DOMAIN 3: Learner Assessment / Outcome Assessment

Do not exceed 2 pages

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1. Name your learner assessment activity(ies):

My activities are carried out in the 500 student course Biology 107-Introductory Cell Biology and Genetics that I teach each Fall and Spring semester. Overall, I seek to understand the underlying factors that impact student learning in large lecture, introductory STEM courses. I am especially interested in characterizing the impacts of Course-Based Undergraduate Research Experiences (CUREs) on student motivation, academic performance, and retention. Further, I seek to measure the impact that proximal stress and early childhood adverse experiences have on undergraduate student learning and educational outcomes in introductory STEM courses.

2. Your role(s): Describe your role(s) and specifically what you contribute to learner assessment.

I am the course coordinator for Biology 107 in Pullman. I am involved in all aspects of the design and implementation of assessment in this course.

3. Learners and amount of contact: Describe types, levels and numbers of learners.

Biology 107 has an enrollment of 504 students. There is one lecture section held in Todd 116 (Todd Auditorium), one of the largest classrooms on campus. Students enroll in one, 3 hour section of lab each week with a total of 21 lab sections (24 students each). In Spring 2017, the demographics of the enrolled students were as follows. Freshmen-41%, Sophomores-34%, Juniors-18%, Seniors-7%, and Post-Bac or non-degree seeking students-1%. From this, one can see that the common descriptor “Freshman” biology is not quite accurate. Students in the class that semester represented 52 different majors at WSU. These included popular life science degrees, including all four offered in CVM, but there were also students from the Physical Sciences, Engineering, Social Sciences, Education, Business Administration, Pre-health, and Nursing.

4. Goals for assessment: List goals for assessment. If these are extensive, provide just a few illustrative examples.

My current specific learner assessment activities are designed to answer the following questions:

A. How do CUREs, and in particular SEA-PHAGES, impact student retention, academic performance, and motivation in the life sciences?

B. What skills, knowledge, and attitudes are imparted to students by their participation in the HHMI SEA-PHAGES CURE? For example, what is the impact on students’ scientific processing skills?

C. Do Prosocial class structures positively influence student performance in CURE laboratories? If yes, then how and why?

D. How can the tenets of Scientific Teaching, and in particular active learning focused on model-based learning, be best implemented in large classroom environments?

5. Methods: Describe assessment formats and methods, how these align with objectives, and rationale for choices.

A. To measure student motivation in STEM, I provide my students two validated instruments, SMQ and CLASS in a pre-post format every semester.

B. To measure student retention, I have looked at a retrospective analysis of student academic majors from semesters before SEA-PHAGES (introduced in Spring 2015) and after its introduction.

C. I worked with an undergraduate researcher from 2015-2017 to use the validated EDAT, BEDCI, and TOSLS instruments in a pre-post format in the 107 laboratories to measure student gains in scientific literacy skills. We also developed and continue to refine a new instrument that can be used in a pre-post format to measure student learning gains in the SEA-PHAGES laboratory

D. I keep meticulous records on student performance each semester in Biology 107, including performance on all major assessments, in order to measure the impact of SEA-PHAGES and other pedagogical changes on student academic performance.

E. I have a collaboration with Xyan Neider in Education where we have adopted the ACE questionnaire and the CCLSS instruments to measure students’ early childhood experiences and proximal stress. We have also used focus groups and interviews to gather qualitative data about students’ experience in

college, and introductory STEM classrooms and how their prior personal experiences impact their academic performance

F. I have a CVM-funded collaboration with Andy Cavagnetto (Biology/Education) to design a prosocial environment for the Biology 107 laboratory, and to measure its impact on student learning and performance

6. Rationale - builds on best practice/evidence: Describe your preparation including the use of best practice and evidence where available, your professional development, and/or congruence with national, curriculum, and/or program goals and resource utilization.

My class has been constructed using the blueprint for 21st century life science education laid out in national reports like Vision & Change (NSF/AAAS) and Bio2010. I have been involved in the NAS/HHMI Summer Institute on Scientific Teaching for four years now, having served as an external facilitator twice at Utah State and twice as the internal director at WSU. I use the principles of Scientific Teaching in designing my class structure and aligning my assessment and classroom activities.

7. Results and impact: Describe evidence of learner satisfaction (*e.g. student ratings*), evidence of appropriate rigor (*e.g. exam statistics such as mean, median, SD, number of C,D & F grades, etc.*), application of assessment process to other settings at your institution, impact on educational programs, and/or recognition/honors within the institution.

Question A: SMQ-CLASS results show that students that participate in SEA-PHAGES retain high levels of motivation to pursue studies in the life sciences, whereas students in traditional laboratories show a significant drop in motivation.

Question B: When we used TOSLS, BEDCI, and EDAT, all instruments designed around experimental design and data interpretation in ecology, we saw no learning gains for students in SEA-PHAGES. We are going to measure learning gains starting in Fall 2017 using our recently developed SEAPHAGES assessment instrument that is designed for a microbiology/molecular biology laboratory experience. During our development phase, post-course data showed that students were answering on average 8.4/10 questions correctly on our SEAPHAGES assessment instrument, including 75-94% success rates on experimental design questions related to phage hunting.

In Fall 2014, my C-/D/F/W rate in the class was 37%. After the introduction of SEA-PHAGES in Spring 2015, my C-/D/F/W rate has dropped to 24% on average each semester. Student performance rose on examinations, and increases in course grade averages were especially notable for Freshmen (C to B-) and underrepresented minorities (C- to C+). Students at high risk for failure (low HS GPA and SAT scores) have shown 20% higher pass rates after the introduction of SEA-PHAGES (jump from 40% to 60%).

Question C: In Spring 2017, we had ½ of the lab sections use a prosocial interaction to learn the fundamentals of phage biology, whereas the other lab sections were provided the same materials but in an unstructured learning environment. A report of the outcomes of Prosocial interventions in introductory STEM labs will be provided to CVM in Fall 2017.

8. Reflective critique: Describe your reflections, what went well and plans for improvement.

So far, the transformation of Biology 107 has gone extremely well. There are areas for improvement, however. First, students only write a laboratory report in the 107 lab, and I recognize now that students need to be provided more opportunities in the lecture to write. I am working with Drs. Cavagnetto and Offerdahl to implement the Science Writing Heuristic in the Biology 107 lecture in Fall 2017. Second, analysis of the CLASS motivation data using statistical modeling shows that the motivation of first generation students decreases over the course of the semester in Biology 107, whereas the same is not seen for non-1st gen students. The results of the ACE-CCLSS study will hopefully identify important factors in the Biology 107 classroom environment that can be improved to help 1st-gen students stay motivated and succeed at levels.

9. Dissemination: If applicable, describe how your efforts have been recognized by others externally through peer review, dissemination, use by others, or awards nationally.

My work on scaling up CURE experiences for large classes was recognized by HHMI when I was invited in Fall 2015 to be a facilitator at their Constellation Studio for CUREs. I have been invited to present my work on ACEs/Proximal stress at WSU several times to audiences in student services and assessment work groups.