed years of high F/RoP rates despite incorporating active learning strategies in 2009.

Placement tests in writing, reading, and math are readily available, including commercial products (e.g. Accuplacer). While the American Chemical Society has developed a widely used placement test, Biology lacks such tools - even though many programs describe tests on-line (see adjacent summary).

Thus, we developed a Biology 211 content-targeted test based on the 2011 Oregon Dept. of Education Standards for Middle & High School Science. Six questions of the 30 total are organized thematically below.

Middle School: Describe the atomic model and explain how the types and arrangements of atoms determine the physical and chemical properties of elements and compounds.

High School: Compare and contrast the four types of organic macromolecules.

Which is found in the nucleus of an atom?
- a. protons only
- b. electrons only
- c. protons and electrons
- d. protons and neutrons

Which is the most hydrophilic?
- a. proteins
- b. lipids
- c. carbohydrates
- d. nucleic acids

High School: Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.

High School: How do cells grow?
- a. carbon dioxide
- b. water
- c. oxygen
- d. light

High School: Explain how cellular processes are regulated in response to the environment.

Photosynthesis produces:
- a. carbon dioxide
- b. water
- c. oxygen
- d. light

A red blood cell in a high salt solution will:
- a. explode
- b. appear shriveled
- c. appear normal
- d. appear swollen but not explode

High School: Explain and apply laws of heredity and their relationship to DNA.

High School: Describe the structure of DNA and its relationship to chromosomes. Explain the role of DNA in protein synthesis.

Crossing two heterozygous individuals yields:
- a. all dominant offspring
- b. all recessive offspring
- c. 1:1 dominant: recessive offspring
- d. 3:1 dominant: recessive offspring

Reading RNA information into protein:
- a. is called replication
- b. is called translation
- c. is called transcription
- d. is called mutation

For the analysis of placement test vs. course outcome, the course outcome for students who took the placement test left the university, most within 2 years of initial enrollment.

Conclusions and Future Work

We observed some knowledge gaps between 2011 Oregon education science standards and our placement test, particularly in terms of cell division.

Many students (nearly 40%) chose to leave Biology after completing a non-majors course focused on cell biology and genetics - mostly (73%) after failing the placement test.

In terms of long-term analysis (2013 cohort only), half of all students who failed the placement test left the university, most within 2 years of initial enrollment.

In terms of long-term analysis (2013 cohort only), 27% are earning Natural Science degrees, 39% Health-focused degrees, and 13% Education degrees.

The next phase of this project involves looking at long-term dynamics of other placement test cohorts, as well as progress over time within the Biology degree.

Previous Presentations About This Work
S.M. Boomer, M.J. Baltzley, K.L. Latham. 2012. Active Learning and Advising Strategies in Freshman Introductory Biology - If You Build It, Some Will Come. ASM-CUE.

S.M. Boomer, M.J. Baltzley, K.L. Latham. 2013. Active Learning and Advising Strategies in Introductory Biology II - If You Click It, a Few More Will Come. ASM-CUE.