EWU Programmatic SLO Assessment
AY 2015-16 and "Closing the Loop" for AY 2014-15

Degree/Certificate: BS
Major/Option: Biology
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Date: 15 September 2016

Part I – Program SLO Assessment Report for 2015-16

Part I – for the 2015-16 academic year: Because Deans have been asked to create College-Level Synthesis Reports annually, the template has been slightly modified for a) clarity for Chairs and Directors, and b) a closer fit with what the Deans and Associate Deans are being asked to report.

1. **Student Learning Outcome**: The student performance or learning outcome as published either in the catalog or elsewhere in your department literature.

Objective	*Student Learning Outcome…students will…*	*Measure*
Provide knowledge content across the full range of biology	1. Demonstrate ability to correctly articulate key concepts of evolution, diversity of life, ***form and function*** of living organisms, information flow, transfer of energy	1. National content test OR Course-embedded measures
Understand and use scientific methodology	2. Interpret observations through the creation, testing, analysis of hypotheses	Course-embedded measures
	3. Design laboratory or field experiments	Course-embedded measures
	4. Inspect data and apply basic statistics to their analysis and communication	Course-embedded measures
Communicate about biological science	5. Write reports and prepare and deliver oral reports on scientific findings that • Demonstrate ability to use scientific journals, periodicals, and electronic media to access current biological information • Demonstrate ability to evaluate journal articles from the primary literature	Course-embedded measures

Assessment for AY 2015-16 Focused on student knowledge specifically related to the relationship between the form and function of living organisms. This knowledge was assessed in both an introductory course (BIOL173) and an upper division elective (BIOL450).

2. **Overall evaluation of progress on outcome:** Indicate whether or not the SLO has been met, and if met, to what level.

    ______*SLO is met after changes resulting from ongoing assessments, referencing assessment results from the previous year to highlight revisions;*

    __*X*__*SLO is met, but with changes forthcoming;*

    ______*SLO is met without change required*

3. **Strategies and methods:** Description of assessment method and choices, why they were used and how they were implemented.

As part of Biology's overall assessment strategy, we plan to assess SLO's throughout a student's trajectory through the curriculum. For AY2015 both our introductory majors course (BIOL173) and an upper division elective (Mammalogy, BIOL450) included assessment related to the form and function of living organisms. This is one of the major subheadings associated with knowledge content within the Biology major. As different courses more directly address different components of our SLO's, subsequent years of assessment will focus on the remaining knowledge and skills outlined above.

The assessment tool implemented in BIOL173 was a pre and post course evaluation based on 15 multiple choice questions designed to test most basic concepts related to organismal form and function (see attachment #1). The initial evaluation was administered during the first week of class in spring quarter of 2016. Subsequently, the same 15 questions comprised the first 15 questions on the final exam. This approach was used as this is a large class (95 students completed both evaluations), which precludes efficiently administering many other assessment tools. In addition, the pre-course evaluation allowed the instructors to gauge the students' knowledge relative to the subject prior to the beginning of the course.

The assessment tool implemented in BIOL450 was a short answer question asking students to consider how an animals size and surface area to volume relationships influences important components of its form and function, such as skeletal support and metabolic requirements (see attachment #2). As this is an upper division elective, students should be able to apply their knowledge to a more open-ended question and compose a well-organized and logical response. The smaller course size also provides more flexibility in assessment tool and affords the instructor sufficient time to evaluate each answer critically.

4. **Observations gathered from data**: Include findings and analyses based on the strategies and methods identified in item #3.

    a. Findings: Ninety-five BIOL173 students completed both the pre- and post-course assessment. Prior to completing the course, the average score on the assessment was 8.04 and only 15 students achieved a score that would have met expectations (Figure 1). All but four of those students scored an 11 out of 15, one point above the 70% threshold identified as the minimum for meeting expectations. No student scored above a 13 and as such, no students would have been assigned to the "exceeds expectations" category (15/15).

After completing the course, the average score was 11.76 and 73 of the 95 students (76.8%) achieved the minimum score of 11/15 to meet expectations. Four students scored 15/15 and exceeded expectations. The remaining 22 students did not meet expectations (Figure 1).

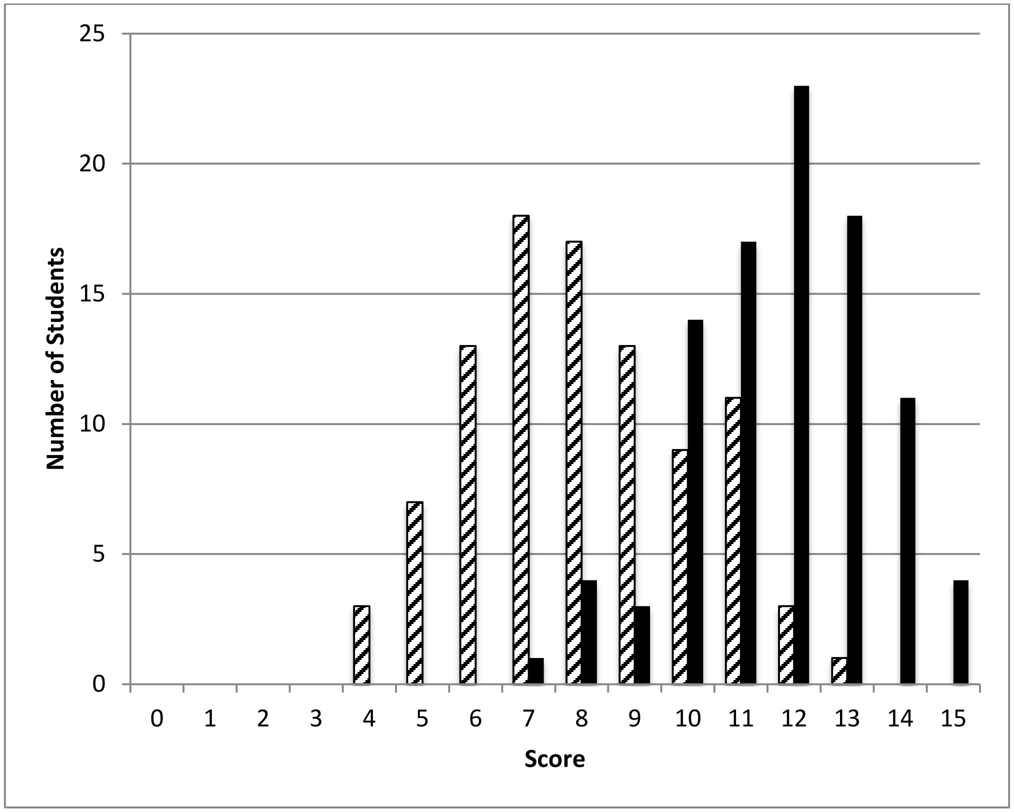


Figure 1. Student scores on the Biology 173 assessment prior to taking the course (hashed bars) and after completing the course (solid bars).

Twenty-three students completed the BIOL450 assessment. Three students exceeded the specified standard, ten students met the standard, and ten students performed below the standard.

b. Analysis of findings:

The shift in mean score from pre-course to post test demonstrated a statistically significant improvement ($P<<0.001$). Only five students failed to demonstrate some improvement after completing the course. In addition, students who scored relatively low on the pre-course evaluation, typically showed substantial improvement in the post-course evaluation (Figure 2).

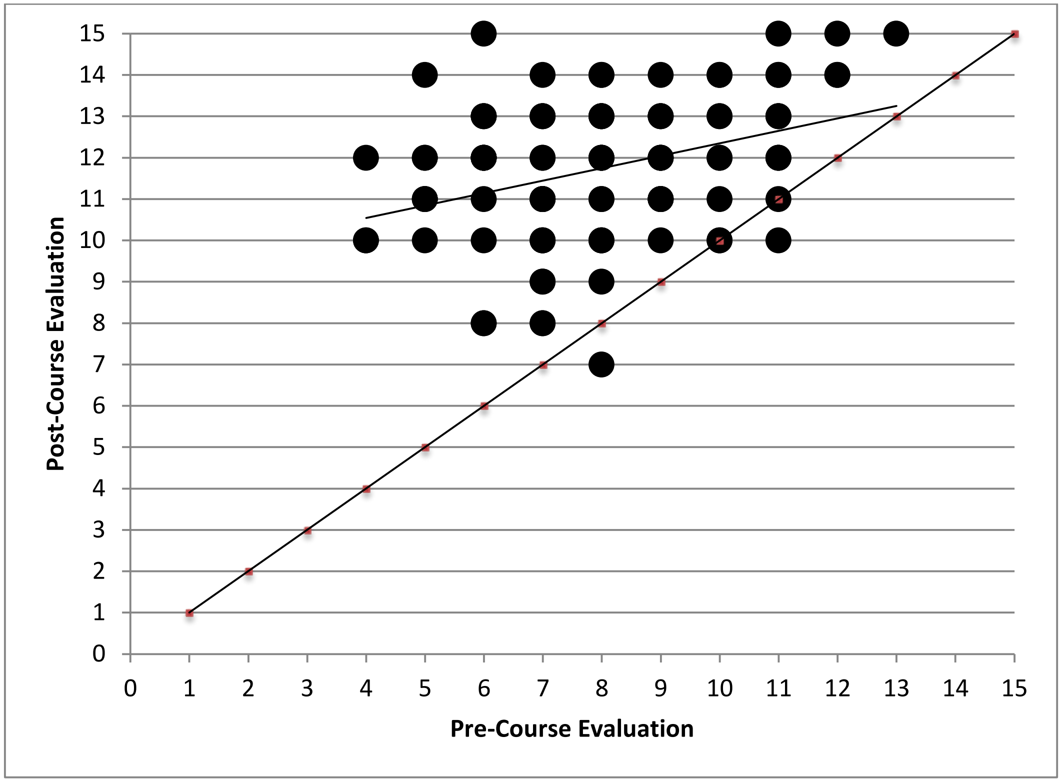


Figure 2. Relationship between pre-course evaluation score and post-course evaluation score for Biology 173 in spring of 2016. The best-fit linear trend line is provided to allow comparison to the slope of the line that would indicate no change from pre- to post-course evaluation.

5. **What program changes will be made based on the assessment results?**

   a) Describe plans to improve student learning based on assessment findings (e.g., course content, course sequencing, curriculum revision, learning environment or student advising).

A few questions on the BIOL173 need to be revised or eliminated. The wording on two questions led to some confusion. In addition, a third question focused on material that we anticipated covering in more detail that was practical based on time constraints. In addition, we will solicit input from a third faculty member that also teaches BIOL173 to insure that the same assessment tool would be suitable for her class.

In future years, an in-class exercise will be added to BIOL450 prior to the assignment of the assessment exercise. This exercise will reinforce material presented in lecture format to emphasis the consequences of body size changes.

In addition, the structure of the exercise will be altered to require peer review of articles prior to the assignment due date. This will eliminate the possibility that students wait until the last minute to do the assignment and should address one of the issues leading to poor student performance.

b) Provide a broad timeline of how and when identified changes will be addressed in the upcoming year.

The changes suggested for BIOL173 will be implemented in Spring of 2017.

The changes suggested for BIOL450 will be implemented the next time the course is taught by Professor O'Connell.

6. Description of revisions to the assessment process the results suggest are needed and an evaluation of the assessment plan/process itself.

As stand alone assessment tools, both exercises appeared to achieve our goals. For AY16 – 17 we anticipate focusing our assessment efforts on developing a strategy to track student achievement as they progress throughout our curriculum. For example, the concept of form and function is prevalent in many of our courses. We would like to coordinate assessment efforts among faculty to assess students understanding of this concept throughout their academic careers at Eastern. In order to begin this process, we have better defined our SLO's and structured those SLO's in a manner that is consistent with the natural hierarchy inherent in biology. This structure is also consistent with recommendations of document Vision and Change in Undergraduate Biology Education produced by a panel convened by the American Association for the Advancement of Science and supported by the National Science Foundation. Our SLO's with example concepts at each level of the biological hierarchy are provided in attachment 3.

We have also begun the process of mapping each course to a specific subset of programmatic SLO's and insuring that those SLO's are included on the course syllabi. SLO's were assigned to courses with input from faculty teaching those courses. We also structured our SLO to course map such that in subsequent years we will have data for each SLO from courses spanning all areas of Biology and progressing from introductory to upper division courses. This framework is provided in attachment 4.

Finally, in order to collect data across all programmatic SLO's, we have designed a schedule of which courses will be the focus of programmatic assessment in any given quarter. Over a four year period, most courses will be the focus of programmatic assessment at least twice. Our introductory series for majors (BIOL171, 172, and 173) will be assessed annually to provide a time series of student preparedness relative to our programmatic SLO's. An example schedule for AY16 – 17 and 17 – 18 is provided in attachment 5.

NOTE: The matrices provided in attachments 3 – 5 will be made available in Excel format upon request.

NEW: Part II – Closing the Loop
Follow-up from the 2014-15 Program Assessment Report

In response to the university's accrediting body, the Northwest Commission on Colleges and Universities, this section has been added. This should be viewed as a follow up to the previous year's findings. In other words, begin with findings from 2014-15, and then describe actions taken during 2015-16 to improve student learning along, provide a brief summary of findings, and describe possible next steps.

PLEASE NOTE: The university also requests that Deans complete a College-Level Synthesis report, which synthesizes which programs/certificates have demonstrated "closing-the-loop" assessments and findings based on the previous year's assessment report.

> ***Working definition for closing the loop***: *Using assessment results to improve student learning as well as pedagogical practices. This is an essential step in the continuous cycle of assessing student learning. It is the collaborative process through which programs use evidence of student learning to gauge the efficacy of collective educational practices, and to identify and implement strategies for improving student learning." Adapted 8.21.13 from http://www.hamline.edu/learning-outcomes/closing-loop.html.*

1. **Student Learning Outcome(s)** assessed for 2014-15
2.

1. Demonstrate knowledge of evolution, diversity of life, form and function of living organisms
2. Interpret observations through the creation, testing, analysis of hypotheses
3. Design laboratory or field experiments
4. Inspect data and apply basic statistics to their analysis and communication
5. Write reports and prepare and deliver oral reports on scientific findings that • **Demonstrate ability to use scientific journals, periodicals, and electronic media to access current biological information** • **Demonstrate ability to evaluate journal articles from the primary literature**

SLOs in bold were assessed for 2014-2015; these are the SLOs aimed to educate students on the process of "how to do science."

3. **Strategies implemented** during 2015-16 to improve student learning, based on findings of the 2014-15 assessment activities.
   Biology implemented two strategies to improve student learning and assessment of the above SLOs.
   - One of our ongoing issues with our efforts to ensure all our students have competency in our SLO that addresses "how to do science" is that many of our students transfer from community colleges. For a variety of reasons, it has not been feasible to require all of these students to take our BIOL 270 class which is our introductory course in "how to do science". In 2013, three Biology faculty (O'Connell, O'Quinn, Matos) attended a NSF-sponsored "PULSE" (Partners in Life Science Education) workshop that was also attended by Spokane Falls Community College Biology faculty. We discussed this issue.
   - Funded through The Howard Hughes Medical Institute, David Lopatto of Grinnell College developed an assessment tool to examine outcomes of Summer Undergraduate Research Experiences (SURE) and outcomes of Course Undergraduate Research Experiences (CURE) in STEM. A description of this can be found at: http://www.spisu.iastate.edu/sites/default/files/events/466/LopattoISUnov282012.pdf. Last spring one of Biology's Capstone courses (Animal Ecophysiology – Dr. Joyner-Matos) participated in the survey by administering a pre- and post-course survey of students in the class.

4. **Summary of results** (may include comparative data or narrative; description of changes made to curriculum, pedagogy, mode of delivery, etc.): Describe the effect of the changes towards improving student learning and/or the learning environment.
   - As an outgrowth of the PULSE workshop, we worked with Dr. Ruth Kirkpatrick who developed a BIOL 270 class for SFCC students.
   - The summary report comparing our BIOL 490 Capstone students to students in other research classes at other institutions is presented in attachment 6. The comparison of our students from other schools suggests that students in this capstone course highly rated activities such as literature review, data analysis, report writing, and conducting experiments that they developed without knowing outcome (i.e., did not conduct "canned" research projects).

5. **What further changes to curriculum, pedagogy, mode of delivery, etc. are projected based on closing-the-loop data, findings and analysis?**
   - SCC is now developing a similar course to our BIOL 270. We hope that in the future, we will be able to require all transfer students to either have had the community college equivalent or to take our BIOL 270. This will ensure students receive the foundation they need before taking more advanced courses.
   - We are encouraging all faculty teaching BIOL 270 and 490 courses to participate in the CURE survey.

Attachment 1. Multiple choice questions used to assess student understanding of form and function prior to and at the completion of Biology 173.

Biology 173 Pre-Assessment
Animal Form and Function

Please put your answers on a scantron sheet.

1. _____ Which of the following lists is arranged in order from the most simple to most complex with respect to the hierarchical organization of animal bodies?

A) cells – tissues – organs – organ systems
B) respiratory system – circulatory system – digestive system – skeletal system
C) lungs – heart – stomach – bone
D) dermis – epidermis – lumen – epithelial tissue
E) circulatory system – lungs – blood plasma – red blood cells

2. _____ You have just landed on an alien planet. One group of organisms on this planet is surprisingly human-like in appearance. As these organisms do not wear clothes, you notice that, on *all individuals*, the area between their knees and ankles is covered with an incredible number of small, thin projections of skin, giving them the appearance that they are growing spaghetti out of their legs. The most likely function of these spaghetti-like skin projections is…

A) insulation
B) attracting mates
C) propulsion while swimming
D) gas exchange
E) protection from thorny plants

3. _____ Organisms use a variety of mechanisms to signal different cells, tissues, and organs to execute a wide array of functions. For example, the hormone ADH (antidiuretic hormone) controls water reabsorption in the kidney. Which of the following mechanism allows this hormone to target a specific organ in the body?

A) ADH is only released in the kidney
B) ADH is only recognized as a signal by cells with ADH-specific receptors
C) ADH in the blood stream is directed to the kidney
D) ADH is concentrated in the kidney by counter current exchange
E) both a and d

4. _____ Which of the following processes DOES NOT use a countercurrent exchange system?

A) oxygen uptake by a fish's gills
B) urine concentration by a human's kidney

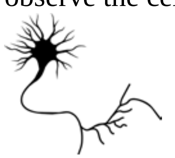
C) heat retention in a dolphin's flipper
D) chemical detection in a dogs olfactory receptors
E) all of the processes listed use a countercurrent exchange mechanism
5. _____ From a biological perspective (that is, thinking about organismal fitness), the primary advantage of sexual reproduction is…

A) it increases the amount of genetic variation among an individuals offspring
B) it increases the number of offspring that can be produced
C) it creates a genetic relationship among siblings
D) it increases the amount of genetic variation among all individuals in a population
E) it encourages a larger proportion of the population to reproduce

6. _____ Which pair of organ systems listed below is <u>most directly</u> responsible for the *production* of energy in animals?

A) endocrine and nervous
B) digestive and nervous
C) respiratory and digestive
D) respiratory and endocrine
E) excretory and immune

7. _____ While cleaning out the Biology stock room at EWU, you find a box of unlabeled microscope slides. You place one slide under a microscope and observe the cell illustrated below. Based on the appearance of this cell, which of the following is most likely its function?



A) these cells most likely form the lining of some structure or organ
B) transporting some substance by circulating through the blood stream
C) reproduction, it is most likely the gamete of a female organism
D) transporting a signal along the length of the cell
E) providing support or rigidity to some structure or organ

8. _____ Homeostasis is …

A) important for maintain an average phenotype in a population
B) the maintenance of a fairly constant internal environment
C) changing between being an endotherm or ectotherm depending upon current conditions
D) the sex that contains two copies of the same sex chromosomes (e.g. XX females in humans)
E) the ability for one organism to consume other organisms with similar chemical compositions to its own

9. _____ The loop of Henle…

A) is responsible for the absorption of most nutrients in the small intestine
B) is water permeable in the descending limb and salt permeable in the ascending limb
C) forms the counter current exchange mechanism in the gills of most fish
D) allows birds to expel salts through their nasal cavities
E) uses active transport to uptake fats which it then transports to a lacteal in the lymphatic system

10.________ While there may be some debate about the issue, for the sake of this question, let's assume that cotton underwear are required articles of clothing and that *cotton fabric is essential* for their construction in the same sense that *essential nutrients* are required by our bodies. If only one factory produced underwear and if it operated under the same restrictions that our bodies operate under, then…

A) all new underwear would be constructed from the recycled fabric of old underwear made in that factory
B) they would construct underwear from new cotton fabric produced in the factory
C) they would need to cut up cotton shirts and pants bought elsewhere to make underwear
D) all underwear would be the same size
E) everyone would be forced to wear tighty whities

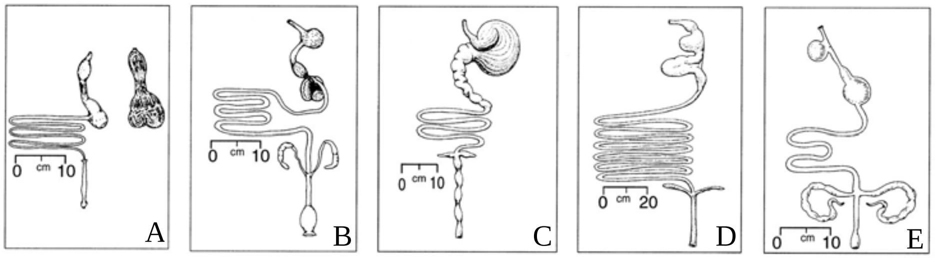
11.________ Thinking about structure and function, which pair would be most similar with regard to <u>structure</u>?

A) leaves and capillaries in the circulatory system
B) root hairs and microvilli in the small intestine
C) xylem in mature trees and blood vessels
D) companion cells and glial cells
E) the Casparian strip and smooth muscle

12._________ The anal canal is the terminal part of the large intestine and is situated between the rectum and anus. Using your understanding of cell form and function, which of the following would you expect to find <u>*in the lining*</u> of the anal canal?

A) some type of stratified epithelial tissue.
B) stratified muscle tissue
C) simple squamous epithelial tissues
D) excrethialial microvilli
E) smooth muscle tissue

13. _____ The panels below each illustrates the digestive system of a different species of bird. Based on these diagrams, which species do you think is likely to eat the highest proportion of green, leafy plant material?



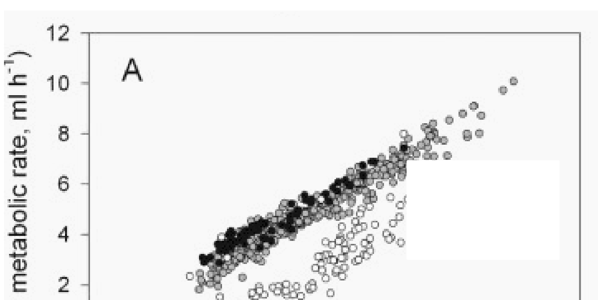
14. _____ A process in which the production of some substance decreases the rate at which that substance is produced is known as…

A) neural plasticity
B) a glycosidic linkage
C) a positive feedback loop
D) a negative feedback loop
E) an extinction vortex

15. _____ The graph below illustrates the relationship between resting metabolic rate and body mass for three groups of organisms. Oddly, there is a white box over the legend so we cannot see what group each of the three symbols represent.

Which of the following is a plausible suggestion for groups represented by each symbol.

	Black Circles	Gray Circles	White Circles
A	fish	whales	birds
B	amphibians	fish	mammals
C	mammals	reptiles	birds
D	Arctic fish	reptiles	tropical fish
E	birds	mammals	reptiles



Attachment 2. Example exam question from Biology 450 used to assess student comprehension of the relationship and importance of the form and function of organism.

Exam Question to address students' ability to articulate consequences of changes in body size in mammals: Your love of mammals compels you to go see the movie "Invasion of the Giant Shrews". You find the movie very **unrealistic** for **two main reasons**: 1) in the scene in which the heroine puts on her x-ray glasses which enable you to see the skeleton of the Giant Shrew, you see that they have **merely enlarged** the skeleton of a 5 gram shrew to a 5,000 kg elephant; and 2) each one of these 5,000 kg Giant Shrews was devouring every animal encountered, **eating as much as 100,000 5-gram shrews**!! **Explain why** you found the movie unrealistic.

Attachment 3. Programmatic SLO's with example content from different areas of biology.

Biology Programatic Student Learning Outcomes

Evolution	Information Flow	Structure and Function	Transformation of Energy and Matter	Systems
cular mechanisms of mutation, DNA , creation of new allele. Epigenetics, gene expression	Central dogma and exceptions. Intracellular and Extracellular signalling. Signal transduction pathways	3-D structure of molecules. Cell shape, organelle shape, membrane shape.	Metabolism. Synthesis and breakdown of molecules.	Cellular response to physical and chemical signals. Developmental patterns in space and time. Cascading effects of small changes.
anges in protein structure and/or egulation. adaptive changes in ological function in response to the onment. Constraints and trade-offs.	Alteration of physiological function resulting from gene expression. Coordinated responses & homeostasis.	Cells, tissues, organs, organ systems. SA : V, tradeoffs	Energy use associated with activities necessary for life (synthesis, growth, transport, movement)	Interaction of cells, tissues and organ systems. Homeostasis, feedback loops, control mechansims.
tive changes at the populaiton level sponse to environmental stressors. scent with modification leading to diversity.	Transmission of genetic material from parent to offspring. Fitness. P=G+E	Anatomic shape tied to ecological function. Interactions also mediated by morphological, physiological, and behavioral traits	Transfer of energy among trophic levels. Transfer of elements between abiotic and biotic components fo an ecosystem.	Population regulation as a result of biotic and abiotic interaction. Dynamic ecosystems and associated responses. Interactions among organsims within communities and ecosystems.

Attachment 4. Content-based programmatic SLO to be assessed by each course in Biology.

Biology Department Content-Based Student Learning Outcomes

Course Number	Course Title	Evolution				Information Flow				Structure and Function				Energy & Matter				Systems			
		Cell Mol	Phys	Ecol Evol	Div	Cell Mol	Phys	Ecol Evol	Div	Cell Mol	Phys	Ecol Evol	Div	Cell Mol	Phys	Ecol Evol	Div	Cell Mol	Phys	Ecol Evol	Div
BIOL100	Intro Biology																				
BIOL115	Investigaing Biology																				
BIOL232	Human A&P I																				
BIOL233	Human A&P II																				
BIOL234	Human A&P III																				
BIOL235	El. Medical Micro																				
BIOL171	Biology I	X	X			X				X				X	X			X			
BIOL172	Biology II			X				X								X				X	
BIOL173	Biology III						X				X								X		
BIOL270	Biological Investigations																				
BIOL310	Fundamentals of Genetics	X				X		X													
BIOL380	Data Analysis for Biol.																				
BIOL301	Microbiology					X												X			
BIOL302	Botany			X								X			X						
BIOL303	Invertebrate Zoology			X								X									
BIOL304	Vertebrate Zoology			X	X							X									
BIOL440	Ecology		X													X				X	
BIOL423	Evolution																				
BIOL436	Cell Biology					X				X											
BIOL438	Molecular Biology	X				X	X														
BIOL351	Princ. Animal Physiology		X																	X	
BIOL352	Princ. Plant Physiology														X				X		
BIOL353	Princ. Microb. Physiology		X												X						
BIOL 334	A&P - Majors III										X								X		
BIOL 490	Senior Capstone - Climate															X					
BIOL 490	Senior Capstone - Microbiome																				
BIOL 490	Senior Capstone - Learning																				
BIOL490	Senior Capstone - Development																				
BIOL 490	Senior Capstone - Disease Ecol			X				X												X	
BIOL490	Senior Capstone -Ecophysiology																				
BIOL490	Senior Capstone -Field Ecol																				
BIOL 332	A&P - Majors I										X				X				X		
BIOL 333	A&P - Majors II													X				X	X		
BIOL343	Biology of Aging													X				X	X		
BIOL411	Field Botany				X								X								
BIOL421	Medical Bacteriology									X				X				X			
BIOL430	Immunology									X				X				X			
BIOL432	Virology																				
BIOL435	Biology of Cancer	X				X															
BIOL441	Ecology Lab																			X	
BIOL442	Conservation Biology							X												X	
BIOL443	Wildlife Management																			X	
BIOL446	Riparian Ecology																			X	
BIOL450	Mammalogy			X							X	X									
BIOL454	Ornithology			X	X							X									
BIOL462	Ichthyology			X								X									
BIOL481	FW Invert Zool			X																	
BIOL496	Human Genetics																				
BIOL496	Plant Microbe Interactions																				
BIOL496	Evolution of Land Plants																				
BIOL485	Molecular BioTech	X				X															
BIOL488	Molecular BioTech Lab																				
BIOL489	Topics in Molecular Biol.					X															
BIOL510	Biological Research Methods																				
BIOL511	Advanced Biostats																				
BIOL514	Current Topics in Ecology / Evolution																				

Attachment 4 [continued]. Skills-based programmatic SLO to be assessed by each course in Biology.

Course Number	Course Title	Biology Department Skills-Based Student Learning Outcomes						
		Experimenta Design and Data Analysis			Communication Skills		Access Scientific Information	
		Create, Test, & Analyze Hypotheses	Experimental Design	Apply Basic Statistic	Report Scientific information (writing)	Report Scientific information (orally)	Use Scientific Journals	Evaluate Journal Articles
BIOL100	Intro Biology							
BIOL115	Investigaing Biology							
BIOL232	Human A&P I							
BIOL233	Human A&P II							
BIOL234	Human A&P III							
BIOL235	El. Medical Micro							
BIOL171	Biology I							
BIOL172	Biology II							
BIOL173	Biology III							
BIOL270	Biological Investigations	X	X	X	X		X	X
BIOL310	Fundamentals of Genetics							
BIOL380	Data Analysis for Biol.							
BIOL301	Microbiology							
BIOL302	Botany							
BIOL303	Invertebrate Zoology							
BIOL304	Vertebrate Zoology							
BIOL440	Ecology							
BIOL423	Evolution							
BIOL436	Cell Biology							
BIOL438	Molecular Biology							
BIOL351	Princ. Animal Physiology							
BIOL352	Princ. Plant Physiology							
BIOL353	Princ. Microb. Physiology							
BIOL 334	A&P - Majors III							
BIOL 490	Senior Capstone - Climate	X	X	X	X		X	X
BIOL 490	Senior Capstone - Microbiome	X	X	X	X		X	X
BIOL 490	Senior Capstone - Learning	X	X	X	X		X	X
BIOL490	Senior Capstone - Development	X	X	X	X		X	X
BIOL 490	Senior Capstone - Disease Ecol	X	X	X	X		X	X
BIOL490	Senior Capstone -Ecophysiology	X	X	X	X		X	X
BIOL490	Senior Capstone -Field Ecol	X	X	X	X		X	X
BIOL 332	A&P - Majors I							
BIOL 333	A&P - Majors II							
BIOL343	Biology of Aging							
BIOL411	Field Botany							
BIOL421	Medical Bacteriology							
BIOL430	Immunology							
BIOL432	Virology							
BIOL435	Biology of Cancer							
BIOL441	Ecology Lab							
BIOL442	Conservation Biology							
BIOL443	Wildlife Management							
BIOL446	Riparian Ecology							
BIOL450	Mammalogy							
BIOL454	Ornithology							
BIOL462	Ichthyology							
BIOL481	FW Invert Zool							
BIOL496	Human Genetics							
BIOL496	Plant Microbe Interactions							
BIOL496	Evolution of Land Plants							
BIOL485	Molecular BioTech							
BIOL488	Molecular BioTech Lab							
BIOL489	Topics in Molecular Biol.							
BIOL510	Biological Research Methods							

Attachment 5. Tentative schedule for courses to contribute to programmatic assessment form academic years 16 – 17 and 17 – 18.

DRAFT SCEHDULE FOR PROGRAMMATIC ASSESSMENT (13 May 2016)

Course Number	Course Title	F 2016	W 2017	Sp 2017	Su 2017		F 2017	W 2018	Sp 2018	Su 2018
BIOL100	Intro Biology									
BIOL115	Investigaing Biology									
BIOL232	Human A&P I									
BIOL233	Human A&P II									
BIOL234	Human A&P III									
BIOL235	El. Medical Micro	X							X	
BIOL171	Biology I	X					X			
BIOL172	Biology II		X				X	X		
BIOL173	Biology III			X				X	X	
BIOL270	Biological Investigations	X	X	X	X		X	X	X	X
BIOL310	Fundamentals of Genetics		X						X	
BIOL380	Data Analysis for Biol.	X								
BIOL301	Microbiology		X						X	
BIOL302	Botany		X							
BIOL303	Invertebrate Zoology	X								
BIOL304	Vertebrate Zoology	X						X		
BIOL440	Ecology			X			X			
BIOL423	Evolution		X							
BIOL436	Cell Biology		X				X			
BIOL438	Molecular Biology			X			X			
BIOL351	Princ. Animal Physiology							X		
BIOL352	Princ. Plant Physiology									
BIOL353	Princ. Microb. Physiology	X								
BIOL 334	A&P - Majors III									
BIOL 490	Senior Capstone - Climate	X					X			
BIOL 490	Senior Capstone - Microbiome		X					X		
BIOL 490	Senior Capstone - Learning		X					X		
BIOL490	Senior Capstone - Development									
BIOL 490	Senior Capstone - Disease Ecol									
BIOL490	Microbial Physiology			X					X	
BIOL490	Senior Capstone -Ecophysiology			X					X	
BIOL490	Senior Capstone -Field Ecol									
BIOL490	Senior Capstone - Bioinformatics		X					X		
BIOL 332	A&P - Majors I									
BIOL 333	A&P - Majors II									
BIOL343	Biology of Aging						X			
BIOL405	Limnology								X	
BIOL409	Mycology	X								
BIOL411	Field Botany								X	
BIOL421	Medical Bacteriology							X		
BIOL430	Immunology			X						
BIOL432	Virology						X			
BIOL435	Biology of Cancer							X		
BIOL441	Ecology Lab			X			X			
BIOL442	Conservation Biology						X			
BIOL443	Wildlife Management									
BIOL446	Riparian Ecology								X	
BIOL450	Mammalogy									
BIOL454	Ornithology			X						
BIOL462	Ichthyology	X								
BIOL471	Pre Professional Seminar									
BIOL477	Embryology									
BIOL480	Clinical Lab Theory & Practicum									
BIOL483	Clinical Lab Theory & Practicum IV									
BIOL481	FW Invert Zool								X	
BIOL496	Human Genetics									
BIOL496	Plant Microbe Interactions		X							
BIOL496	Skeletal Biology	X								
BIOL496	Evolution of Land Plants									
BIOL496	Ecosystem Ecology		X							
BIOL496	Fish & Wildlife Management		X							
BIOL485	Molecular BioTech									
BIOL488	Molecular BioTech Lab									
BIOL489	Topics in Molecular Biol.									
BIOL510	Biological Research Methods									
BIOL511	Advanced Biostats									
BIOL514	Current Topics in Ecology / Evolution									
ENVS100										
ENVS400	Sr. Seminar Env. Sci.									
BIOL390	Secondary Biology Methods									

Attachment 6. Results of the CURE Survey

Spring 2016 CURE Report

A Collaborative Project Funded by HHMI

The CURE survey offers a comparison of learning benefits between course experiences and undergraduate research experiences. The pre-course survey collects student data based upon demographic questions, reasons for taking the course, level of experience on various course elements, science attitudes, and learning style. The post-course survey parallels the pre-course survey and includes additional questions that focus on student estimates of learning gains in specified course elements, estimates of learning benefits that parallel questions in the SURE surveys, overall evaluation of the experience, and science attitudes.

David Lopatto
Leslie Jaworski

Spring 2016 CURE Report
A Collaborative Project Funded by HHMI
Summary for **Eastern Washington University** (BIOL 490 - Senior Capstone)

	Your Students		All Students*	
	PreCourse	PostCourse	PreCourse	PostCourse
N**	23	21	9227	8878

** The data from "all students" in this report was obtained from the CURE Survey between June 1, 2015 - May 24, 2016.*

*** N represents the total number of respondents. Note that not every respondent answered each question in the survey, resulting in Ns smaller than the total (participation) postcourse N. In such instances, the total is represented by a lower case n.*

Demographics

Gender

	Your Students		All Students		
	PreCourse	PostCourse	PreCourse	PostCourse	
	10	8	3127	2985	**Male**
	13	12	5923	5550	**Female**
n	23	20	9050	8535	

Ethnicity

	Your Students		All Students		
	PreCourse	PostCourse	PreCourse	PostCourse	
	0	0	2	3	**Alaskan Native**
	0	0	78	80	**American Indian**
	0	1	1039	1005	**Asian American**
	0	0	691	607	**Black or African American**
	0	0	78	78	**Filipino**
	0	0	151	136	**Foreign National**
	0	0	2	6	**Hawaiian**
	1	1	733	579	**Hispanic/Latino**
	0	0	15	13	**Pacific Islander**
	19	17	5461	5307	**White**
	2	1	474	416	**Two or more races**
	0	0	217	186	**Other**
n	22	20	8941	8416	

	Your Students		All Students		Current Status
	PreCourse	PostCourse	PreCourse	PostCourse	
	0	0	73	51	**High School**
	0	0	3043	2915	**First-year college student**
	0	2	2264	2118	**Second-year college student**
	1	0	1708	1665	**Third-year college student**
	22	19	1730	1688	**Fourth-year college student**
	0	0	101	72	**Graduate or medical student**
	0	0	200	132	**Other**
n	23	21	9119	8641	

Academic Information

	Your Students		All Students		Declared Major
	PreCourse	PostCourse	PreCourse	PostCourse	
	23	20	7198	7342	**Yes**
	0	1	1990	1351	**No**
n	23	21	9188	8693	

	Your Students		All Students		Considering Science Major
	PreCourse	PostCourse	PreCourse	PostCourse	*(excludes those already science majors)*
	n.a.	1	1138	750	**Definitely yes**
	n.a.	0	525	300	**It is likely**
	n.a.	0	182	152	**I'm not sure**
	n.a.	0	69	67	**It is unlikely**
	n.a.	0	33	51	**Definitely no**
n	*n.a.*	1	1947	1320	

PreCourse Survey: Post-Graduate Plans

	Your Students	*All Students*	%	
	6	1094	12.6%	**Grad school for Ph.D. in biology field**
	0	255	2.9%	**Grad school for Ph.D. in physical science field**
	0	566	6.5%	**Grad school for Masters in life science**
	1	325	3.7%	**Grad school for Masters in physical science**
	1	429	4.9%	**Grad School for Ph.D. or Masters in social science**
	0	64	0.7%	**Grad school for Ph.D. or Masters in humanities or fine arts**
	1	127	1.5%	**Earn certification or degree to qualify for teaching**
	0	2285	26.3%	**Go to school for a medical degree (M.D.)**
	1	1240	14.3%	**Go to school for an M.D./PhD.**
	6	1464	16.9%	**Go to school for other health professions**
	0	276	3.2%	**Go to grad school for professional degree other than above (such as law)**
	6	562	6.5%	**No graduate education in near future**
n	22	8687		

PostCourse Survey: Post-Graduate Plans

	Your Students	*All Students*	%	
	5	1055	13.8%	**I have not considered post-graduate education**
	1	206	2.7%	**I now plan NOT to pursue post-graduate education**
	4	1619	21.1%	**I now plan to pursue a Master's degree in science field**
	3	1609	21.0%	**I now plan to pursue a Doctoral degree in science field**
	1	344	4.5%	**I now plan to pursue a Master's degree in non-science field**
	0	124	1.6%	**I now plan to pursue a Doctoral degree in non-science field**
	2	2585	33.7%	**I now plan to pursue a medical degree**
	0	126	1.6%	**I now plan to pursue a law, architectural, or other degree**
n	16	7668		

PreCourse Survey: Reasons for Taking Course

10 reasons for taking a course **1 = Not important, 3 = very important**

Your Students

Level of Importance				
Not	***Moderate***	***Very***	N*	
4	5	9	*18*	**To fill a distribution requirement**
1	2	20	*23*	**To fill a requirement for my major**
5	5	8	*18*	**I need it for graduate or professional school**
4	6	11	*21*	**I need it for my desired employment after college**
3	13	7	*23*	**Interest in the subject matter**
5	9	9	*23*	**To learn lab techniques**
3	10	10	*23*	**To learn about science and the research process**
4	8	11	*23*	**To get hands-on research experience**
6	12	4	*22*	**It fit in my schedule**
4	8	10	*22*	**The course and/or the instructor has a good reputation**

** Each student was asked to rate each reason for taking the course.*

Course Elements

25 items about course elements

On the pre-course survey, students were asked to assess their prior experience on each element. They were asked to rate their experience on a scale where 1 means no experience or that the student feels inexperienced and 5 means much experience or that the student feels that she or he has mastered the element. These data are most useful, first, descriptively, and second, as covariates that aid in the interpretation of other data. On the post-course survey, the students were asked to "rate the gains you may have made as a result of taking this course." The 5-point scale, where 1 = no or very small gain to 5 = very large gain, is consistent with the scale used to rate other learning gains.

Means are used to represent the data.

Your Students		***All Students***		
PreCourse Experience	PostCourse Gain	PreCourse Experience	PostCourse Gain	
3.17	3.00	3.46	3.29	**Scripted lab or project where students know outcome**
3.32	2.86	3.34	3.38	**Lab or project where only instructor knows outcome**
2.91	3.75	2.55	3.35	**Lab or project where no one knows the outcome**
3.83	3.76	3.65	3.66	**A least one project assigned and structured by instructor A**
3.09	3.90	3.03	3.84	**project where students have input into process or topic A project**
2.52	3.95	2.57	3.54	**entirely of student design**
3.52	3.26	3.64	3.41	**Work individually Work**
2.91	2.83	3.16	3.26	**as a whole class Work in**
3.77	3.95	3.86	3.90	**small groups**
3.55	3.95	3.83	3.92	**Become responsible for a part of the project Read**
3.57	4.19	3.13	3.62	**primary scientific literature**
3.09	4.00	2.55	3.47	**Write a research proposal Collect**
3.43	4.24	3.66	3.89	**data**
3.14	4.10	3.59	4.01	**Analyze data**
3.17	4.05	3.17	3.58	**Present results orally**
3.41	4.00	3.42	3.73	**Present results in written papers or reports Present**
2.73	2.50	2.92	3.33	**posters**
2.82	3.25	2.99	3.31	**Critique work of other students**
4.33	3.95	4.08	3.57	**Listen to lectures**
4.18	2.21	4.04	3.11	**Read a textbook Work**
3.95	2.73	3.86	3.48	**on problem sets Take**
4.38	2.15	4.20	3.35	**tests in class**
3.82	3.47	3.93	3.59	**Discuss reading materials in class Maintain lab**
3.32	3.90	3.62	3.47	**notebook**
2.36	3.13	2.31	3.12	**Computer modeling**

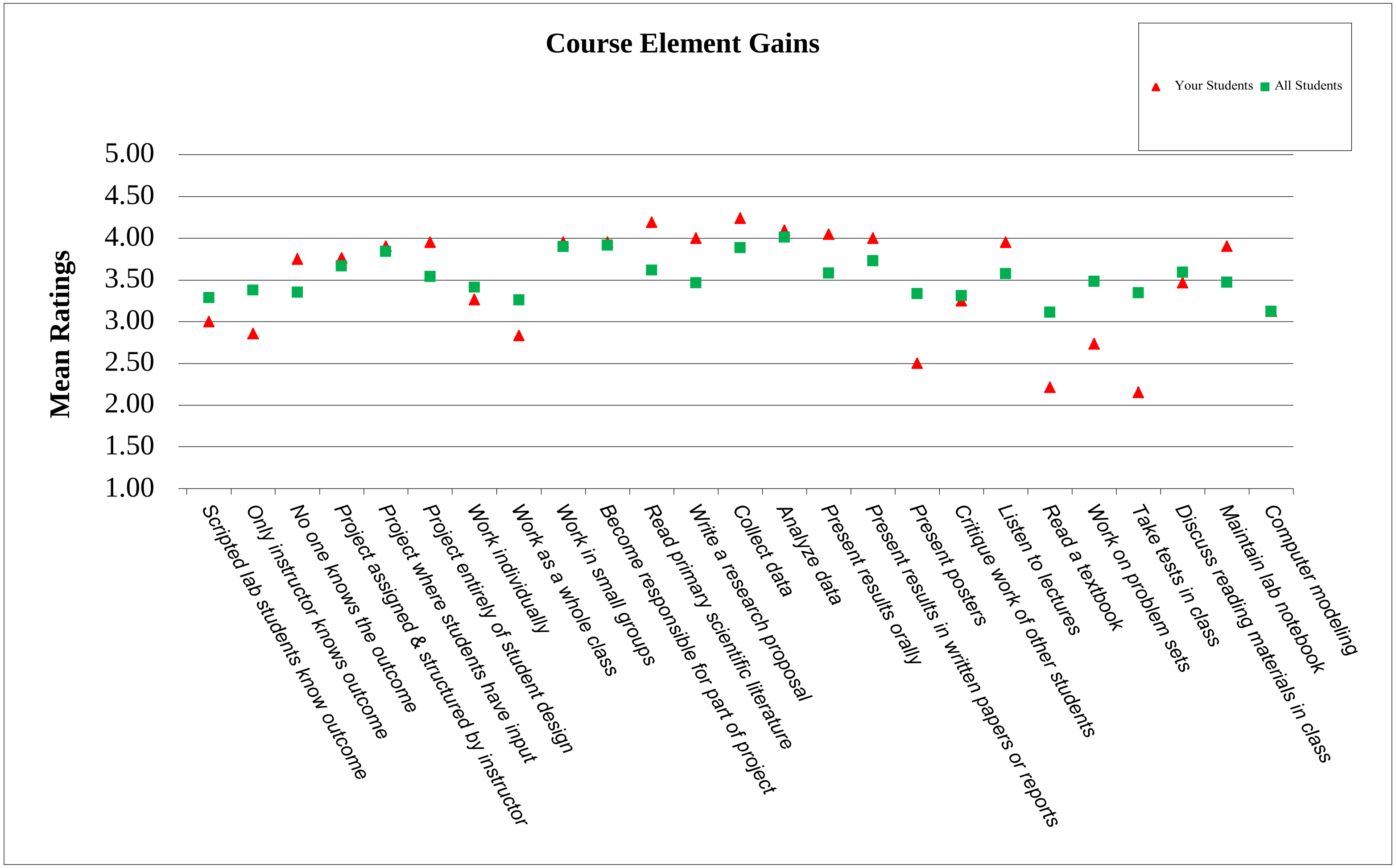


Figure 1. The figure illustrates the mean ratings by students of gains in 25 areas corresponding to the course elements above.

PostCourse Survey: Benefits

21 items about learning gains

The learning gain items below are the same as a list of gains students assess when they complete the SURE survey, an assessment of summer undergraduate research experiences. The parallel between the two surveys permits an analysis of how well the course experience emulates the gains of a research experience. A consistent result is that CURE means on most items, except for writing and ethics, are lower than SURE means. In addition, courses with a research-like component yield means higher than courses with no research-like component. The means shown for the benchmark on the right are for all CURE participants, regardless of course. The scale is 1 to 5, with 5 being the largest gain. These items appear only on the post-course survey. *Means are used to represent the data.*

Your Students	*All Students*	SD	
n≤20	n≤8581		
3.37	3.08	1.23	**Clarification of a career path**
3.50	3.60	1.00	**Skill in interpretation of results**
3.75	3.57	1.02	**Tolerance for obstacles faced in the research process**
3.74	3.49	1.07	**Readiness for more demanding research**
3.45	3.52	1.02	**Understanding how knowledge is constructed**
3.84	3.56	1.08	**Understanding the research process**
3.74	3.53	1.02	**Ability to integrate theory and practice**
3.75	3.65	1.05	**Understanding how scientists work on real problems**
3.63	3.69	1.04	**Understanding that scientific assertions require supporting evidence**
3.60	3.76	0.98	**Ability to analyze data and other information**
3.70	3.68	1.01	**Understanding science**
3.89	3.32	1.18	**Learning ethical conduct**
3.75	3.71	1.09	**Learning laboratory techniques**
3.70	3.48	1.15	**Ability to read and understand primary literature**
3.58	3.25	1.25	**Skill in how to give an effective oral presentation**
3.70	3.44	1.14	**Skill in science writing**
3.50	3.35	1.18	**Self-confidence**
3.58	3.50	1.08	**Understanding how scientists think**
3.16	3.43	1.13	**Learning to work independently**
3.32	3.54	1.11	**Becoming part of a learning community**
3.25	3.04	1.28	**Confidence in my potential as a teacher**

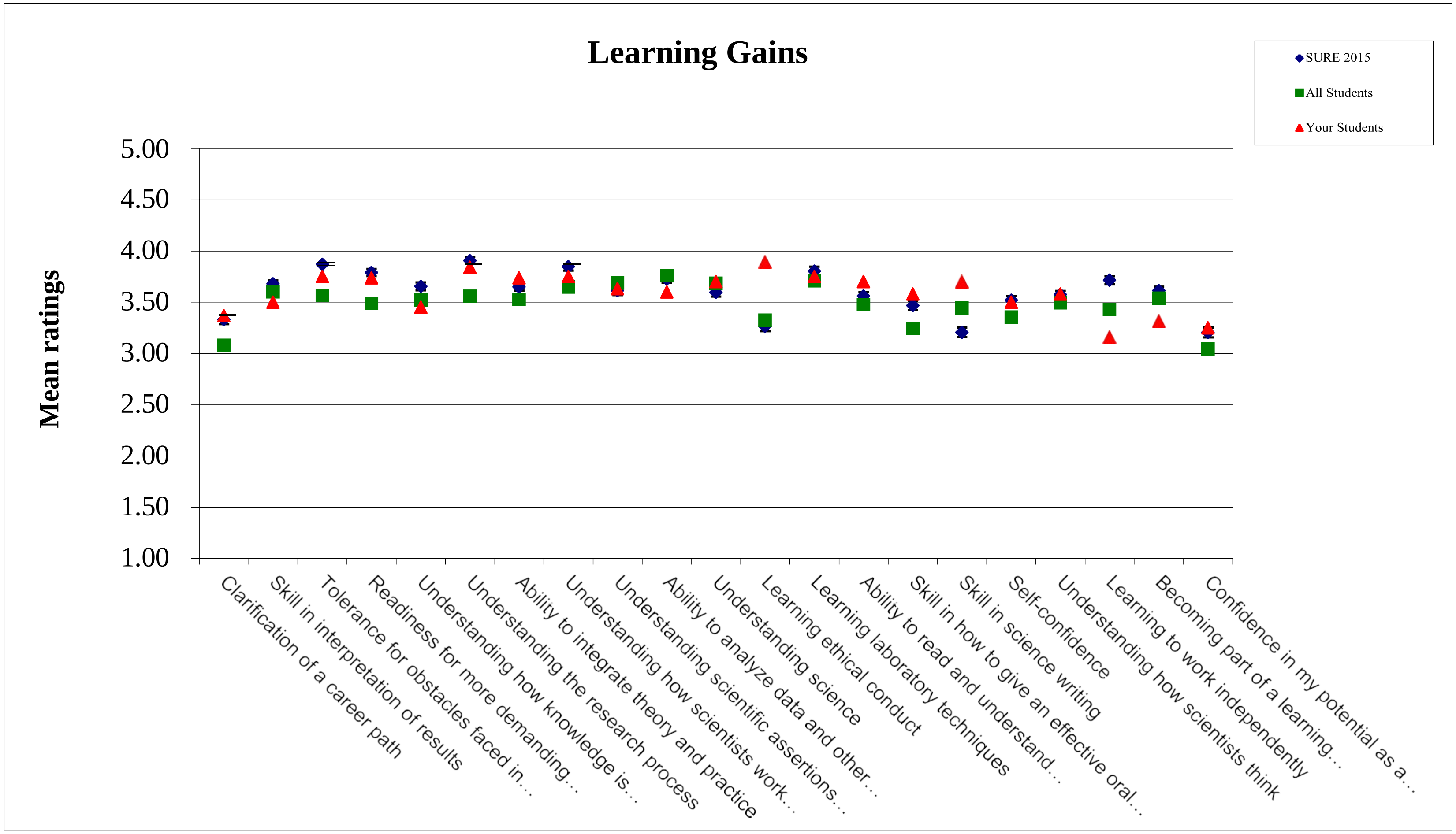


Figure 2. The figure illustrates the mean ratings by students of gains in 21 areas, corresponding to the areas above. As these same items are evaluated by students who participate in summer undergraduate research, the recent results of the Summer Undergraduate Research Experience (SURE) survey are presented for reference. Also presented (green squares) are the overall mean ratings by the reference cohort of students who completed the CURE survey from June 1, 2015 - May 24, 2016. The vertical lines around the SURE means represent 2 standard errors above and below. *Note:* Data from students who completed the pre-course survey and those who did not are indistinguishable.

Attitudes about Science

22 questions about science

These items appear on both the pre-course survey and the post-course survey. The scale is 1 (strongly disagree) to 5 (strongly agree). We have not found large changes from pre- to post-course survey. Note that 5 items are printed in italics. In exploratory factor analysis these 5 items load on a factor that we have named "engagement". Engagement scores, whether pre-course or post-course, have correlated in our first findings with higher reported learning gains and a greater likelihood to declare a science major. *Means are used to represent the data.*

Your Students		***All Students***		
PreCourse	PostCourse	PreCourse	PostCourse	
4.18	4.35	4.10	4.21	*Even if I forget the facts, I'll still be able to use thinking skills learned in science*
3.59	3.26	3.36	3.39	You can rely on scientific results to be true and correct
3.95	4.11	3.96	3.99	*The process of writing in science is helpful for understanding scientific ideas*
2.78	3.28	2.97	3.15	When scientific results conflict with my personal experience, I follow my experience in making choices
2.45	2.11	2.30	2.48	Students who do not major/concentrate in science should not have to take science courses
2.82	2.83	2.92	2.93	I wish science instructors would just tell us what we need to know so we can learn it
2.18	2.00	1.90	2.08	Creativity does not play a role in science
1.95	1.95	2.01	2.20	Science is not connected to non-science fields such as history, literature, economics, or art
2.71	3.05	2.94	3.06	When experts disagree on a science question, it's because they don't know all the facts yet
3.86	4.10	4.23	4.21	*I get personal satisfaction when I solve a scientific problem by figuring it out myself*
2.50	2.65	2.69	2.78	Since nothing in science is known for certain, all theories are equally valid
3.23	3.42	3.19	3.19	Science is essentially an accumulation of facts, rules, and formulas
4.05	4.00	4.01	4.03	*I can do well in science courses*
2.62	3.58	3.05	3.24	Real scientists don't follow the scientific method in a straight line

Attitudes about Science (cont.)

Your Students		*All Students*		
PreCourse	PostCourse	PreCourse	PostCourse	
2.41	2.85	2.71	2.79	There is too much emphasis in science classes on figuring things out for yourself
2.73	2.65	2.40	2.58	Only scientific experts are qualified to make judgments on scientific issues
1.95	2.20	1.99	2.19	Scientists know what the results of their experiments will be before they start
3.77	4.06	4.10	4.11	*Explaining science ideas to others has helped me understand the ideas better*
3.10	3.55	3.27	3.33	Main job of the instructor is to structure the work so that we can learn it ourselves
3.00	3.22	2.89	2.87	Scientists play with statistics to support their own ideas
3.64	3.74	3.74	3.70	Lab experiments are used to confirm information studied in science class
1.57	1.60	1.85	1.99	If an experiment shows that something doesn't work, the experiment was a failure

Learning style items

10 pairs of statements

The pre-course survey included 10 self-descriptive items derived from a brief learning style survey published by Romero et al. Each item contained pairs of statements, and the student was to use a 1-6 scale to describe how closely one or the other statement described him or her. Two scales, one a dimension of concrete-abstract information preference and one a dimension of reflective-active learning preference were scored. The diagram below describes the names given to four kinds of learning styles and the majors typically associated with them. We are currently exploring the possible relations between this information and other information from the surveys. See Romero, Tepper, and Tetrault (1992). Development and validation of new scales to measure Kolb's learning style dimensions. *Educational and Psychological Measurement* , 52, 171-180.

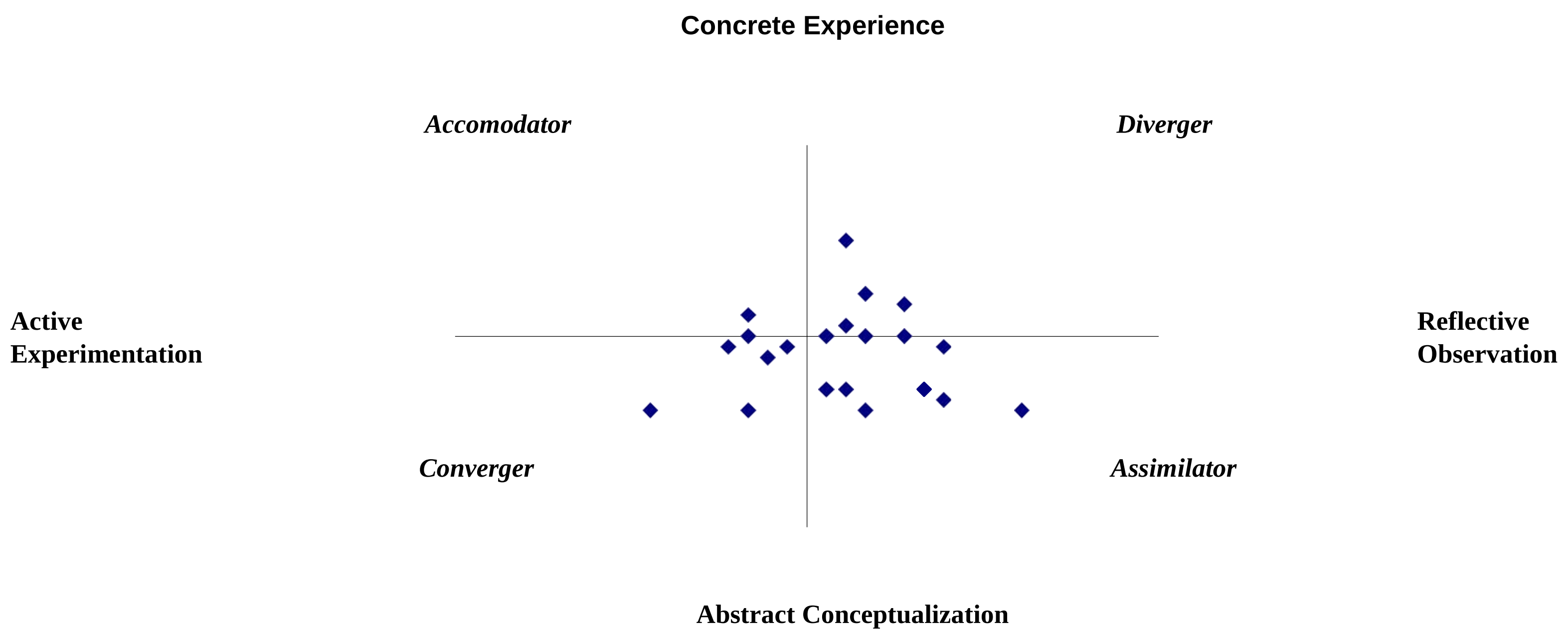


Figure 3. The two dimensions of learning style, with typical majors suggested by Romero, et al. In that report, science majors tended to score in the "Assimilator" or "Converger" quadrants.

Learning Style Quadrants

	Your Students	All Students	%	
	7	1959	23.0%	**Divergers**
	8	2102	24.7%	**Assimilators**
	5	2780	32.6%	**Convergers**
	2	1676	19.7%	**Accomodators**
n	22	8517		

PostCourse Survey: Overall Assessment

These four questions serve as an overall assessment of the course. Note that the scale is 1 (strongly disagree) to agree). The questions are on the post-course survey only. *Means are used to represent the data.*

Your Students	All Students	SD	
3.95	4.08	0.97	**This course was a good way of learning about the subject**
4.50	4.06	1.00	**This course was a good way of learning about the process of sc**
4.11	3.92	1.10	**This course had a positive effect on my interest in science**
4.35	4.12	0.98	**I was able to ask questions in this class and get helpful respons**

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