

Supplemental Material

CBE—Life Sciences Education

Shi *et al.*

Supplemental Materials For

Exploring the complementarity of measures of instructional practices

Lu Shi, Maia Popova, Robert M. Erdmann, Anthony Pellegrini, Binh Le, Victoria Johnson, Trina Nelson, Zachary Nelson, Molly Undersander Gaston, and Marilyne Stains

Table of Contents

Table S1. Modified LCTR rubrics

Table S2. Description of LCTR score by each LCTR rubric

Table S3. COPUS and LCTR outputs for each study participant

Table S1. Modified LCTR rubrics

| Rubric | Components |
|--|---|
| I. The Function of Content | <ol style="list-style-type: none"><li data-bbox="523 387 1382 488">1. In addition to building a knowledge base, the instructor uses content to help students understand why they need to learn the content for courses within or outside their major and for their future career.<li data-bbox="523 499 1382 555">2. The instructor uses content to practice using scientific practices in the discipline or to solve authentic problems.<li data-bbox="523 566 1382 656">3. The instructor helps students acquire in-depth conceptual understanding of the content to facilitate deep learning and use of transferable skills. |
| II. The Role of The Instructor | <ol style="list-style-type: none"><li data-bbox="523 667 1382 768">1. The instructor creates a supportive and success-oriented environment for learning and for accomplishment for all students through proactive, clear, and overt course-specific techniques.<li data-bbox="523 779 1382 835">2. The instructor uses diverse teaching strategies that promote the achievement of student learning.<li data-bbox="523 846 1382 902">3. The instructor develops and uses a variety of learning outcomes/goals.<li data-bbox="523 913 1382 1037">4. The instructor aligns two essential components of a course: learning outcomes/goals and assessment methods in terms of content and uses consistent verbs representing the same cognitive processing demands/intellectual skills placed on the students. |
| III. The Responsibility for Learning | <ol style="list-style-type: none"><li data-bbox="523 1048 1382 1149">1. The instructor sets student expectations, which enable the responsibility for learning to be shared between the instructor and the students.<li data-bbox="523 1160 1382 1216">2. The instructor fosters students' engagement in reflection and critical review of their learning through well-structured activities. |
| IV. The Purposes and Processes of Student Assessment | <ol style="list-style-type: none"><li data-bbox="523 1227 1382 1283">1. The instructor uses formative assessment within the learning process.<li data-bbox="523 1294 1382 1328">2. The instructor promotes students to use peer-assessments.<li data-bbox="523 1339 1382 1395">3. The instructor allows the students to demonstrate mastery of the objectives and ability to learn from mistakes.<li data-bbox="523 1406 1382 1462">4. The instructor uses authentic assessments (e.g., research report, case study). |
| V. The Balance of Power | <ol style="list-style-type: none"><li data-bbox="523 1473 1382 1570">1. The instructor allows for some flexibility of course policies, assessment methods, learning methods, and deadlines or how students earn grades. |

Table S2. Description of LCTR score by each LCTR rubric

| N-LCTR Classification | LCTR rubrics | | | | |
|------------------------------|--|---|---|--|--|
| | The Function of Content: How the students will use and why they should learn the content | The Role of the Instructor: Instructor should facilitate and create an environment to promote students' learning | The Responsibility for Learning: Instructors can teach students to take responsibility for their learning | The Purposes and Processes of Assessment: Assessment should be given during the learning process | The Balance of Power: Students have more control over their learning |
| Instructor-centered | The instructor 1) only helps students to build a knowledge base, but does not use content to help students understand why they need to learn the content; 2) provides no opportunities for student to practice using scientific practice or to solve authentic problems; 3) does not provide opportunities for students to apply knowledge to new content or encourage the development of transferable skills. | The instructor 1) does not make themselves/resources available beyond office hours; 2) primarily lectures; 3) does not develop or not use (or have vague) learning outcomes/goals; 4) does not align learning outcomes/goals with assessment methods. | The instructor 1) takes the responsibility for student learning; 2) provides no opportunities for student reflection, critical review, and self-assessment of their learning. | The instructor 1) does not integrate formative assessment within the learning process; 2) does not provide students with opportunities for peer-assessment; 3) does not provide any opportunities for students (or only give opportunities to some students) to demonstrate that they learned from mistakes or to show mastery beyond the first attempt; 4) rarely or never uses authentic assessment. | The instructor mandates all policies, learning and assessment methods and deadline, or allows some students flexibility in deadlines or how they earn grades but does not let other students know about these possibilities. |
| Lower level of transitioning | The instructor 1) helps student to recognize why they need to learn the content; 2) provides limited opportunities for students to practice using scientific practices or to solve authentic problems but does not teach how to do it or only teaches if students ask in one-on-one interaction; 3) provides limited opportunities to apply knowledge to new content and to develop transferable skills. | The instructor 1) is available to help students in one-on-one situations; 2) uses limited number of teaching strategies other than lecturing; 3) develops low-level learning outcomes/goals only (based on Bloom's taxonomy), and may share them with students; 4) aligns learning outcomes/goals and assessment methods but does not explain this to students. | The instructor 1) believes that students and instructors should share responsibility for learning; 2) provides opportunities for student reflection, critical review, and self-assessment of their learning, but does not teach students how to do self-assessment. | The instructor 1) minimally integrates formative assessment within the learning process; 2) requires students to use peer-assessments once or twice, and does not count this toward the final grade; 3) provides one opportunity (e.g., cumulative final) for students to demonstrate that they mastered the material after the first attempt; 4) uses one authentic assessment that is weighted 10-20 % of the final grade. | The instructor is flexible on one of the following: course policies, learning or assessment methods, deadlines, how students earn grades, and allows all students the same flexibility. |

| | | | | | |
|-------------------------------|--|---|---|---|--|
| Higher level of transitioning | The instructor 1) provides several opportunities to help students identify why they need to learn the content for use in courses within or outside their major and for their careers; 2) provides students several opportunities to practice scientific practices or to solve authentic problems and teaches this to all student in the class; 3) requires all students to use content in other contexts. | The instructor 1) in one-on-one situations gives clear and overt specific techniques to help students to succeed; 2) uses several teaching strategies other than lecturing; 3) develops low- and high-level learning outcomes/goals, and shares them with students in the syllabus; 4) aligns learning outcomes/goals and assessment methods, and shares them with students in course documents, but does not explain to students why it is important. | The instructor 1) believes that students should take responsibility for their learning; 2) provides opportunities throughout the course for student reflection, critical review, and self-assessment of their learning, and intentionally teaches students how to do self-assessment. | The instructor 1) somewhat integrates formative assessment within the learning process; 2) teaches students how to meaningfully conduct peer-assessments, uses it several times during a course, and it counts towards the final grade; 3) provides several opportunities for students to demonstrate that they mastered the material; 4) uses one authentic assessment (or assessment have authentic elements) that is weighted 21-50 % of the final grade. | The instructor is flexible on at least two of the following: course policies, learning or assessment methods, deadlines, and how students earn grades course policies, and allows students to provide feedback on policies, methods and deadlines. |
| Learner-centered | The instructor 1) periodically (at least weekly) requires students to reflect or evaluate in majority of their assessment why they need to learn content for use in courses within or outside their major and for their careers; 2) provides (at least weekly) student practice to develop scientific practices or to solve authentic problems and assesses them; 3) requires students to learn or integrate content on their own in a large paper or project. This assignment counts towards their final grade. | The instructor 1) gives clear and overt specific techniques to all students and explain to students how these methods promote students success; 2) uses many teaching strategies and regularly uses active learning approaches; 3) places in the syllabus low- and high-level learning outcomes/goals and regularly refers to them throughout the course; 4) aligns learning outcomes/goals and assessment methods. This is clearly shown and explained and is actually used to align course materials. | The instructor 1) encourages students to take responsibility for learning and provides opportunities and teaches them how to do it; 2) provides formative feedback and assess students' self-assessment which includes facilitates students to develop reflection, critical review, and self-assessment skills of their learning, and explains how and why they need to do self-assessment. | The instructor 1) mostly integrates formative assessment within the learning process; 2) models how to conduct meaningful peer-assessments, uses it several time in the course, provides feedback to students, and counts it toward the final grade; 3) provides many opportunities for students to demonstrate what they mastered; 4) uses authentic assessments throughout the course. These authentic assessment elements count toward 51-80 % of the final grade. | The instructor is flexible on at least four of the following: course policies, learning or assessment methods, deadlines, and how students earn grades course policies, and actively seeks student feedback on policies, methods and deadlines and responds to their feedback with appropriate and considered changes. |

Table S3. COPUS and LCTR outputs for each study participant

| Instructor | Number of video observations | COPUS instructional styles | | | LCTR rubric | | | | | |
|------------|------------------------------|----------------------------|---------------------|------------------|--------------------|---------------------------|--------------------------|--|--|------------------------|
| | | Didactic | Interactive Lecture | Student-centered | Average LCTR score | 1.The function of content | 2.The role of instructor | 3.Development of the student responsibility for learning | 4.The purposes and processes of student assessment | 5.The balance of power |
| 6 | 4 | 100% | 0% | 0% | 1.33 | 1.67 | 1.50 | 1.00 | 1.50 | 1.00 |
| 7 | 3 | 100% | 0% | 0% | 1.50 | 2.00 | 1.75 | 1.00 | 1.75 | 1.00 |
| 8 | 2 | 100% | 0% | 0% | 1.68 | 1.67 | 2.50 | 1.50 | 1.75 | 1.00 |
| 9 | 2 | 100% | 0% | 0% | 1.88 | 1.67 | 2.00 | 1.50 | 1.25 | 3.00 |
| 10 | 2 | 100% | 0% | 0% | 2.17 | 3.33 | 2.25 | 1.50 | 1.75 | 2.00 |
| 11 | 2 | 100% | 0% | 0% | 2.20 | 3.00 | 2.50 | 1.00 | 1.50 | 3.00 |
| 12 | 3 | 100% | 0% | 0% | 2.25 | 2.00 | 3.25 | 2.00 | 2.00 | 2.00 |
| 1 | 3 | 100% | 0% | 0% | 2.28 | 2.67 | 3.00 | 2.00 | 1.75 | 2.00 |
| 13 | 8 | 63% | 38% | 0% | 1.62 | 1.33 | 2.75 | 1.00 | 2.00 | 1.00 |
| 14 | 2 | 50% | 50% | 0% | 2.02 | 2.33 | 2.75 | 1.00 | 2.00 | 2.00 |
| 15 | 4 | 25% | 75% | 0% | 2.47 | 3.33 | 2.75 | 2.00 | 2.25 | 2.00 |
| 16 | 5 | 20% | 80% | 0% | 2.87 | 3.33 | 3.50 | 2.00 | 2.50 | 3.00 |
| 17 | 6 | 17% | 83% | 0% | 2.22 | 3.33 | 2.50 | 2.00 | 2.25 | 1.00 |
| 18 | 4 | 0% | 100% | 0% | 1.85 | 1.00 | 1.75 | 1.50 | 2.00 | 3.00 |
| 5 | 2 | 0% | 100% | 0% | 2.05 | 3.00 | 2.75 | 1.00 | 2.50 | 1.00 |
| 19 | 3 | 0% | 100% | 0% | 2.12 | 2.33 | 2.00 | 1.50 | 2.75 | 2.00 |
| 20 | 3 | 0% | 100% | 0% | 2.32 | 2.00 | 2.33 | 2.00 | 2.25 | 3.00 |
| 21 | 4 | 0% | 100% | 0% | 2.38 | 3.33 | 2.33 | 1.50 | 2.75 | 2.00 |
| 22 | 6 | 50% | 33% | 17% | 1.88 | 2.67 | 2.75 | 1.50 | 1.50 | 1.00 |
| 23 | 4 | 25% | 50% | 25% | 2.65 | 3.00 | 3.00 | 2.00 | 2.25 | 3.00 |
| 24 | 5 | 40% | 20% | 40% | 2.32 | 2.33 | 3.00 | 1.50 | 1.75 | 3.00 |
| 4 | 4 | 50% | 0% | 50% | 3.12 | 3.33 | 3.50 | 3.50 | 2.25 | 3.00 |
| 3 | 4 | 0% | 50% | 50% | 2.03 | 1.67 | 2.50 | 2.00 | 2.00 | 2.00 |
| 2 | 2 | 0% | 50% | 50% | 2.27 | 3.33 | 3.00 | 2.00 | 2.00 | 1.00 |
| 25 | 4 | 0% | 50% | 50% | 3.17 | 3.33 | 3.50 | 4.00 | 3.00 | 2.00 |
| 26 | 5 | 40% | 0% | 60% | 2.43 | 2.67 | 3.50 | 2.00 | 2.00 | 2.00 |
| 27 | 3 | 0% | 33% | 67% | 2.60 | 3.00 | 2.50 | 2.00 | 2.50 | 3.00 |
| 28 | 3 | 0% | 0% | 100% | 2.72 | 3.33 | 3.50 | 2.00 | 1.75 | 3.00 |