Supplemental Material

CBE—Life Sciences Education

Beck and Blumer

Beck and Blumer, The relationship between perceptions of instructional practices and student self-efficacy in guided-inquiry laboratory courses

Supplemental Materials

Table S1. Items for each construct in the instructional practices survey (Beck & Blumer, 2016) Student responses were on two different four-point Likert scales depending on the item (A = never, B = seldom, C = often, D = all of the time; or A = not at all, B = very little, C = somewhat, D = a great deal. Faculty responded to modified items, for example: "[I had students work on projects…] That allow them to figure out what the information means."

Construct	Items
Scientific Synthesis	[I worked on projects…] That allow me to figure out what the information means.
	[I worked on projects…] Requiring me to learn and use skills that are expected of practicing scientists (e.g. technology, teamwork, problem solving).
	[I worked on projects…] Requiring me to justify my results with evidence from my experiments.
	[I worked on projects…] Requiring me to apply knowledge from one or more disciplines or content areas.
	[I worked on projects…] Requiring a significant investment of time and intellectual resources.
	[I worked on projects…] Requiring me to use various methods, media, and sources to conduct an investigation.
	[I worked on projects…] Grounded in real life and work.
Science Process Skills	You make presentations to explain what you have learned.
	You participated in whole-class discussions where your instructor talked less than the students.
	[I worked on projects…] Requiring me to develop my own experimental procedures.
	[I worked on projects…] Using research methods from one or more disciplines.
	You are asked to apply prior knowledge to new tasks.
	My instructor graded students through methods such as presentations, portfolios, and exhibitions.
	You work on activities that have a range of possible outcomes and solutions rather than a single correct response.
Instructor-directed teaching	[I worked on projects…] In which my instructor provided me with experimental design protocols.

	[I worked on projects…] Requiring me to arrive at a specific experimental design that my instructor has in mind.
	[I worked on projects…] In which the correct results are already known.

Table S2. Paired t-test values and effect sizes for pre-semester/post-semester comparisons of student self-efficacy based on pre-semester quartile. Pre-semester self-efficacy was approximately normally distributed. As a result, students were assigned to a pre-semester quartile based on their self-efficacy. Students in quartile 1 had the lowest self-efficacy at the beginning of the semester and those in quartile 4 had the highest self-efficacy at the beginning of the semester. Effect size was calculated as Cohen's d for paired samples.

Pre-semester quartile	t-value	df	p-value	Effect size
1	-10.806	88	<0.001	1.15
2	-8.181	79	<0.001	0.91
3	-5.8618	86	<0.001	0.63
4	-0.86282	73	0.39	0.10

Table S3. Relationship between perceptions of instructional practices and absolute gains (post-semester minus pre-semester) in student self-efficacy. The Faculty Perceptions model examines differences in faculty perceptions of instructional practices among courses and their relationship with post-semester self-efficacy. The Average Student Perceptions model examines differences in student perceptions of instructional practices among courses and their relationship with change in self-efficacy. The Individual Student Perceptions model examines differences in student perceptions of instructional pratices within courses and their relationship with change in self-efficacy. The best model based on AIC is the Individual Student Perceptions model (see Table 1). Significant effects are indicated in bold.

	Estimate	Std. Error	t value	P value
Faculty Perceptions				
Intercept	**2.37**	**0.58**	**4.04**	**< 0.01**
Pre-semester self-efficacy	**-0.52**	**0.05**	**-10.36**	**< 0.001**
Scientific synthesis	0.04	0.26	0.16	0.88
Science process skills	-0.05	0.22	-0.21	0.84
Instructor-directed teaching	-0.07	0.15	-0.46	0.65
Average Student Perceptions				
Intercept	1.15	1.26	0.92	0.37
Pre-semester self-efficacy	**-0.53**	**0.05**	**-10.54**	**< 0.001**
Scientific synthesis	0.67	0.58	1.16	0.27
Science process skills	-0.25	0.48	-0.53	0.6
Instructor-directed teaching	-0.13	0.31	-0.41	0.69
Individual Student Perceptions				
Intercept	**2.29**	**0.15**	**15.55**	**< 0.001**
Pre-semester self-efficacy	**-0.55**	**0.04**	**-12.73**	**< 0.001**
Scientific synthesis	**0.49**	**0.10**	**4.75**	**< 0.001**
Science process skills	**0.23**	**0.09**	**2.50**	**0.01**
Instructor-directed teaching	0.13	0.07	1.83	0.07

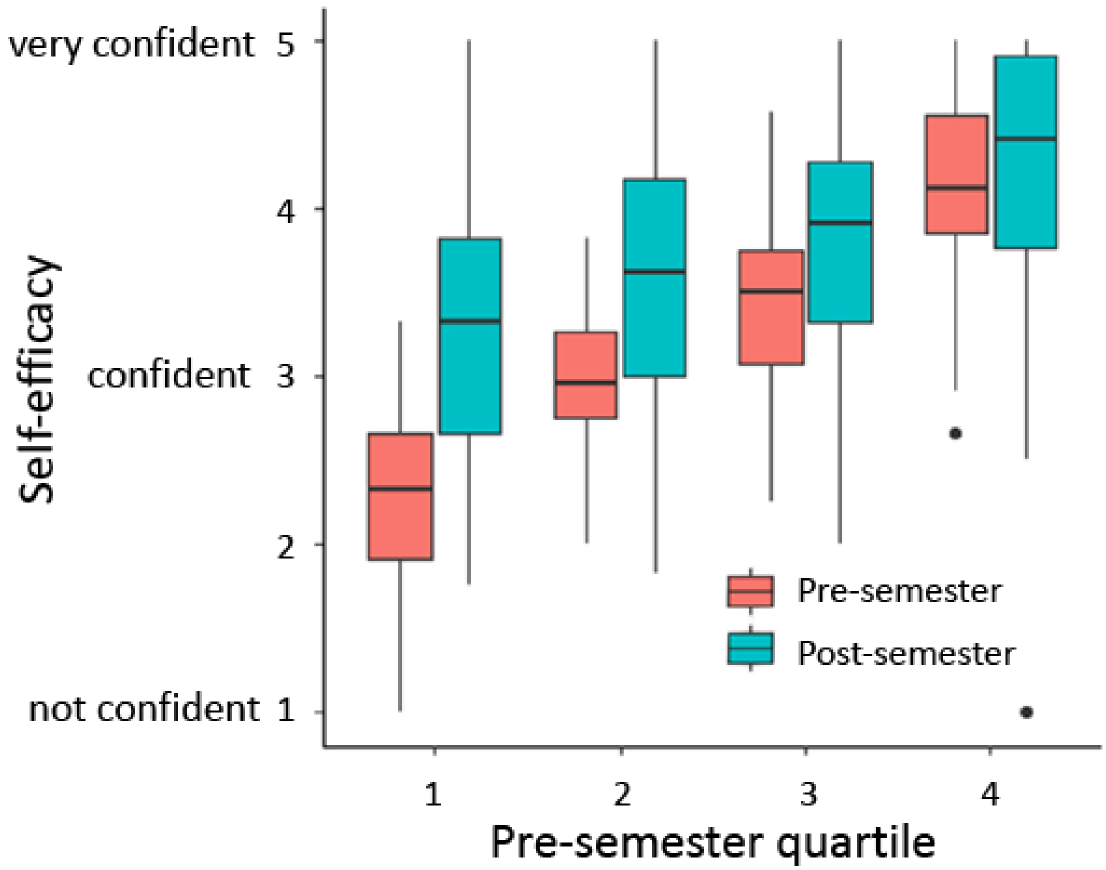

Figure S1. Increase in student self-efficacy from beginning to end of semester based on pre-semester quartile. Pre-semester self-efficacy was approximately normally distributed. As a result, students were assigned to a pre-semester quartile based on their self-efficacy. Students in quartile 1 had the lowest self-efficacy at the beginning of the semester and those in quartile 4 had the highest self-efficacy at the beginning of the semester.

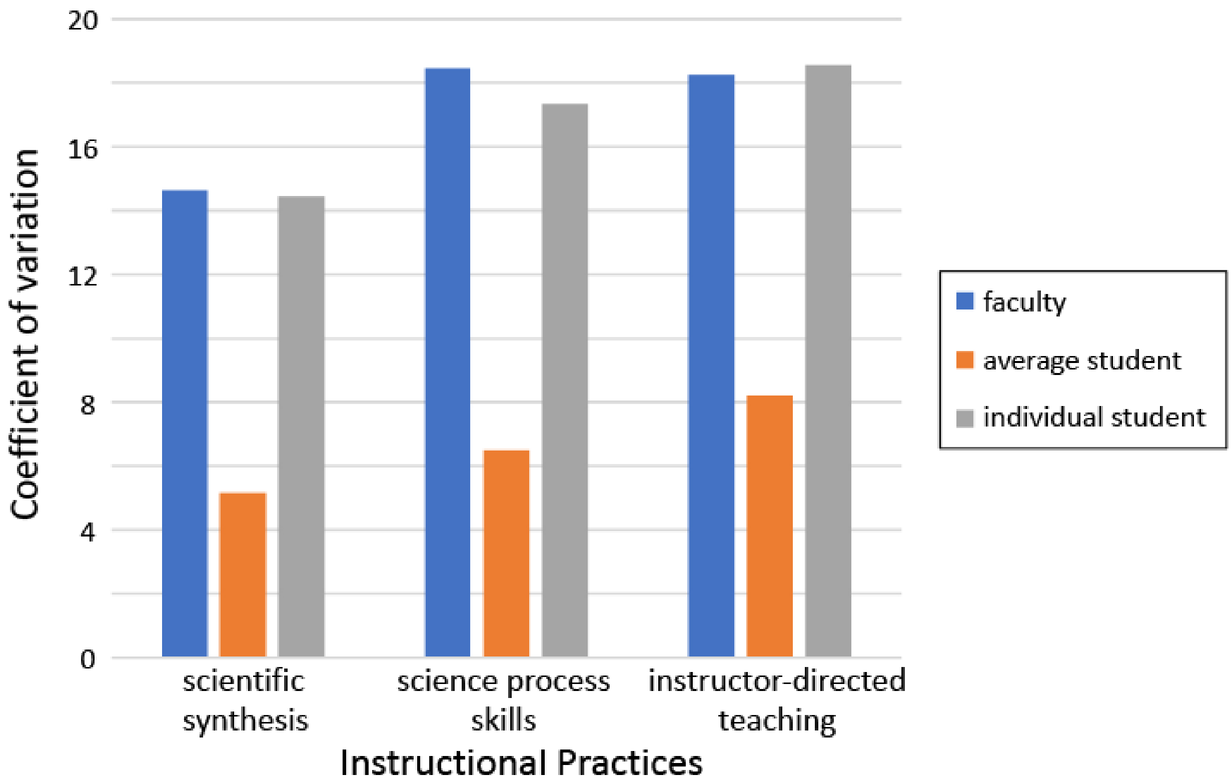

Figure S2. Coefficient of variation in perceptions of instructional practices by faculty, average student, and individual students. Average student perceptions reflects variation among courses Individual student perceptions reflects variation within courses.

Self-Efficacy Survey (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.