Supplemental Material

CBE—Life Sciences Education

Sellami *et al.*

Supplementary Material

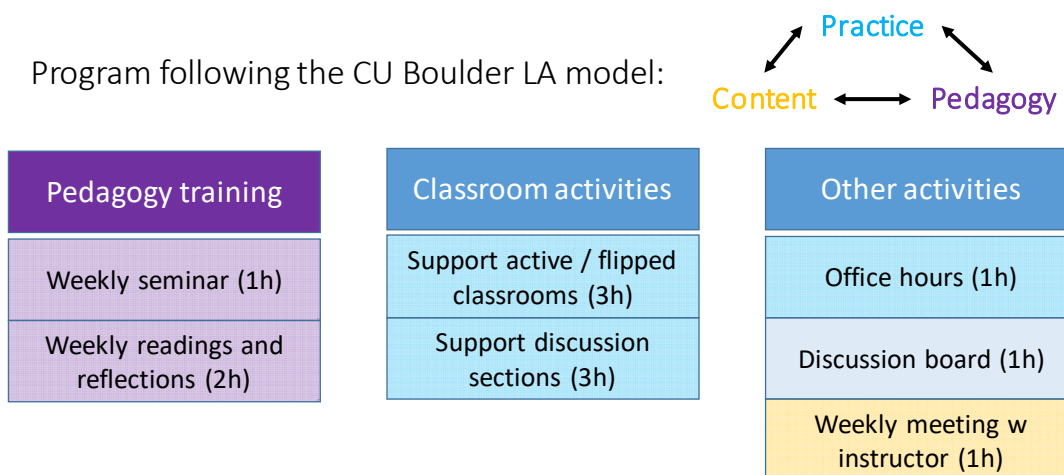## Contents

UCLA Learning Assistant Program

Life Sciences Core Education	Physics and Astronomy	Chemistry and Biochemistry

Students are selected based on grades and prior experience. They receive 4 units upper division course credit for participating as an LA.

Program following the CU Boulder LA model:

Practice

Content ←→ Pedagogy

Pedagogy training	Classroom activities	Other activities
Weekly seminar (1h)	Support active / flipped classrooms (3h)	Office hours (1h)
Weekly readings and reflections (2h)	Support discussion sections (3h)	Discussion board (1h)
		Weekly meeting w instructor (1h)

Explanation of other activities:

Office hours
LAs hold office hours at a time that is convenient to them and a location convenient to them and the students. This results in some office hours being held at campus dormitories or coffee shops, which are easily accessible to students. Office hour attendance was not recorded and typically ranged between 1 and 10 students.

Discussion board
All courses are also supported by an online discussion board (https://piazza.com/). Instructor, TAs and LAs monitor the discussions and answer student questions online.

Weekly meeting with instructor
The weekly meeting with instructor is held together with TAs for the course. The instructor provides a worksheet each week. LAs and TAs work through the problems in collaborative groups, as the instructor is circulating the room and modeling desired behavior for LAs and TAs.

After completing the worksheet, the solutions are presented by LAs and TAs and answers and problems as well as common student misconceptions discussed.

The weekly meeting is also used to discuss clicker questions and classroom activities for the upcoming week.

Learning Assistant Pedagogy Seminar

The LA Pedagogy Seminar is attended by all LAs across the different departments and disciplines. The seminar is taught in an active, student-centered way and includes multiple think-pair-share activities, small group discussions and role play exercises per meeting. Effective study strategies and ways to learn are highlighted by the assigned readings and in the class discussions.

The instructors model desired LA behavior during those activities as they circulate from group to group, elicit reasoning through posing questions, guiding towards answers with questions, promoting collaborative group work and facilitating class discussion.

Pedagogy Seminar Assignments:
- Weekly teaching reflections
- Weekly reading and reading reflections
- Mid-quarter feedback survey and presentation
- Weekly meeting with faculty of the course in which LA
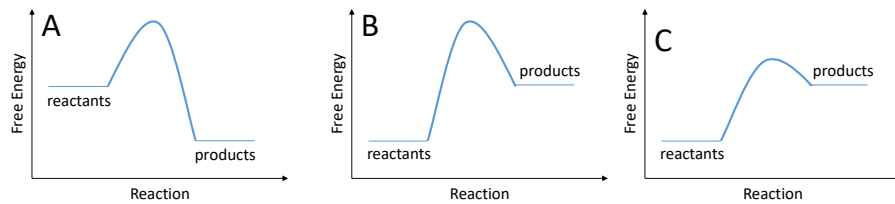- Final feedback / letter to future LAs

Sample Schedule (Spring Quarter 2016):

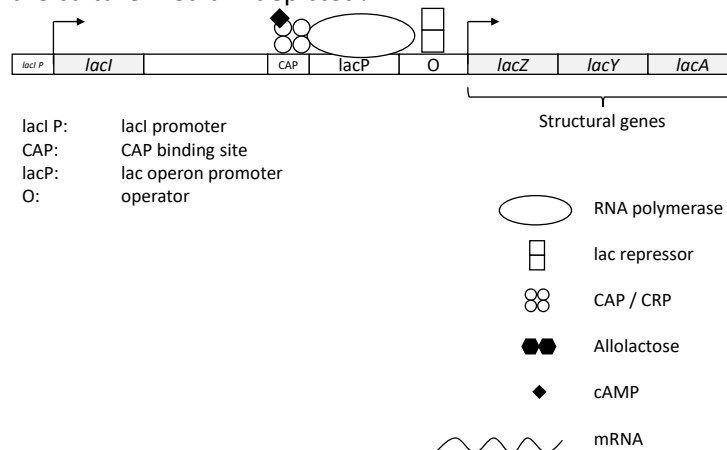| Week	Topic
1	Orientation Open and closed questions + Classroom discourse
2	Questioning Strategies and Question Types
3	Student Conceptions (in the Content Areas) & Formative Assessment
4	Motivation and Cooperative Learning
5	Argumentation and Metacognition
6	Presentations (Mid-Quarter Feedback)
7	Growth vs. Fixed Mindset
8	Multiple Intelligences and Differentiated Instruction
9	Qualities of an Effective Learner
10	Memorial Day No Lecture

Sample Exam Questions

Sample exam questions*	
Bloom's level (Cognitive level)	Sample question
Knowledge (LOCS)	Which of the following is NOT considered a weak chemical bond? a) Hydrogen bond b) Van-der-Waals interaction c) Disulfide bond d) Ionic bond
Comprehension (LOCS)	Consider the energy diagrams below. Which of the following will lead to a spontaneous reaction? Mark A, B or C for your answer.
Application (HOCS)	Consider the following diagram. Which sugars do you predict would be in the culture medium depicted? lacI P: lacI promoter CAP: CAP binding site lacP: lac operon promoter O: operator a. Glucose only b. Lactose only c. Both Glucose and lactose d. Neither glucose nor lactose

Analysis (HOCS)	The gels shown below could explain the results on an RNA and Protein gel if the gene is targeted by a HAT. (in this case the WT would not be targeted, the mutant would result in targeting) Mark A for True and B for False (T / F)

RNA   Protein

WT   Mut   WT   Mut
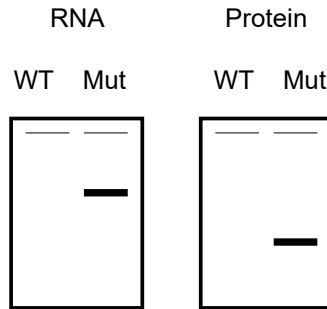
*The full set of exam questions is available upon request.
 Correct answers are highlighted in red.*

Supplementary Tables

Supplementary Table 1: Regression tables for impact of student and course characteristics on exam scores on HOCS (N=466) and CT (N=413) questions

Variable	Score on HOCS questions				Score on CT questions			
	B^a	S.E.^{a}	$P^{a,b}$	Partial Eta Squared	B^a	S.E.^{a}	$P^{a,b}$	Partial Eta Squared
Intercept	27.30	4.74	**0.00**	0.07	0.21	0.23	0.36	0.00
HS GPA	3.61	1.05	**0.00**	0.03	0.06	0.05	0.21	0.00
Year in college	-1.64	0.49	**0.00**	0.02	-0.04	0.02	0.07	0.01
Term number	-0.40	0.57	0.49	0.00	-0.01	0.03	0.79	0.00
Pell recipient^c	-1.42	0.62	**0.02**	0.01	-0.02	0.03	0.47	0.00
Transfer student^c	3.24	1.07	**0.00**	0.02	0.04	0.05	0.41	0.00
First generation student^c	-0.45	0.61	0.46	0.00	-0.02	0.03	0.41	0.00
Student sex = female^c	-1.72	0.49	**0.00**	0.03	-0.04	0.02	0.08	0.01
URM student^c	-1.61	0.60	**0.01**	0.02	-0.04	0.03	0.19	0.00
LA implementation^c	2.37	1.08	**0.03**	0.01	-0.02	0.05	0.67	0.00
Corrected Model			**0.00**	0.19			**0.01**	0.05

^{a} B: unstandardized regression coefficient; S.E.: standard error; *p*: significance
^{b} Bold type indicates significant *p*-values
^{c} Variables are coded 0=No, 1=Yes; the reference value is 0=No

Supplementary Table 2: Regression tables for impact of student and course characteristics on exam scores on HOCS (N=326) and CT (N=292) questions including SAT scores as independent variable

| Variable	Score on HOCS questions				Score on CT questions			
	B[a]	S.E.[a]	*P*[a,b]	Partial Eta Squared	B[a]	S.E.[a]	*P*[a,b]	Partial Eta Squared
Intercept	3.92	8.11	0.63	0.00	-0.04	0.33	0.90	0.00
HS GPA	1.25	1.28	0.33	0.00	0.03	0.06	0.69	0.00
SAT verbal	0.01	0.00	**0.01**	0.02	0.00	0.00	0.51	0.00
SAT math	0.02	0.00	**0.00**	0.07	0.00	0.00	0.14	0.01
SAT writing	0.00	0.00	0.57	0.00	0.00	0.00	0.52	0.00
Year in college	-0.83	0.56	0.14	0.01	-0.05	0.03	0.05	0.01
Term number	-0.29	0.64	0.65	0.00	0.02	0.03	0.46	0.00
Pell recipient[c]	-1.26	0.71	0.08	0.01	-0.06	0.03	0.09	0.01
Transfer student[c,d]	-9.03	4.83	0.06	0.01	N/A	N/A	N/A	N/A
First generation student[c]	0.60	0.76	0.43	0.00	0.04	0.04	0.24	0.01
Student sex = female[c]	-1.29	0.59	**0.03**	0.02	-0.02	0.03	0.48	0.00
URM student[c]	0.70	0.74	0.35	0.00	-0.01	0.04	0.71	0.00
LA implementation[c]	3.19	1.30	**0.01**	0.02	-0.11	0.06	0.09	0.01
Corrected Model			**0.00**	0.34			**0.00**	0.12

[a] B: unstandardized regression coefficient; S.E.: standard error; *p*: significance

[b] Bold type indicates significant *p*-values

[c] Variables are coded 0=No, 1=Yes; the reference value is 0=No

[d] Transfer students do not typically report SAT scores during admissions, only one transfer student had SAT scores and was lacking the CT pre-test

Supplementary Figures
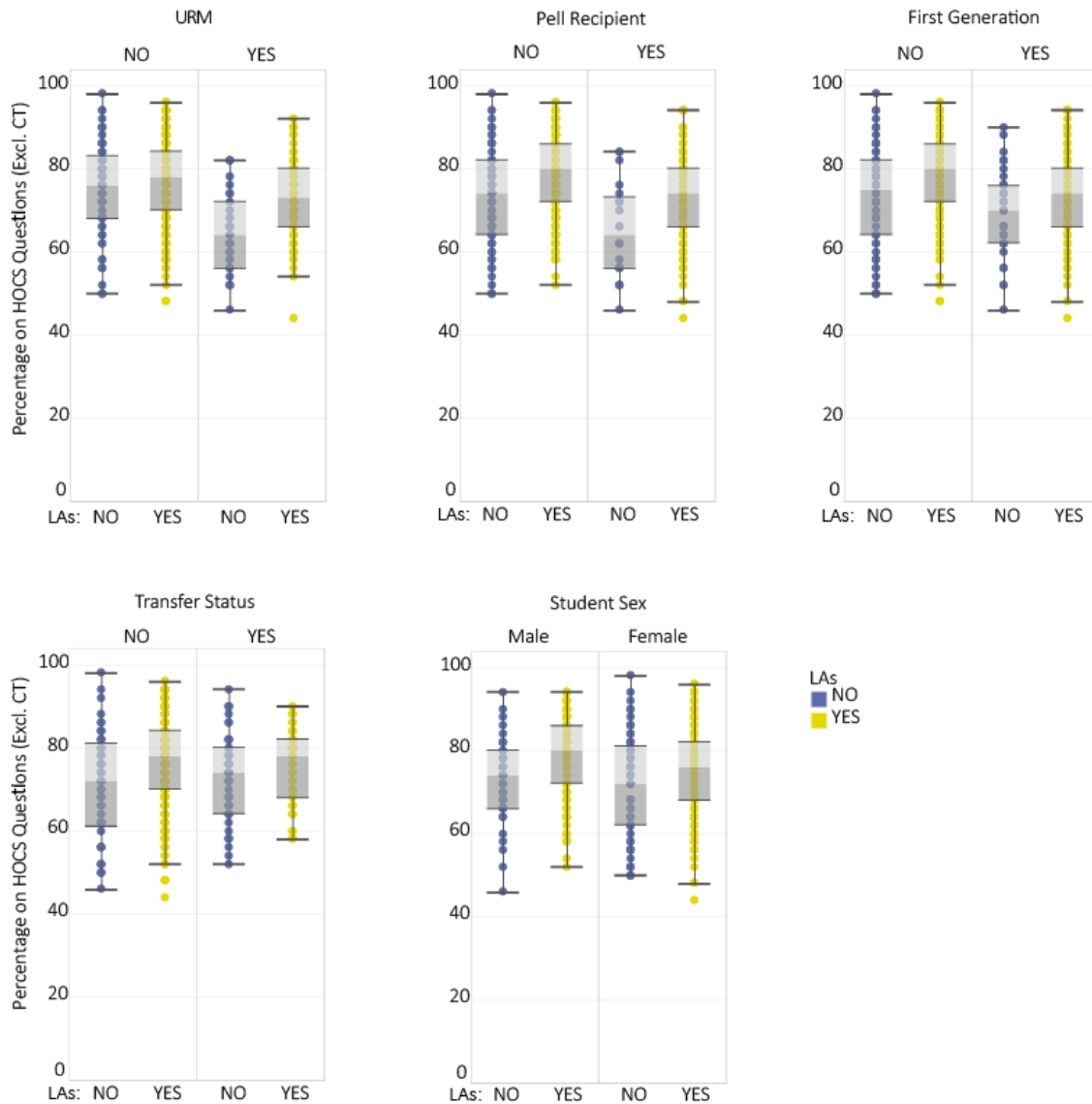
	No LA				With LA		
	N	Avg	SD		N	Avg	SD
URM	29	64.6	9.9		78	73.2	9.9
Non-URM	60	74.8	11.8		301	77.5	9.9
Pell	20	64.9	11.5		115	73.3	10.8
Non-Pell	74	73.5	11.5		289	78.2	9.5
First Gen	36	69.3	10.6		122	73.7	10.5
Non-First Gen	58	73.1	12.6		280	78.1	9.7
Transfer	46	72.8	10.6		44	75.5	9.5
Non-Transfer	48	70.5	13.2		358	77.0	10.2
Female	59	71.1	12.7		265	75.7	10.2
Male	35	72.6	10.7		137	78.8	9.7

Supplementary Figure 1: Disaggregation of HOCS scores by student demographic characteristics. NO = no LA program implemented, YES = LA program was implemented. Boxes represent the 25th and 75th percentile of data points, whiskers extend to data within 1.5 times the interquartile range. The horizontal lines within boxes represents the median. The table lists the number of students in each group (N), with respective HOCS percentage (excl. CT) averages (Avg) and standard deviation (SD).