

Supplemental Material

CBE—Life Sciences Education

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Supplemental material

Supplement 1. Survey instrument.

In this section we ask about your perceptions of **active learning practices**: teaching practices (e.g. polling, in-class activities, student group work, student discussion) that differ from traditional lecture. Do not include practices from laboratories or recitation/discussion sections in your responses.

- Okay (4)

Have you ever TAKEN a STEM college class that used active learning practices? Please explain.

- No (1)
- Yes (please explain): (2) _____

Have you ever TAUGHT a college class using active learning practices? Please explain.

- No (1)
- Yes (please explain): (2) _____

How would you rate your current level of KNOWLEDGE of active learning practices?

- Not at all knowledgeable (1)
- Slightly knowledgeable (2)
- Moderately knowledgeable (3)
- Very knowledgeable (4)
- Extremely knowledgeable (5)
- Don't know (6)

How would you rank your current level of SKILL in using active learning practices?

- Not at all skilled (1)
- Slightly skilled (2)
- Moderately skilled (3)
- Very skilled (4)
- Extremely skilled (5)
- Don't know (6)

To what extent do you believe active learning practices are EFFECTIVE in promoting student learning?

- Not at all effective (1)
- Slightly effective (2)
- Moderately effective (3)
- Very effective (4)
- Extremely effective (5)
- Don't know (6)

How MOTIVATED do you feel to incorporate active learning practices in your teaching?

- Not at all motivated (1)
- Slightly motivated (2)
- Moderately motivated (3)
- Very motivated (4)
- Extremely motivated (5)
- Don't know (6)

Please rate the level of support from your department to use active learning practices in your teaching.

	Not at all supportive (1)	Mostly not supportive (2)	Mixed or moderate support (3)	Mostly supportive (4)	Very supportive (5)	Don't know (6)
Support from department colleagues to use active learning practices in teaching (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support from department head or chair to use active learning practices in teaching (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In this section, we would like you to tell us about **ONE** course that you frequently teach at a **two year college**.

Do you teach General/Introductory Biology?

- Yes (1)
- No (2)

Please answer the following questions about your General/Introductory Biology course, under typical conditions (before COVID).

- Okay

Please tell us about ONE course you frequently teach. Select ONE course from the list below

- Ecology/Environmental Science (1)
- Microbiology (4)
- Cellular/Molecular Biology (5)
- Genetics (6)
- Other (please specify) (7) _____

Please answer the following questions about the course you selected, under typical conditions (before COVID).

- Okay (4)

In which format do you teach this course most often (before COVID)?

- Face to face (1)
- Hybrid (face to face and online) (2)
- Online synchronous (3)

- Online asynchronous (5)
- Other (4) _____

Select one or two types of students you predominantly teach in this course.

- Students enrolled in a certificate program
- Students seeking an associate degree
- Students intending to transfer to a 4-year college or university
- Other (please specify) _____

About how many times have you taught this course in your teaching career?

- 1-5 (4)
- 6-10 (5)
- 11-20 (6)
- 20 or more (7)

Is your class taught on the quarter system or semester system?

- Semester (1)
- Quarter (2)
- Other (3) _____

How many times per week does your class meet? Do NOT include dedicated lab or discussion/recitation sessions.

▼ 1 (6) ... 5 (10)

\How many hours per week does your class meet? Do NOT include dedicated lab or discussion/recitation sessions.

▼ 1 (4) ... 7 or more (10)

What is the name of the institution where you teach this course?

Do you coordinate with others for this course? Please select all that apply.

- I team teach this course (7)
- I use the same exams as others in my department (8)
- I use the same textbook as others in my department (14)
- I coordinate materials or assignments with others in my department (9)
- I meet with other instructors to discuss or design course content (10)
- I use the same syllabus as others in my department (11)
- None of the above (12)
- Other type of coordination (please explain): (13)

Please answer the questions based only on your General/Introductory Biology course, **under typical conditions (before COVID)**. Throughout this section, please provide your best estimate of the frequencies of teaching practices that occurred as part of this course. **Do not include practices from laboratories or recitation/discussion sections in your responses.**

Learning goals are statements provided by the instructor that inform students of the specific knowledge and skills that the instructor expects students to master in a course. Learning goals can be presented to students in the form of learning objectives, specific study questions, study guides, focal points, etc.

Learning goals were provided by the instructor for:

Please select all that apply.

- not provided to students (0)
- the course as a whole (1)
- each unit or exam (2)
- each broad topic or chapter (3)
- each specific subtopic or chapter subsection (4)
- some or most individual activities or assignments (5)
- each individual activity or assignment (6)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Polling methods include clickers, Poll Everywhere, Learning Catalytics, colored cards, or other audience response systems that are used to determine how many students answer a question in a particular way.

Students were asked to use a **polling method** to answer questions in the classroom approximately:

- never (0)
- 1-2 questions per month (1)
- 3-4 questions per month (2)
- 2-3 questions per week (3)
- 4-5 questions per week (4)
- 6-10 questions per week (5)
- more than 10 questions per week (6)

Learning goals are statements provided by the instructor that inform students of the specific knowledge and skills that the instructor expects students to master in a course. Learning goals can be presented to students in the form of learning objectives, specific study questions, study guides, focal points, etc.

Indicate the approximate percent of **polling questions** that overlapped with the **learning goals** provided by the instructor:

	%										Don't know	
	0	1	2	3	4	5	6	7	8	9	10	
	0	0	0	0	0	0	0	0	0	0	0	
()												

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

In-class activities other than polling questions include any exercise or activity in which the students are not listening to a lecture during class, such as student discussions, worksheets, problem sets, case studies, hands-on demonstrations, role plays, concept maps, one-minute essays, think-pair-shares, inquiry-based activities, low point value quizzes, and other related activities. Students were asked to complete **in-class activities** approximately:

- never (0)
- up to 1 activity per month (1)
- 2-3 activities per month (2)
- 4-7 activities per month (3)

- 2-3 activities per week (4)
- 4-5 activities per week (5)
- more than 5 activities per week (6)

Learning goals are statements provided by the instructor that inform students of the specific knowledge and skills that the instructor expects students to master in a course. Learning goals can be presented to students in the form of learning objectives, specific study questions, study guides, focal points, etc.

Indicate the approximate percent of **in-class activities** that overlapped with the **learning goals** provided by the instructor:

	%										Not Applicable	
	0	1	2	3	4	5	6	7	8	9	10	
	0	0	0	0	0	0	0	0	0	0	0	
	()											

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Students were asked to **work in groups** of two or more for any portion of this course:

- Yes (1)
- No (0)

Indicate the average percent of class time during which students were asked to work in groups of two or more:

	%										Don't know	
	0	1	2	3	4	5	6	7	8	9	10	
	0	0	0	0	0	0	0	0	0	0	0	
	()											

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Diversity includes differences in race, ethnicity, culture, background, religion, affiliation, age, gender, orientation, course performance, personality type, etc.

Please rate the degree to which you agree with the following statements regarding diversity in this course.

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)	Don't know (6)	Not applicable (7)

Examples or analogies used in this course included diverse people and cultures. (1)

Students were encouraged to challenge dominant systems of knowledge and culture propagated by those with power and privilege. (2)

Students were encouraged to connect or relate learning to their real life experiences, communities, and cultures. (3)

Students were encouraged to consider the ideas and contributions of diverse researchers and other people involved in science. (4)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Students were asked to provide formal or informal feedback (e.g. surveys, written student reflections, one-on-one or group conversations with the instructor) on course activities and content prior to the end of the term evaluation:

- never (0)
- 1 time during the term (1)
- 2 times during the term (2)
- 3 times during the term (3)
- 4 times during the term (4)
- 5 times during the term (5)
- 6 or more times during the term (6)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

As the instructor, I was generally aware of instances when a concept was not understood by the majority of students prior to an exam:

- not at all (0)
- rarely (1)
- less than half of the time (2)
- half of the time (3)
- more than half of the time (4)
- most of the time (5)
- always (6)

When it became clear that the class did not understand a concept, students were provided with follow-up discussion, activities, or resources.

- not at all (0)
- rarely (1)
- less than half of the time (2)
- half of the time (3)
- more than half of the time (4)
- most of the time (5)
- always (6)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses. Please consider both **in-class and out-of-class** required course activities in your responses.

Students were asked to identify or formulate hypotheses or make predictions about the results of demonstrations, experiments, or examples approximately:

- zero times (0)
- 1-2 times during the term (1)
- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)
- more than 4 times per week (6)

Students were asked to design experiments to answer scientific questions approximately:

- never (0)
- 1-2 times during the term (1)

- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)
- more than 4 times per week (6)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Please consider both **in-class** and **out-of-class** required course activities in your responses.

Students were asked to analyze or interpret scientific data shown in graphs or tables approximately:

- never (0)
- 1-2 times during the term (1)
- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)
- more than 4 times per week (6)

Students were asked to use data to make decisions or defend scientific conclusions approximately:

- never (0)
- 1-2 times during the term (1)
- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)
- more than 4 times per week (6)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Please consider both **in-class** and **out-of-class** required course activities in your responses.

Students engaged in higher level thought processes that required them to apply, analyze, incorporate, or evaluate their knowledge or skills rather than just memorizing facts or processes approximately:

- never (0)
- 1-2 times during the term (1)
- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)
- more than 4 times per week (6)

Students were asked to participate in open-ended exercises, such as case-studies or questions in which multiple correct answers are possible approximately:

- never (0)
- 1-2 times during the term (1)
- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)

- more than 4 times per week (6)

Please report teaching practices under typical conditions (before COVID). Do not include practices from laboratories or recitation/discussion sections in your responses.

Please consider **both in-class and out-of-class** required course activities in your responses.

Students were provided with opportunities or suggestions to reflect on whether their study habits were effective for learning approximately:

- never (0)
- 1-2 times during the term (1)
- about 1 time per month (2)
- 2-3 times per month (3)
- 1-2 times per week (4)
- 3-4 times per week (5)
- more than 4 times per week (6)

What biology concepts do you find students have persistent misconceptions about in your course? Tell us about one or two of these.

What biology concepts do you find students struggle to develop deep understanding about in your course?

What **study skills** do students struggle to develop that are critical for your course?

What **life or thinking skills** do students struggle to develop in your course that they need to succeed?

Please rate the degree to which you agree with the following statements related to student learning.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)	Don't know (6)
I believe that students have a certain amount of intelligence and they really can't do much to change it. (1)	○	○	○	○	○	○

I believe that students' intelligence is something about them that they can't change very much. (4)

I believe that students can learn new things, but they can't really change their basic intelligence. (5)

Rate the extent to which the following factors may impede or have impeded your use of active learning practices in your course.

Active learning teaching practices: teaching practices (e.g. polling, in-class activities, student group work, student discussion) that differ from traditional lecture.

	Prevents my use (1)	Impedes, but does not prevent my use (2)	Does not impede my use (3)	Don't know (4)
Students are resistant or unwilling to engage or interact in an active learning classroom. (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students have too wide a disparity in background knowledge, preparation, and abilities. (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Student evaluations may decrease, which could negatively affect me. (21)

Rate the extent to which the following factors may impede or have impeded your use of active learning practices in your course.

	Prevents my use (1)	Impedes, but does not prevent my use (2)	Does not impede my use (3)	Don't know (4)
My department chair is not supportive or encouraging of these practices in my course. (28)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The departmental norm for teaching is lecture. (29)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are no funds available to support implementing active learning practices (e.g., grant opportunities, teaching release). (30)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate the extent to which the following factors may impede or have impeded your use of active learning practices in your course.

	Prevents my use (1)	Impedes, but does not prevent my use (2)	Does not impede my use (3)	Don't know (4)
I do not have sufficient knowledge to implement active learning practices. (42)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Too much preparation time is required. (43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have to cover too much content. (44)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The subject matter is not conducive to using active learning practices. (45)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assessing student learning in an active learning classroom is difficult. (46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't have access to suitable active learning course materials. (47)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate the extent to which the following factors may impede or have impeded your use of active learning practices in your course.

	Prevents my use (1)	Impedes, but does not prevent my use (2)	Does not impede my use (3)	Don't know (4)
The classrooms available for my course are inappropriately designed (e.g., fixed chairs, lecture hall). (58)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My class is too large to use active learning practices. (59)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Where do you teach? (select all that apply)

- Two-year college (1)

- Four-year college (2)
- Masters-granting comprehensive university (3)
- Ph.D.-granting research university (4)
- Other (please specify): (5) _____

What is your current status at your two-year institution?

- Tenured (1)
- Probationary, Tenure Track (2)
- Renewable Contract Instructor (e.g., Adjunct) (3)
- Other (please specify): (6) _____

In a typical year, are you considered a full-time employee of your two-year institution for at least nine months of the year?

- Yes (1)
- No (2)

Is your institution designated as a minority-serving institution (e.g. HBCU, HSI, Tribal College)?

- Yes (1)
- No (2)
- Unsure (3)

How much college level teaching experience do you have?

- < 2 years (1)
- 2-5 years (2)
- 6-10 years (3)
- 11-20 years (4)
- >20 years (5)

Gender: How do you identify?

- Woman (1)
- Non-binary (5)
- Man (6)
- Prefer to self-describe [Please self describe] (7)

-
- Prefer not to answer (8)

Are you of Hispanic, Latina/o/x, or Spanish origin?

- Yes (1)
- No (2)
- Unsure (4)
- Prefer not to answer (3)

What is your race? (select all that apply)

- American Indian or Alaskan Native (7)
- Asian (8)
- Black or African American (9)
- Native Hawaiian or Pacific Islander (10)
- White (11)
- Other (please specify): (13) _____
- Prefer not to answer (12)

Supplement 2. Descriptive statistics of MIST short items ($n= 388$).

MIST survey item	Scale / Frequency (%)						
	not provided to students	the course as a whole	each unit or exam	each broad topic or chapter	each specific subtopic or chapter subsection	some or most individual activities or assignments	each individual activity or assignment
Learning goals were provided by the instructor for:	0%	32%	19%	21%	11%	11%	6%
	never	1-2 questions per month	3-4 questions per month	2-3 questions per week	4-5 questions per week	6-10 questions per week	more than 10 questions per week
Students were asked to use a polling method to answer questions in the classroom approximately:	42%	14%	8%	13%	10%	8%	5%
	never	up to 1 activity per month	2-3 activities per month	4-7 activities per month	2-3 activities per week	4-5 activities per week	more than 5 activities per week
Students were asked to complete in-class activities approximately:	6%	13%	24%	23%	24%	5%	5%
Students were provided with opportunities or suggestions to reflect on whether their study habits were effective for learning approximately:	12%	29%	24%	16%	15%	3%	1%
	never	1 time during the term	2 times during the term	3 times during the term	4 times during the term	5 times during the term	6 or more times during the term
Students were asked to provide formal or informal feedback	13%	36%	26%	13%	4%	2%	5%
	not at all	rarely	less than half of the time	half of the time	more than half of the time	most of the time	always
As the instructor, I was generally aware of instances when a concept was not understood by the majority of students	1%	7%	10%	17%	23%	38%	4%

prior to an exam:							
When it became clear that the class did not understand a concept, students were provided with follow-up discussion, activities, or resources.	1%	4%	6%	8%	16%	40%	27%
	zero times	1-2 times during the term	about 1 time per month	2-3 times per month	1-2 times per week	3-4 times per week	more than 4 times per week
Students were asked to identify or formulate hypotheses or make predictions about the results of demonstrations, experiments, or examples approximately:	5%	19%	16%	25%	30%	4%	2%
Students were asked to design experiments to answer scientific questions approximately:	22%	31%	15%	15%	15%	2%	1%
Students were asked to analyze or interpret scientific data shown in graphs or tables approximately:	3%	16%	18%	26%	26%	8%	2%
Students were asked to use data to make decisions or defend scientific conclusions approximately:	11%	20%	16%	25%	21%	6%	1%
Students engaged in higher level thought processes approximately:	2%	7%	10%	29%	33%	14%	6%
Students were asked to participate in open-ended exercises, such as case-studies or questions in which multiple correct answers are possible approximately:	9%	18%	18%	24%	24%	5%	2%
	No	Yes					
Students were asked to work in groups of two or more for any portion of this course:	20.80%	79.20%					
	Mean	Std Deviation					
Indicate the average percent of class time during which students were asked to work in groups of two or more:	33.33	22.21					
Indicate the approximate percent of polling questions that overlapped with the learning goals provided by the instructor:	71.15	26.31					
Indicate the approximate percent of in-class activities that overlapped with the learning goals provided by the instructor:	76.43	25.27					
	Strongly disagree	Disagree	Neither agree nor	Agree	Strongly agree		

			disagree				
Examples or analogies used in this course included diverse people and cultures.	1%	7%	20%	46%	26%		
Students were encouraged to consider the ideas and contributions of diverse researchers and other people involved in science.	2%	8%	16%	42%	32%		

Supplement 3. Confirmatory factor analysis

Standardized factor loadings for latent variable TPB constructs.

Construct	Observed variable	Standardized loading
Social norm	Collegial support	0.80
	Chair support	0.97
Perceived behavioral control	Active learning knowledge	0.89
	Active learning skill	0.90