Supplemental Material

CBE—Life Sciences Education

Dowd *et al.*

Student Survey

We are interested in enhancing the learning experience for students who undertake a thesis. Thissurvey has several sections and asks about your motivations and goals, views about knowledge, and your self-appraisals of your writing skills.

Please enter your full name here. We only require your name so that we can initially identify you as aparticipant. Once surveys are collected, [researcher] will immediately remove your name and replace it with a unique study subject number.

Part 1 of 6

1. We recognize that you may have multiple motivations for undertaking a thesis. We are interested in therelative importance to you of different reasons.

   Please distribute 100 points to reflect the relative importance to you of each of the following [5] reasons thatyou might have undertaken a thesis. You could assign all 100 points to one reason or distribute morepoints to some than other reasons; but your total across all [5] reasons must add up to 100.

   a. To distinguish myself from other students
   b. To demonstrate mastery of a topic [mastery]
   c. To learn how to, or gain experience with, generating and applying knowledge [mastery]
   d. To demonstrate my abilities and competencies to graduate or profession school admissions committees or prospectiveemployers
   e. To fulfill a graduation requirement

2. In addition to the above ratings, please describe in your own words your reason for undertaking a thesis.

Part 2 of 6

3. At this point in time, to what extent do you feel you can…
   (Response scale: Not at all, Limited, Moderate, Large, Superior)

   a. construct a good openingsentence quickly?
   b. come up with an unusualopening paragraph to capturereaders' interest?
   c. write a brief but informativeoverview that will preparereaders for the main thesis ofyour paper?
   d. use your first attempt at writingto refine your ideas on a topic?
   e. meet the writing standards ofan evaluator who is verydemanding?
   f. come up with memorableexamples quickly to illustratean important point?
   g. rewrite your wordy or confusingsentences clearly?
   h. use words to create a vividpicture when you need tomake a subtle or an abstractidea more imaginable?

i. locate and use appropriatereference sources when youneed to document animportant point?
j. write very effective transitionalsentences from one idea toanother?
k. find ways to overcome theproblem when you get stuckwriting a paper?
l. find and correct all yourgrammatical errors when youhave written a long or complexpaper?
m. revise a first draft of any paperso that it is shorter and betterorganized?
n. find other people who will givecritical feedback on early draftsof you paper?
o. come up with a shortinformative title when my paperis written on a complicatedtopic?

Part 3 of 6

4. At this point in time, to what extent do you feel you can…
(Response scale: Not at all, Limited, Moderate, Large, Superior)

a. identify unanswered questionsin the literature that arerelevant to your research?
b. make use of primary scientificresearch literature in yourfield?
c. identify a specific researchquestion for investigation?
d. describe the main goals ofyour research project?
e. generate a hypothesis relatedto your research question?
f. design an experiment ormethod to test yourhypothesis?
g. observe and collect data?
h. analyze your data?
i. interpret your results in light ofyour proposed hypothesis?
j. discuss alternativeexplanations for your results?
k. explain inconsistencies in yourresults?
l. describe limitations in thedesign of your study?
m. explain the broadersignificance of your research?
n. suggest additionalexperiments or future avenuesfor research in your field?
o. design effective andappropriate tables and figuresto present your results?
p. explain terms and conceptsthat are specific to yourresearch to a non-specialist(but still scientific) audience?
q. orally communicate yourresearch to a non-specialistaudience?
r. write a thesis or other majorresearch paper in yourdiscipline?
s. write an academic paper forpublication?
t. think independently about yourresearch?

Part 4 of 6

5. Please indicate the extent to which you agree or disagree with the following statements.
(Response scale: Strongly disagree, Disagree, Neutral, Agree, Strongly agree)

a. Reasoning skills used tounderstand this discipline canbe helpful to me in myeveryday life. [real world]
b. Truth is unchanging in thissubject. [certainty & simplicity]

c. This subject has little relationto what I experience in the realworld. [real world]
d. To understand this discipline, Isometimes think about mypersonal experiences andrelate them to the topic beinganalyzed.[real world]
e. In this subject, most work hasonly one right answer.[certainty & simplicity]
f. Sometimes you just have toaccept answers from theexperts in this field, even if youdon't understand them. [authority as source]
g. If you read something in atextbook for this subject, youcan be sure it's true. [authority as source]
h. All professors in this fieldwould probably come up withthe same answers toquestions in this field.[certainty & simplicity]
i. If my personal experienceconflicts with ideas in thetextbook, the book is probablyright. [authority as source]
j. Learning this disciplinechanges my ideas about howthe world works.[real world]
k. [not used for analysis] We use this question todiscard the survey of peoplewho are not reading thestatements. Please selectagree, option 4 (not stronglyagree), to preserve youranswers.
l. I am most confident that Iknow something when I knowwhat the experts think. [authority as source]
m. In this subject, it is good toquestion the ideas presented.[certainty & simplicity]
n. Answers to questions in thisfield change as experts gathermore information.[certainty & simplicity]
o. All experts in this fieldunderstand the field in thesame way.[certainty & simplicity]
p. Principles in this field areunchanging.[certainty & simplicity]
q. Most of what is true in thissubject is already known.[certainty & simplicity]

Part 5 of 6

6. Each item consists of a pair of contrasting statements. These statements describe two individuals, Robinand Chris. After each pair of statements, please indicate whether (1) only one view can be correct, (2)both views can be correct, but one is more correct than the other, or (3) both views can be correct, andneither is more correct than the other.

    a. Robin says warm summerdays are the nicest. Chris sayscool autumn days are nicest.
    b. Robin says the stew is spicy.Chris says the stew is notspicy at all.
    c. Robin thinks weddings shouldbe held in the afternoon. Christhinks weddings should beheld in the evening.
    d. Robin thinks the first book theyboth read is better. Christhinks the second book theyboth read is better.
    e. Robin thinks people shouldtake responsibility forthemselves. Chris thinkspeople should work together totake care of each other.
    f. Robin thinks lying is wrong.Chris thinks lying ispermissible in certainsituations.
    g. Robin thinks the governmentshould limit the number ofchildren families are allowedto have to keep the populationfrom getting too big. Chris thinks families should have asmany children as they choose.
    h. Robin has one view of whycriminals keep going back tocrime. Chris has a differentview of why criminals keepgoing back to crime.

i. Robin thinks one book'sexplanation of why theCrimean wars began is right.Chris thinks another book'sexplanation of why theCrimean wars began is right.
j. Robin agrees with one book'sexplanation of how children learn language. Chris agreeswith another book'sexplanation of how childrenlearn language.
k. Robin believes one book'sexplanation of what atoms are made up of. Chris believes another book's explanation ofwhat atoms are made up of.
l. Robin believes onemathematician's proof offormula is right. Chris believesanother mathematician's proofof formula is right.
m. Robin believes one book'sexplanation of how the brain works. Chris believes anotherbook's explanation of how thebrain works.

Part 6 of 6

7. To evaluate knowledge claims and explanations, I rely on...

    a. my experiences and knowledge.
    b. mostly my experiences and knowledge, though also my core beliefs and values.
    c. equal parts of experience and knowledge and core beliefs and values.
    d. mostly my core beliefs and values, though also my experiences and knowledge.
    e. my core beliefs and values.

8. To evaluate knowledge claims and explanations, I must evaluate the credibility of...

    a. the source of the claim.
    b. mostly the source of the claim, though also the argument and evidence presented.
    c. equal parts of the source of the claim and the argument and evidence presented.
    d. mostly the argument and evidence presented, though also the source of the claim.
    e. the argument and evidence presented.

9. Overall, please indicate which perspective best reflects your view.

    a. Knowledge is discovered and consists of facts that have been determined to be true and about which we can becertain. Knowledge claims are verifiable as right or wrong on the basis of objective evidence and standards.
    b. Knowledge is socially constructed and uncertain and consists of opinions and interpretations that are subjective.People are entitled to their own opinion, and thus there are no bases on which to judge the merits of knowledge claims.
    c. Knowledge is socially constructed, imperfect, and provisional and consists of objectively verifiable facts and subjectiveopinions and interpretations. The merits of knowledge claims can be judged against alternative claims on the basis ofthe quality of the arguments and evidence.

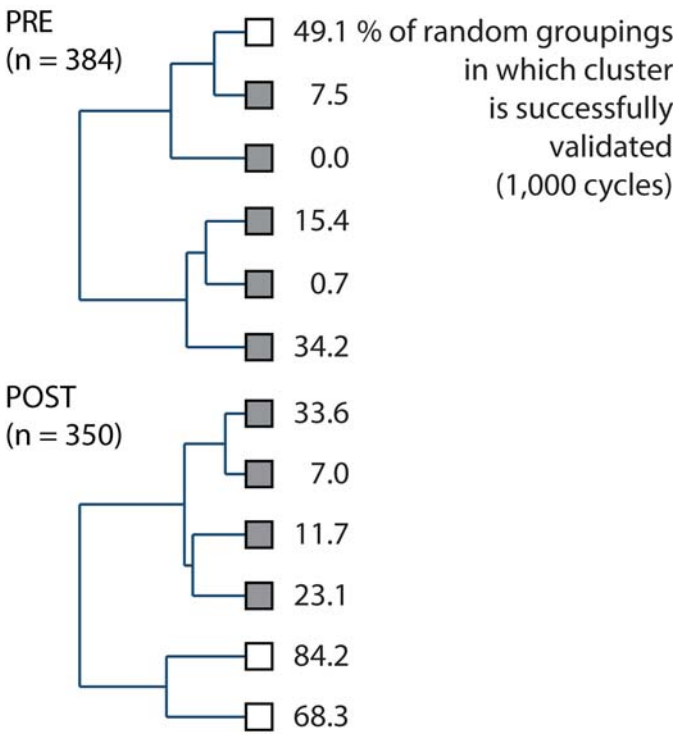
PRE
(n = 384)
49.1 % of random groupings
in which cluster
is successfully
validated
(1,000 cycles)
7.5
0.0
15.4
0.7
34.2
POST
(n = 350)
33.6
7.0
11.7
23.1
84.2
68.3

TABLE S1: Correlations among students' pre-coursepersonal dimensions (n = 384)[a]

	Mastery	Writing SE	Science SE	Cert. & Simp.	Auth. as Source
Mastery Motivation	1				
Writing Self-Efficacy	0.079 *0.124*	1			
Science Self-Efficacy	0.087 *0.090*	0.714 *<0.0001*	1		
Certainty & Simplicity	0.179 *0.0004*	0.135 *0.008*	0.124 *0.015*	1	
Authority as Source	0.163 *0.001*	0.095 *0.062*	0.107 *0.037*	0.453 *<0.0001*	1

[a] In each cell, the top number is the correlation and the bottom, italicized number is the associated *p*-value.

TABLE S2: Correlations among students' post-coursepersonal dimensions (n = 350)[a]

	Mastery	Writing SE	Science SE	Cert. & Simp.	Auth. as Source
Mastery Motivation	1				
Writing Self-Efficacy	0.167 *0.002*	1			
Science Self-Efficacy	0.203 *0.0001*	0.743 *<0.0001*	1		
Certainty & Simplicity	0.097 *0.071*	0.189 *0.0004*	0.195 *0.0003*	1	
Authority as Source	0.103 *0.055*	0.098 *0.066*	0.109 *0.041*	0.553 *<0.0001*	1

[a]In each cell, the top number is the correlation and the bottom, italicized number is the associated *p*-value.

TABLE S3: Correlations between students' pre- and post-coursepersonal dimensions (n = 314)[a]

PRE	Mastery	Writing SE	Science SE	Cert. & Simp.	Auth. as Source
POST					
Mastery	0.596	0.031	0.104	0.087	0.050
Motivation	*<0.0001*	*0.582*	*0.066*	*0.123*	*0.381*
Writing	0.196	0.460	0.340	0.185	0.111
Self-Efficacy	*0.0005*	*<0.0001*	*<0.0001*	*0.001*	*0.050*
Science	0.155	0.365	0.496	0.144	0.109
Self-Efficacy	*0.006*	*<0.0001*	*<0.0001*	*0.011*	*0.053*
Certainty &	0.144	0.119	0.092	0.601	0.395
Simplicity	*0.011*	*0.035*	*0.102*	*<0.0001*	*<0.0001*
Authority as	0.176	0.071	0.048	0.358	0.565
Source	*0.002*	*0.208*	*0.396*	*<0.0001*	*<0.0001*

[a] In each cell, the top number is the correlation and the bottom, italicized number is the associated *p*-value.

TABLE S4: Correlations among changes in students' personal dimensions, pre to post (n = 314)[a]

	Mastery	Writing SE	Science SE	Cert. & Simp.	Auth. as Source
Mastery Motivation	1				
Writing Self-Efficacy	0.062 *0.271*	1			
Science Self-Efficacy	0.048 *0.393*	0.702 *<0.0001*	1		
Certainty &Simplicity	0.023 *0.683*	0.052 *0.357*	0.097 *0.086*	1	
Authority as Source	0.002 *0.971*	0.076 *0.182*	0.085 *0.134*	0.352 *<0.0001*	1

[a] In each cell, the top number is the correlation and the bottom, italicized number is the associated *p*-value.