Supplemental Material

CBE—Life Sciences Education

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Appendix Table A: Detailed Rubrics for Qualitative Coding of Instructor Talk

Positively-Phrased Instructor Talk: Categories and Subcategories Rubric

Productive Category	Productive Subcategory	Characteristics
Building the Instructor/ Student Relationship	Demonstrating Respect for Students	- Expressing empathy for and acknowledging student challenges - Showing appreciation for students and their efforts - Note: If subcategory is unclear, assign Demonstrating Respect for Students
	Revealing Secrets to Success	- Explaining study strategies that have been effective for other students - Telling students what they can do to succeed in learning or life - Note: This subcategory does not include instructing students how to successfully get points, but instead on successfully learning
	Boosting Self-Efficacy	- Giving praise to students for their efforts - Expressing belief that students are capable
Establishing Class Culture	Pre-Framing Classroom Activities	- Preparing students for in-class activities - Sharing how much time activities will take, activity structure, and/or what comes next - Does not include course logistics, logistics for future activities, or homework instructions
	Practicing Scientific Habits of Mind	- Encouraging students to be skeptical, ask questions, use evidence, etc. - Engaging students in predicting, hypothesizing, proposing alternative hypotheses, or specifically promoting any other use of scientific method,
	Building a Biology Community among Students	- Encouraging students to help one another - Promoting positive student-to-student relationships - Explicitly stating that learning occurs through interactions with other students too, not just from the instructor - Note: This does not include instructing students to interact with one another (PCA)
	Giving Credit to	- Recognizing research or contributions from others

	Colleagues	- Praising fellow faculty members, scientists, staff, or other colleagues
	Indicating it's OK to be Wrong/ Disagree	- Stating to students that it's OK if they don't know the right answer - Emphasizing that disagreement among students is likely and is productive - Encouraging students to share their own ideas
Explaining Pedagogical Choices	Supporting Learning through Teaching Choices	- Explaining the reasons why an instructor is using certain in-class teaching strategies - Note: If subcategory is unclear, assign Supporting Learning Through Teaching Choices
	Using Student Work to Drive Teaching Choices	- Using evidence from students to decide where to go next in class(HW, clickers, etc.)
	Connecting Biology to the Real World and Career	- Describing how the concepts that students are learning may be important for their future - Using examples that relate to students' potential careers
	Discussing How People Learn	- Describing research on how people learn or how the brain works - Focusing students on the importance of attention and relevance in learning - Encouraging students to think metacognitively about their own learning
	Fostering Learning for the Long-Term	- Emphasizing long-term knowledge, rather than short-term gains - Deemphasizing quizzes and tests as goals of learning
Sharing Personal Experiences	Recounting Personal Information or Anecdotes	- Sharing personal stories that are not specifically related to student experience (see below) - Discussing family, dog, travel, or other personal stories - Conveying experiences of being an instructor, grading, preparing for class, etc.
	Relating to Student Experiences	- Connecting with students by sharing experiences from their past that students may have had too, e.g. being shy in class, sitting in the back of the room, being confused by certain course material - Recounting career choices and stories

Unmasking Science	Being Explicit about the Nature of Science	- Sharing examples of how science has been done - Describing that working in science is never done alone - Emphasizing that science is about figuring out the unknown
	Promoting Diversity in Science	- Being explicit that there is a place for everyone in science - Emphasizing the importance of diversity in solving complex problems - Celebrating examples of diversity in science
	Fostering Wonder in Science	- Encouraging excitement about what students are learning - Sharing interesting biology ideas that the instructor finds wonder in

Negatively-Phrased Instructor Talk: Categories and Subcategories Rubric

Non-Productive Category	Non-Productive Subcategory	Characteristics
Dismantling the Instructor-Student Relationship	Ignoring Student Challenges	- Keeping students past class time - Assuming it should be easy for students to speak in front of class - Ignoring that students have lives outside of school and class
	Assuming Poor Behaviors from Students	- Assuming that students do not want to be in class, participate in activities, or learn - Assuming students are sleeping in class, not doing their homework, not studying, etc.
	Making Public Judgments about Students	- Targeting single students or groups of students in front of the class - Expressing criticism or pointing out student deficits publicly - Calling students lazy, quiet, stupid, tired, etc
Disestablishing Class Culture	Expecting Students to Know What to Do	- Not giving explicit directions but expecting students to know what to do - Criticizing the class as a whole for behavior that the instructor didn't want or expect - Note: Does not include guiding students to participate in class activities
	Parallel to Practicing Scientific Habits of Mind	- No instances observed yet
	Discouraging Community Amongst Students	- Gathering input from students about how to punish other students for cheating - Note: Have not seen much evidence for this sub-category, yet
	Criticizing Colleagues	- Publicly judging other professors or scientists - Note: Does not include constructively questioning what other scientists believe or write
	Encouraging Only the Right Answer	- Telling students the instructor wants them to only know the right answer, rather than encouraging questions or observations - Telling students that it's okay to just know the right answer and not

		understand why

Compromising Pedagogical Choices	Expressing Doubt in Pedagogical Choice	- Sharing skepticism with students about teaching techniques being used - Note: Have not seen much evidence for this sub-category, yet
	Using Convenience to Drive Teaching Choices	- Encouraging students to do what's easiest for the instructor rather than what is best for student learning - Convenience influences teaching choices made in class, this does not include choices made about testing/grading/etc. - Note: Does not include showing appreciation/demonstrates respect for students doing what might be easier for the instructor
	Parallel to Connecting Biology to the Real World and Career	- No instances observed yet
	Teaching to a Subset of Students	- Disregarding that some students are still struggling - Note: Have not seen much evidence for this sub-category, yet
	Focusing on the Grade/Short Term	- Encouraging earning points for grade rather than learning - Talking about grades to motivate participation
Sharing Personal Judgment / Pity	Sharing Self-Judgment or Self-Pity	- Publicly insulting oneself - Sharing self-pity with students - Note: Does not include admitting instructor mistakes - Note: Does not include sharing personal stories or relating to student experiences
	Distancing from Student Experiences	- Using the hypothetical student to express disdain towards student groups, e.g. "I hate that student that doesn't have to study." - Using culturally insensitive examples - Stereotyping groups of students, e.g. "those pre-meds"
Masking Science	Being Implicit about the Nature of Science	- Dismissing student curiosity or questions about science - Obscuring how scientific ideas were discovered
	Intimidating Students From Science	- Implying that the course is scaring students away from science - Note: Have not seen much evidence for this sub-category, yet
	Parallel to Fostering	- No instances observed yet

Notes on Common Instructor Talk Coding Confusions:

1. Identifying Instructor Talk and Excluding Logistics
   - Include all non-content language used by the instructor during class time, addressing the class as a whole, and excluding logistics as described below:
     - Exclude when instructor references changes to class schedule or office hours
     - Exclude when instructor emphasizes assignment instructions, expectations, associated point values, or assignment submission preferences
       - Note: If instructor uses points to drive motivation, then include as Negatively-Phrased Instructor Talk in subcategory Focusing on the Grade/ Short Term (FOG) under category Compromising Pedagogical Choices.

2. Establishing Class Culture (ECC): Pre-Framing Classroom Activities OR Explaining Pedagogical Choices (EPC): Supporting Learning Through Teaching Choices
   - Assign ECC: Pre-Framing Classroom Activities when instructor uses language to structure the classroom environment.
   - Assign EPC: Supporting Learning Through Teaching Choices when instructor is explaining why activities may benefit student learning.

3. Establishing Class Culture (ECC) OR Building the Instructor Student Relationship (BISR)
   - Assign ECC when instructor is emphasizing class culture or student-to-student relationships.
   - Assign BISR when instructor is emphasizing their relationship with students.

4. Practicing Scientific Habits of Mind (PSHM) OR Connecting Biology to the Real World (CBRW)
   - Assign PSHM when an instructor emphasizes specific practices but not how these practices relate to the real world.
   - Assign CBRW when instructor emphasizes preparing for future careers or scientific habits that are used by individuals in the real world.

Appendix Table B. The First 15-minute Instructor Talk Sample *equals or exceeds* Expected 15-minute Instructor Talk for Overall Positively-Phrased Instructor Talk, as well as for Individual Categories, with Few Exceptions

		Overall Positively-phrased Instructor Talk			Building the Instructor/ Student Relationship			Establishing Class Culture			Explaining Pedagogical Choices			Sharing Personal Experiences			Unmasking Science		
		Exp. 15m[a]	Act. 15m[b]	Total[c] (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)
Previous Study	**Inst. A**	133	237	485	47	99	172	40	67	147	27	50	100	8	11	29	7	7	25
	Inst. B	22	31	80	5	8	17	10	18	37	3	3	12	1	0	3	1	2	5
Number of Instructor Talk Instances	**Gordon**	10	25	59	3	4	16	2	3	10	4	14	25	1	4	7	0	0	1
	Luisa	14	36	84	8	20	45	5	10	27	1	3	6	1	3	5	0	0	1
	Helen	31	55	184	12	31	72	8	11	46	2	4	14	6	7	36	1	0	3
	Simone	31	76	183	17	51	99	3	1	16	5	9	28	6	13	38	0	2	2
	Loretta	45	41	271	11	11	63	20	16	118	8	6	48	6	7	38	1	1	4
	Ana	47	97	284	27	65	163	7	8	43	4	10	22	8	14	45	2	0	11
	Jerry	67	122	403	25	54	149	22	35	132	12	15	70	8	16	48	1	0	4
	Mario	65	173	388	37	106	219	3	1	17	3	7	17	19	46	115	3	12	20
	Average ± SEM	46 ±11	89 ±22	242 ±47	19 ±5	45 ±12	102 ±22	12 ±4	17 ±6	59 ±16	7 ±2	12 ±4	34 ±9	6 ±2	12 ±4	36 ±10	2 ±1	2 ±1	8 ±3

Note: Shading highlights where the Actual 15-minute Instructor Talk Sample *equals or exceeds* the Expected 15-minute Instructor Talk for that course in that category (calculated as described below), suggesting that the first 15-minutes of class sampling method *represents or over-represents* the amount of Instructor Talk present throughout the class session.

[a] Exp. 15m. = Expected 15-minute Instructor Talk: This was calculated by multiplying the total number of Instructor Talk instances detected in a category across all class sessions by the proportion of time that the first 15 minutes of class would represent for that course (e.g. 15/50 multiplier (0.3) for a course with 50-minute class sessions or a 15/120 multiplier (0.125) for a course with 2-hour class sessions).

[b] Act. 15m. = Actual 15-minute Instructor Talk Sample: This was the number of Instructor Talk instances detected in the first 15 minutes across all class sessions for that course.

[c] Total (n) = Total Instructor Talk Instances: This was the number of Instructor Talk instances detected in all class sessions for that course in the particular category.

Appendix Table C. The First 15-minute Instructor Talk Sample *equals or exceeds* Expected 15-minute Instructor Talk for Overall Negatively-Phrased Instructor Talk, as well as for Individual Categories, with Few Exceptions

		Overall Negatively-phrased Instructor Talk			Dismantling the Instructor/ Student Relationship			Dis-establishing Class Culture			Compromising Pedagogical Choices			Sharing Personal Judgment			Masking Science		
		Exp. 15m	Act. 15m	Total	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)	Exp. 15m	Act. 15m	Total (n)
Previous Study	**Inst. A**	4	5	13	3	3	10	0	0	0	1	2	2	0	0	1	0	0	0
	Inst. B	1	1	3	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0
Number of Instructor Talk Instances	**Gordon**	1	1	4	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0
	Luisa	1	5	8	1	2	4	0	0	0	0	1	1	1	2	3	0	0	0
	Helen	2	2	9	1	1	3	0	0	1	1	1	4	0	0	1	0	0	0
	Simone	3	7	17	1	3	3	0	0	0	1	3	5	2	1	9	0	0	0
	Loretta	7	9	43	4	5	26	1	1	6	2	3	10	0	0	1	0	0	0
	Ana	9	14	52	4	7	22	1	2	5	1	4	8	3	1	17	0	0	0
	Jerry	1	6	8	0	0	1	0	0	1	1	6	5	0	0	1	0	0	0
	Mario	17	62	102	7	16	42	2	6	11	5	29	27	4	11	21	0	0	1
	Average ± SEM	4 ±2	11 ±6	26 ±10	2 ±1	4 ±2	12 ±4	0 ±0	1 ±1	2 ±1	1 ±0	5 ±3	6 ±3	1 ±0	2 ±1	5 ±2	0	0	0

Note: Shading highlights where the Actual 15-minute Instructor Talk Sample *equals or exceeds* the Expected 15-minute Instructor Talk for that course in that category (calculated as described below), suggesting that the first 15-minutes of class sampling method *represents or over-represents* the amount of Instructor Talk present throughout the class session.

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[c] Total (n) = Total Instructor Talk Instances: This was the number of Instructor Talk instances detected in all class sessions for that course in the particular category.