Supplemental Material

CBE—Life Sciences Education

Beck and Blumer

Self-Efficacy Pre-Test (based on Champagne, 1989)

The following questions ask you to rate your confidence in certain abilities. To rate your level of confidence, use a scale of 1 to 5, with 1 meaning 'not confident' and 5 meaning 'very confident.'

How confident are you in your ability to:

1. Pose a question that can be addressed through scientific experimentation, e.g. state a testable hypothesis

2. Provide a scientific explanation for a natural process, e.g. photosynthesis, digestion, combustion

3. Assess the appropriateness of the methodology of an experiment

4. Read and understand articles on science in the newspaper

5. Read and interpret graphs displaying scientific information

6. Design an experiment that is a valid test of a hypothesis

7. Assess the accuracy of scientific statements, e.g. the seasons change with the distance of the earth from the sun

8. Give an instance of how a scientific discovery or idea has affected society e.g. the germ theory of disease

9. Challenge authority on evidence that supports scientific statements

10. Describe natural phenomena, e.g. the phases of the moon

11. Apply scientific information in personal decision- making, e.g. ozone depletion and the use of aerosols

12. Locate valid scientific information when needed

Champagne, A.B. (1989). Defining scientific literacy. Educ Leadership *47*, 85-86.

Instructional Practices Survey -- Post-Test

Instructional Strategies

How often were the following true about the laboratory portion of your class? We are only interested in the laboratory part of the class, rather than the lecture portion.

Please choose the appropriate response for each item: Never, Seldom, Often or All the Time

1. Your instructor lectured in lab.
2. You participated in whole-class discussions where your instructor talked less than the students.
3. You are asked to apply prior knowledge to new tasks.
4. You work on activities that have a range of possible outcomes and solutions rather than a single correct response.
5. You collect evidence of your own learning.
6. You make presentations to explain what you have learned.
7. You work on projects that are meaningful to you.
8. You work on tasks without fear of embarrassment, punishment, or implications that you are inadequate.
9. You develop experimental designs by following a set of detailed requirements.
10. Your experimental design looks very similar to the designs of other students in your class.

To what extent was the following true about the laboratory portion of your class? Again, we are only interested in the laboratory part of the class, rather than the lecture portion.

I worked on projects…

Please choose the appropriate response for each item: Not at All, Very Little, Somewhat or A Great Deal

11. Requiring a significant investment of time and intellectual resources.
12. Requiring me to apply knowledge from one or more disciplines or content areas.
13. Using research methods from one or more disciplines.
14. That allow me to figure out what the information means.
15. In which the correct results are already known.
16. Grounded in real life and work.
17. Requiring me to develop my own experimental procedures.
18. Requiring me to learn and use skills that are expected of practicing scientists (e.g. technology, teamwork, problem solving)
19. Requiring me to arrive at a specific experimental design that my instructor has in mind.

20. In which my instructor provides me with experimental design protocols.
21. Requiring me to use various methods, media and sources to conduct an investigation.
22. Requiring me to justify my results with evidence from my experiments.

Assessment Strategies

How often were the following true about your <u>laboratory</u> portion of your class? Again, we are only interested in the laboratory part of the course, not the lecture portion.

Please choose the appropriate response for each item: Never, Seldom, Often, or All the Time

23. I used project criteria (rubrics) that I helped establish to gauge what I am learning.
24. My instructor graded students through methods such as presentations, portfolios, and exhibitions.
25. I knew exactly how my work would be assessed.
26. My instructor provided me with examples of exemplary work and scoring guidelines.
27. My instructor provided me with specific, descriptive feedback focused on next steps.
28. I can define what it looks like to master each topic.
29. I can describe what I was supposed to learn.
30. I can describe what comes next in my learning.

Revised Instructional Practices Survey -- Post-Test

The following 24 items are those that had sufficient factor loadings and were grouped in the five constructs used in the Instructional Practices analysis.

Instructional Strategies

How often were the following true about the laboratory portion of your class? We are only interested in the laboratory part of the class, rather than the lecture portion.

Please choose the appropriate response for each item: Never, Seldom, Often or All the Time

1. You participated in whole-class discussions where your instructor talked less than the students. (Science Process Skills)
2. You are asked to apply prior knowledge to new tasks. (Science Process Skills)
3. You work on activities that have a range of possible outcomes and solutions rather than a single correct response. (Science Process Skills)
4. You make presentations to explain what you have learned. (Science Process Skills)

To what extent was the following true about the laboratory portion of your class? Again, we are only interested in the laboratory part of the class, rather than the lecture portion.

I worked on projects…

Please choose the appropriate response for each item: Not at All, Very Little, Somewhat or A Great Deal

5. Requiring a significant investment of time and intellectual resources. (Scientific Synthesis)
6. Requiring me to apply knowledge from one or more disciplines or content areas. (Scientific Synthesis)
7. Using research methods from one or more disciplines. (Science Process Skills)
8. That allow me to figure out what the information means. (Scientific Synthesis)
9. In which the correct results are already known. (Instructor-directed Teaching)
10. Grounded in real life and work. (Scientific Synthesis)
11. Requiring me to develop my own experimental procedures. (Science Process Skills)
12. Requiring me to learn and use skills that are expected of practicing scientists (e.g. technology, teamwork, problem solving) (Scientific Synthesis)
13. Requiring me to arrive at a specific experimental design that my instructor has in mind. (Instructor-directed Teaching)

14. In which my instructor provides me with experimental design protocols. (Instructor-directed Teaching)
15. Requiring me to use various methods, media and sources to conduct an investigation. (Scientific Synthesis)
16. Requiring me to justify my results with evidence from my experiments. (Scientific Synthesis)

Assessment Strategies

How often were the following true about your laboratory portion of your class? Again, we are only interested in the laboratory part of the course, not the lecture portion.

Please choose the appropriate response for each item: Never, Seldom, Often, or All the Time

17. I used project criteria (rubrics) that I helped establish to gauge what I am learning. (Science Process Skills)
18. My instructor graded students through methods such as presentations, portfolios, and exhibitions. (Science Process Skills)
19. I knew exactly how my work would be assessed. (Feedback and Assessment)
20. My instructor provided me with examples of exemplary work and scoring guidelines. (Feedback and Assessment)
21. My instructor provided me with specific, descriptive feedback focused on next steps. (Feedback and Assessment)
22. I can define what it looks like to master each topic. (Metacognition)
23. I can describe what I was supposed to learn. (Metacognition)
24. I can describe what comes next in my learning. (Metacognition)

Supplemental Materials

Table S1: Factor loading table for seven factors (eigenvalue > 1)

		Component						
		1	2	3	4	5	6	7
Item28	I can define what it looks like to master each topic.	.742						
Item29	I can describe what I was supposed to learn.	.740						
Item30	I can describe what comes next in my learning.	.736						
Item25	I knew exactly how my work would be assessed.	.648						
Item27	My instructor provided me with specific, descriptive feedback focused on next steps.	.642						
Item26	My instructor provided me with examples of exemplary work and scoring guidelines.	.584						
Item12	Requiring me to apply knowledge from one or more disciplines or content areas.		.759					
Item13	Using research methods from one or more disciplines.		.737					
Item11	Requiring a significant investment of time and intellectual resources.		.562					
Item17	Requiring me to develop my own experimental procedures.		.541					
Item21	Requiring me to use various methods, media and sources to conduct an investigation.		.502					
Item18	Requiring me to learn and use skills that are expected of practicing scientists (e.g. technology, teamwork, problem solving)			.723				
Item22	Requiring me to justify my results with evidence from my experiments.			.688				
Item14	That allow me to figure out what the information means.			.640				
Item16	Grounded in real life and work.			.385				
Item2	You participated in whole-class discussions where your instructor talked less than the students.				.625			
Item3	You are asked to apply prior knowledge to new tasks.		.406		.419			
Item4	You work on activities that have a range of possible outcomes and solutions rather than a single correct response.				.399			
Item6	You make presentations to explain what you have learned.				.607			
Item7	You work on projects that are meaningful to you.				.627			

Item23	I used project criteria (rubrics) that I helped establish to gauge what I am learning					.683		
Item24	My instructor graded students through methods such as presentations, portfolios, and exhibitions.					.534		
Item1	Your instructor lectured in lab.					.406		
Item15	In which the correct results are already known.						.723	
Item19	Requiring me to arrive at a specific experimental design that my instructor has in mind.						.562	
Item20	In which my instructor provides me with experimental design protocols.						.601	
Item5	You collect evidence of your own learning.							.456
Item8	You work on tasks without fear of embarrassment, punishment, or implications that you are inadequate.							.470
Item9	You develop experimental designs by following a set of detailed requirements.							.735
Item10	Your experimental design looks very similar to the designs of other students in your class.							.557

Table S2: Regression models for the relationship between faculty perceptions and student perceptions for each construct at the course level

	Sum of Squares	df	Mean Square	F	P
Metacognition					
Faculty Perception	0.29	1	0.29	3.90	0.06
Residual	2.78	37	0.08		
Total	3.07	38			
Feedback & Assessment					
Faculty Perception	0.20	1	0.20	1.44	0.24
Residual	5.20	37	0.14		
Total	5.40	38			
Scientific Synthesis					
Faculty Perception	0.55	1	0.55	14.16	0.001
Residual	1.45	37	0.04		
Total	2.00	38			
Science Process Skills					
Faculty Perception	0.07	1	0.07	2.62	0.11
Residual	1.00	37	0.03		
Total	1.07	38			
Instructor-directed Teaching					
Faculty Perception	0.29	1	0.29	3.29	0.08
Residual	3.20	37	0.09		
Total	3.48	38			

Table S3: Regression models for the relationship between faculty perceptions and student perceptions for each construct at the instructor level

	Sum of Squares	df	Mean Square	F	P
Metacognition					
Faculty Perception	0.24	1	0.24	3.94	0.06
Residual	1.17	19	0.06		
Total	1.41	20			
Feedback & Assessment					
Faculty Perception	0.03	1	0.03	0.27	0.61
Residual	2.17	19	0.11		
Total	2.20	20			
Scientific Synthesis					
Faculty Perception	0.14	1	0.14	5.08	0.04
Residual	0.53	19	0.03		
Total	0.67	20			
Science Process Skills					
Faculty Perception	0.06	1	0.06	3.12	0.09
Residual	0.37	19	0.02		
Total	0.43	20			
Instructor-directed Teaching					
Faculty Perception	0.22	1	0.22	5.75	0.03
Residual	0.72	19	0.04		
Total	0.94	20			