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Investigating the Impact of Faculty Learning Communities on Biology Instructors

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INTRODUCTION

- **Faculty Learning Communities (FLCs) to support faculty change**
  - Few prior studies on STEM FLCs
  - Five-year study: 19 participants at six Research-I institutions
- **Automated Analysis of Constructed Response (AACR) facilitates student writing in large undergraduate classes**
  - Faculty members choose a question from a database
  - Student responses analyzed by computer
  - Report identifies scientific and alternative ideas
- **FLCs support faculty using AACR questions and reports**
  - Face-to-face local monthly meetings
  - Virtual meetings with FLCs at other institutions
  - Initial face-to-face meeting for all FLC participants
- **Prior research supports the FLC model**
  - Extended support for PD leads to lasting change (Henderson *et al.* 2011, J Res Sci Teach *48*(8), 952 – 984 and Henderson *et al.* 2012, Phys Rev Spec Top *8*(2), 020104-020101 – 020104-020115).

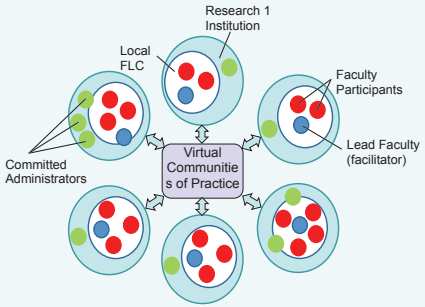


Figure 1: The structure of the faculty learning communities (FLCs). Each local FLC is made up of faculty participants and a lead faculty member who serves as a facilitator. Committed administrators offer support.

RESEARCH QUESTION

How does participation in an FLC impact instructors' teaching practices and their conceptions of teaching and learning?

METHODS

- **Classroom Observation Protocol of Undergraduate STEM (COPUS)**
  - Instructors' teaching practices
- Online survey including the **Approaches to Teaching Inventory**
  - Initial conceptions of teaching and learning.
- **Semi-structured interviews**
  - Perceptions of the FLCs
  - Conceptions of teaching and learning.

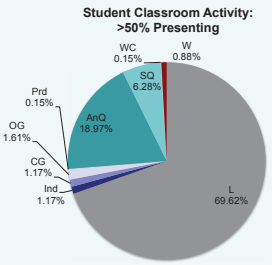
Table 1: FLC Participants, arranged by hours of Teaching PD.

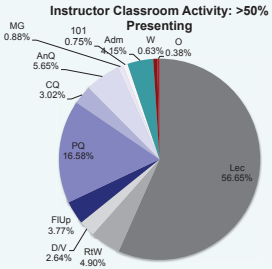
Pseudonym	Position/Title	Teaching PD	Teaching Experience
Patrick	Department Chair, Professor	31+ hours	31 years
Kate	Professor Attendant	31+ hours	31 years
Jessica	Associate Professor	31+ hours	20 years
Elaine	Senior Instructor	31+ hours	18 years
Doug	Associate Professor	31+ hours	15 years
Jeff	Lecturer	31+ hours	14 years
Andrew	Visiting Assistant Professor	31+ hours	12 years
Kyle	Assistant Professor	31+ hours	10 years
Sara	Academic Specialist	31+ hours	8 years
Claire	Associate Professor	21 – 30 hours	16 years
Allison	Instructor	21 – 30 hours	8 years
Tim	Instructor	21 – 30 hours	6 years
Hannah	Lecturer	11 - 20 hours	15 years
Matt	Associate Professor	6 – 10 hours	20 years
Liz	Professor	1 – 5 hours	20 years
Josh	Assistant Professor	1 – 5 hours	7 years
Ryan	Department Head, Professor	0 hours	24 years
Laura	Associate Professor	0 hours	17 years
Ben	Associate Professor	0 hours	13 years

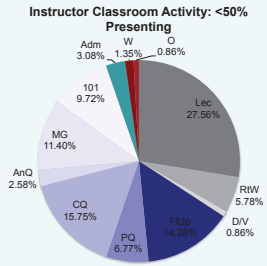
RESULTS

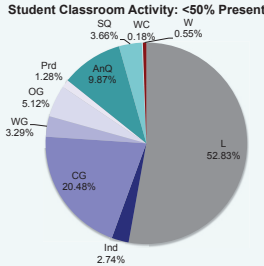
CLASSROOM OBSERVATIONS: COPUS

- The Classroom Observation Protocol for Undergraduate STEM (COPUS) provides a systematic way to catalog the various behaviors of students and instructors (Smith *et al.* 2013, CBE Life Sci Educ, *12*(4), 618-627)
  - This is a descriptive tool; it captures *behaviors* and not content
  - Trained observers mark a spreadsheet for all behaviors that occur in two-minute intervals
  - To determine code prevalence: divide the total number of times a code is marked by the total number of all codes







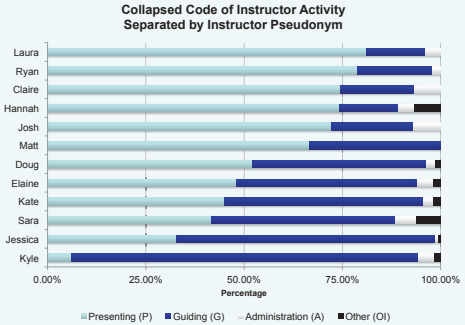


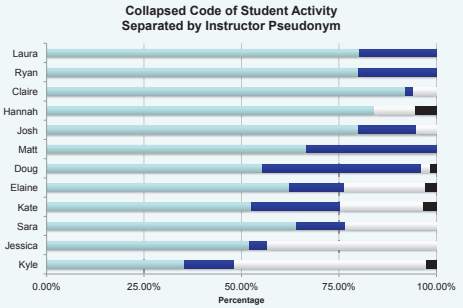
Figures 3a and 3b: Student Classroom Activity. The percentages show the frequency of an individual code averaged across all courses where instructors spend >50% of their time presenting (top) or <50% of their time presenting (bottom). Receiving codes are shown in gray, Students Working codes are shown in purple, Whole Class Guiding codes are shown in turquoise, and Other codes are shown in red. N = 14.

Figures 2a and 2b: Instructor Classroom Activity. The percentages show the frequency of an individual code averaged across all courses where instructors spend >50% of their time presenting (left) or <50% of their time presenting (right). Presenting codes are shown in gray, Guiding codes are shown in green, Administration codes are shown in yellow, and Other codes are shown in blue. N = 14.

Table 2: Description of COPUS codes. To provide a general sense of what occurs in the classroom, the 25 codes have been collapsed into four overall categories for both students and instructors.

	Collapsed Codes	Individual Codes
Instructor is Doing	Presenting (P)	Lec – Lecturing or Giving Information RtW – Real-time writing D/V – Showing or conducting a demo, experiment, simulation, video
	Guiding (G)	FlUp – Follow-up/Feedback on clicker question or activity PQ – Posing non-clicker question to students (non-rhetorical CQ – Asking clicker question (entire time, not just when first asked) AnQ – Listening to and answering student questions to the entire class MG – Moving through class guiding ongoing student work 1o1 – One-on-one extended discussion with individual students
	Administration (A)	Adm – Administration (assign homeowrk, return tests, etc.)
	Other (OI)	W – Waiting (instructor late, fixing AV problems) O - Other
Students Are Doing	Receiving (R)	L – Listening to instructor
	Whole Class Guiding (WCG)	AnQ – student answering question (posed by instructor) SQ – Student asks quiestion WC – Students engaged in whole class discussion SP – Students presenting to entire class
	Students Working (SW)	Ind – Individual thinking/problem solving CG – Discuss clicker question in groups WG - Working in groups on worksheet activity OG – Other assigned group activity Prd – Making a prediction about a demo or experiment TQ – Test or Quiz
	Other (OS)	W – Waiting (instructor late, fixing AV problems) O - Other





Figures 4a and 4b: Percentage of Collapsed Codes for Each Instructor. Each horizontal row represents a different instructor. Codes were averaged across time periods when multiple observations were conducted on the same instructor. Instructor activity (top) is arranged from the least amount of time presenting to the most. Student activity (bottom) is arranged in the same order as the instructor activity. N = 12.

APPROACHES TO TEACHING INVENTORY

- The Approaches to Teaching Inventory (ATI) is a 16-item survey (Trigwell & Prosser, 2004, Ed Psych Rev, *16*(4), 409-424)
  - Inventory contains two *independent* scales
    - Information transmission/teacher-focused (ITTF)
    - Conceptual change/student-focused (CCSF)
- All participants completed the ATI via an online survey
  - Participants responded to each item on a 5-point Likert scale ("only rarely" = 1 to "almost always" = 5)
  - Each participant received a sum total for both scales (min = 8, max = 40)
  - The mean is the average of the summed scores for all participants

Teacher Focus (ITTF)		Student Focus (CCSF)		N
Mean Score	SD	Mean Score	SD	
21.5	5.2	23.2	5.6	19

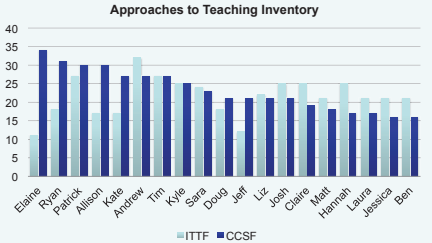


Figure 5: Approaches to Teaching Inventory. Each participant received a sum total score for the information transmission/teacher-focused scale (light blue) and the conceptual change/student-focused scale (dark blue). The scales are independent; it is possible to be high or low on both scales. Each scale contains 8 total items. Participants are arranged from high CCSF score to low.

INTERIVEWS

- Semi-structured interviews were conducted either in person or via video conferencing
  - Coding of the interview data is ongoing, but the following themes are emerging:
- **Participants' Conceptions of Teaching and Learning**
  - Teaching

" I don't want them to know cytochrome c is at this point in the electron transport chain, but I want them to understand in general terms how an electron transport chain actually generates ATP, you know, that sort of thing." Andrew

  - Assessment

"Some of them are very skilled at being able to pick apart multiple choice questions without really knowing what the subject was about… if they don't know what they're talking about, and they've just guessed or used their intuition… they won't be able to explain it." Laura

  - Learning

"I mean, learning is a progressive process. You have to start with some basic foundational understanding and then build on that." Patrick

- **Overall Benefits of the FLC to Participants**
  - How to use AACR

"… A lot of the meetings this last semester were going over how do you ask the question, how do you read the reports, sort of more of the basic stuff. I think in the future, I can see there's more like, 'Okay, here is our report. What kind of ideas can we get to address these misconceptions?'" Claire

  - Increased efficiency in changing teaching

"…Having the FLC can make things go faster… we know that what you're talking about is pretty good, but it's better when it goes this way and that's something I might have discovered five years later, but now I can just jump right through it and that kind of thing." Tim

  - Community of biology teachers

"… We kind of have a lot of the same issues with our students and it's kind of a way to commiserate but to also learn about new things." Ben

CONCLUSIONS

- This study allows us to establish a baseline description of the faculty who are participating in the AACR FLCs. Thus far, we can conclude the following:
  - Faculty have diverse approaches to and conceptions of teaching (COPUS, ATI, Interviews)
  - Faculty perceive that the FLC is critical to their use of AACR and potentially of great value to their teaching (Interviews)
  - In future years, we will continue to collect data over the duration of the project to investigate how the FLC participants change