Supplemental Material

CBE—Life Sciences Education

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Appendix 1

Table 6 Standardized factor loadings, mean and standard deviations for five-factor model

Factor	Item	Question	Standardized Factor loading	Mean	SD
Thinking and Working Like a Scientist	Q1	Analyzing data for patterns.	.50	3.4	1.2
	Q2	Figuring out the next step in a research project.	.60	3.8	1.0
	Q3	Problem-solving in general.	.56	3.7	.9
	Q4	Formulating a research question that could be answered with data.	.59	3.4	1.1
	Q5	Identifying limitations of research methods and designs.	.48	3.8	1.0
	Q6	Understanding the theory and concepts guiding my research project.	.55	4.1	1.0
	Q7	Understanding the connections among scientific disciplines.	.56	3.5	1.1
	Q8	Understanding the relevance of research to my coursework.	.52	3.5	1.1
Personal and Professional Gains	Q9	Confidence in my ability to do research.	.63	3.8	1.0
	Q10	Comfort in working collaboratively with others.	.61	3.6	1.1
	Q11	Confidence in my ability to do well in future science courses.	.60	3.5	1.1
	Q12	Ability to work independently.	.50	3.8	1.1
	Q13	Understanding what everyday research work is like.	.52	4.2	1.0
	Q14	Taking greater care in conducting procedures in the lab or field.	.56	3.8	1.1
	Q15	Developing patience with the slow pace of research.	.49	3.6	1.1
Skills	Q16	Writing scientific reports or papers.	.47	3.0	1.2
	Q17	Making oral presentations.	.62	3.5	1.1
	Q18	Defending an argument when asked questions.	.56	3.0	1.1
	Q19	Explaining my project to people outside my field.	.59	3.8	1.0
	Q20	Preparing a scientific poster.	.45	3.6	1.4
	Q21	Keeping a detailed lab notebook.	.44	3.0	1.2
	Q22	Conducting observations in the lab or field.	.53	3.3	1.1
	Q25	Understanding journal articles.	.59	2.6	1.3
	Q26	Conducting database or internet searches.	.44	2.5	1.2
	Q27	Managing my time.	.46	3.1	1.1

(Table 6 cont.)

Factor	Item	Question	St. Factor loading	Mean	SD
Attitudes and Behaviors	Q28	Engage in real-world science research	.59	4.3	.9
	Q29	Feel like a scientist.	.68	4.0	1.0
	Q30	Think creatively about the project.	.62	3.7	1.0
	Q31	Try out new ideas or procedures on your own.	.40	3.2	1.4
	Q32	Feel responsible for the project.	.54	4.1	1.1
	Q33	Work extra hours because you were excited about the research.	.54	3.4	1.3
	Q35	Feel a part of a scientific community.	.52	3.7	1.3
Satisfaction	Q36	My working relationship with my research mentor	.57	4.1	1.1
	Q37	My working relationship with research group members.	.55	4.1	1.1
	Q38	The amount of time I spent doing meaningful research.	.69	3.9	.9
	Q39	The amount of time I spent with my research mentor.	.59	3.7	1.1
	Q40	The research experience overall.	.85	4.2	.8

Note: Based on first sample n = 506. Ratings from 1 – 5.

Note: Q23, Q24, Q34 left out of analysis due to large amount of missing data from "non-applicable" option.

Note: Standardized factor loadings Q1 – Q35 from four factor model, Q36 – Q40 from 5 factor model.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q1	1.00																			
Q2	0.34	1.00																		
Q3	0.28	0.44	1.00																	
Q4	0.34	0.39	0.39	1.00																
Q5	0.19	0.31	0.30	0.38	1.00															
Q6	0.18	0.32	0.22	0.25	0.33	1.00														
Q7	0.32	0.27	0.27	0.29	0.26	0.35	1.00													
Q8	0.27	0.24	0.20	0.28	0.15	0.35	0.45	1.00												
Q9	0.25	0.31	0.24	0.27	0.13	0.29	0.25	0.25	1.00											
Q10	0.26	0.20	0.20	0.19	0.20	0.34	0.28	0.27	0.46	1.00										
Q11	0.25	0.15	0.14	0.19	0.10	0.21	0.25	0.27	0.44	0.42	1.00									
Q12	0.24	0.22	0.19	0.18	0.11	0.16	0.16	0.19	0.31	0.22	0.40	1.00								
Q13	0.19	0.15	0.19	0.20	0.15	0.23	0.25	0.27	0.30	0.26	0.25	0.23	1.00							
Q14	0.22	0.21	0.25	0.24	0.27	0.24	0.26	0.33	0.25	0.27	0.27	0.20	0.44	1.00						
Q15	0.14	0.17	0.27	0.14	0.16	0.15	0.12	0.24	0.22	0.23	0.30	0.35	0.36	0.35	1.00					
Q16	0.24	0.20	0.18	0.17	0.18	0.17	0.13	0.12	0.18	0.18	0.15	0.14	0.11	0.22	0.09	1.00				
Q17	0.20	0.18	0.17	0.20	0.17	0.32	0.32	0.28	0.17	0.30	0.15	0.16	0.25	0.30	0.14	0.37	1.00			
Q18	0.22	0.19	0.22	0.26	0.21	0.26	0.24	0.15	0.15	0.28	0.18	0.12	0.11	0.19	0.08	0.32	0.52	1.00		
Q19	0.20	0.19	0.24	0.18	0.18	0.28	0.23	0.19	0.20	0.31	0.19	0.21	0.21	0.27	0.23	0.29	0.41	0.44	1.00	
Q20	0.04	0.19	0.14	0.15	0.12	0.28	0.20	0.19	0.21	0.21	0.21	0.14	0.23	0.24	0.16	0.27	0.33	0.24	0.33	1.00
Q21	0.08	0.18	0.20	0.14	0.10	0.14	0.11	0.17	0.18	0.14	0.21	0.14	0.23	0.40	0.15	0.18	0.23	0.18	0.20	0.23
Q22	0.25	0.24	0.24	0.26	0.19	0.22	0.26	0.28	0.27	0.28	0.29	0.21	0.31	0.45	0.18	0.21	0.27	0.26	0.24	0.26
Q23	0.44	0.14	0.03	0.20	0.09	0.12	0.20	0.16	0.17	0.13	0.15	0.09	0.11	0.15	0.07	0.16	0.17	0.19	0.16	0.17
Q24	0.21	0.12	0.09	0.10	0.09	0.15	0.20	0.17	0.08	0.07	0.17	0.12	0.12	0.27	0.09	0.10	0.12	0.10	0.11	0.11
Q25	0.29	0.24	0.23	0.28	0.14	0.25	0.28	0.27	0.25	0.21	0.20	0.29	0.22	0.28	0.20	0.25	0.34	0.26	0.29	0.21
Q26	0.17	0.15	0.13	0.17	0.01	0.17	0.14	0.23	0.09	0.17	0.16	0.18	0.12	0.11	0.17	0.22	0.20	0.19	0.24	0.17
Q27	0.15	0.21	0.17	0.17	0.06	0.16	0.07	0.17	0.22	0.17	0.28	0.29	0.26	0.30	0.37	0.16	0.22	0.14	0.25	0.18
Q28	0.19	0.27	0.23	0.25	0.16	0.26	0.19	0.15	0.30	0.27	0.14	0.05	0.10	0.13	0.06	0.10	0.13	0.14	0.16	0.13
Q29	0.16	0.25	0.22	0.20	0.14	0.22	0.14	0.17	0.42	0.31	0.25	0.18	0.16	0.24	0.19	0.12	0.16	0.16	0.13	0.20
Q30	0.12	0.29	0.17	0.28	0.14	0.23	0.11	0.14	0.27	0.23	0.13	0.18	-0.02	0.06	0.11	0.13	0.06	0.17	0.20	0.13
Q31	0.05	0.19	0.11	0.19	0.09	0.03	-0.04	-0.03	-0.01	-0.05	-0.05	0.12	-0.13	-0.10	0.01	0.02	-0.05	-0.02	0.02	0.03
Q32	0.16	0.28	0.20	0.18	0.16	0.18	0.07	0.09	0.18	0.10	0.08	0.22	-0.01	0.05	0.09	0.12	0.01	0.00	0.07	0.09
Q33	0.10	0.21	0.14	0.19	0.13	0.17	0.10	0.13	0.20	0.16	0.14	0.20	0.08	0.14	0.19	0.06	0.08	0.06	0.05	0.09
Q34	0.00	-0.04	0.00	0.01	-0.01	-0.01	-0.04	0.01	0.17	0.01	0.05	0.03	0.07	0.12	0.03	0.01	0.08	0.04	0.04	0.02
Q35	0.14	0.16	0.16	0.15	0.11	0.19	0.16	0.15	0.30	0.25	0.18	0.03	0.13	0.21	0.09	0.17	0.17	0.24	0.13	0.20
Q36	0.12	0.21	0.16	0.14	0.10	0.22	0.12	0.14	0.26	0.21	0.14	0.02	0.13	0.11	0.10	0.09	0.06	0.12	0.01	0.06
Q37	0.19	0.23	0.24	0.22	0.16	0.19	0.17	0.11	0.18	0.27	0.14	0.06	0.13	0.17	0.02	0.11	0.07	0.08	0.01	0.17
Q38	0.19	0.25	0.19	0.19	0.10	0.22	0.16	0.15	0.30	0.22	0.19	0.13	0.13	0.18	0.19	0.14	0.07	0.12	0.12	0.16
Q39	0.15	0.21	0.15	0.16	0.11	0.18	0.12	0.11	0.15	0.11	0.10	0.07	0.05	0.07	0.04	0.08	0.10	0.15	0.08	0.12
(Q40	0.26	0.31	0.21	0.23	0.18	0.33	0.24	0.20	0.39	0.25	0.28	0.18	0.19	0.17	0.14	0.18	0.14	0.15	0.13	0.22

(Table 8 cont.)

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q21	1.00																			
Q22	0.43	1.00																		
Q23	0.05	0.22	1.00																	
Q24	0.23	0.32	0.22	1.00																
Q25	0.24	0.27	0.19	0.17	1.00															
Q26	0.14	0.13	0.22	0.07	0.52	1.00														
Q27	0.29	0.28	0.07	0.18	0.33	0.24	1.00													
Q28	0.07	0.18	0.07	-0.01	0.15	0.09	0.02	1.00												
Q29	0.15	0.21	0.01	0.06	0.15	0.08	0.13	0.55	1.00											
Q30	-0.01	0.13	0.01	0.03	0.07	0.03	0.11	0.29	0.37	1.00										
Q31	-0.09	-0.07	-0.05	-0.07	0.01	0.05	-0.04	0.12	0.12	0.49	1.00									
Q32	0.00	0.05	0.03	0.02	0.08	0.07	0.05	0.25	0.28	0.41	0.43	1.00								
Q33	0.07	0.14	-0.07	0.01	0.10	0.01	0.11	0.25	0.31	0.38	0.32	0.39	1.00							
Q34	-0.01	0.01	0.04	-0.13	0.03	-0.05	-0.02	0.17	0.21	0.07	0.01	0.04	0.15	1.00						
Q35	0.04	0.15	0.09	0.03	0.17	0.09	0.06	0.38	0.48	0.25	0.09	0.18	0.28	0.38	1.00					
Q36	0.00	0.06	-0.01	0.14	0.03	-0.02	0.07	0.19	0.22	0.20	0.01	0.21	0.19	0.12	0.25	1.00				
Q37	0.02	0.18	0.09	0.18	0.10	-0.01	0.02	0.25	0.28	0.22	0.12	0.18	0.16	0.02	0.23	0.36	1.00			
Q38	0.12	0.20	0.11	0.13	0.12	0.00	0.15	0.36	0.43	0.27	0.07	0.29	0.33	0.08	0.29	0.32	0.30	1.00		
Q39	-0.05	0.03	0.12	0.04	0.05	0.01	0.04	0.26	0.22	0.19	0.05	0.14	0.13	0.09	0.25	0.40	0.41	0.43	1.00	
Q40	0.06	0.13	0.13	0.15	0.14	0.04	0.14	0.37	0.41	0.34	0.11	0.32	0.30	0.12	0.31	0.50	0.46	0.60	0.48	1.00

(Key for table 8)

Q1	Analyzing data for patterns.
Q2	Figuring out the next step in a research project.
Q3	Problem-solving in general.
Q4	Formulating a research question that could be answered with data.
Q5	Identifying limitations of research methods and designs.
Q6	Understanding the theory and concepts guiding my research project.
Q7	Understanding the connections among scientific disciplines.
Q8	Understanding the relevance of research to my coursework.
Q9	Confidence in my ability to do research.
Q10	Comfort in working collaboratively with others.
Q11	Confidence in my ability to do well in future science courses.
Q12	Ability to work independently.
Q13	Understanding what everyday research work is like.
Q14	Taking greater care in conducting procedures in the lab or field.
Q15	Developing patience with the slow pace of research.
Q16	Writing scientific reports or papers.
Q17	Making oral presentations.
Q18	Defending an argument when asked questions.
Q19	Explaining my project to people outside my field.
Q20	Preparing a scientific poster.
Q21	Keeping a detailed lab notebook.
Q22	Conducting observations in the lab or field.
Q23	Using statistics to analyze data.
Q24	Calibrating instruments needed for measurement.
Q25	Understanding journal articles.
Q26	Conducting database or internet searches.
Q27	Managing my time.
Q28	Engage in real-world science research
Q29	Feel like a scientist.
Q30	Think creatively about the project.
Q31	Try out new ideas or procedures on your own.
Q32	Feel responsible for the project.
Q33	Work extra hours because you were excited about the research.
Q34	Interact with scientists from outside your school.
Q35	Feel a part of a scientific community.
Q36	My working relationship with my research mentor
Q37	My working relationship with research group members.
Q38	The amount of time I spent doing meaningful research.
Q39	The amount of time I spent with my research mentor.
Q40	The research experience overall.