Pedagogical Professional Development for STEM Faculty: From Individual Change to Community Empowerment

Part 1: Workshop

Leilani Arthurs, Chu-Lin Cheng, Carly Flaagan, Pierre Lu, and Patrick Shabram

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The PRIMERS project is a collaboration of three institutions.

1. Community College, PWI
   - Patrick Shabram
     Geographer & Viticulturist
     Front Range Community College
     PRIMERS FRCC Lead
   - Carly Flaagan
     Front Range Community College
     PRIMERS FRCC Assistant

2. Emerging Research, HSI
   - Chu-Lin “Mike” Cheng
     Geohydrologist
     University of Texas Rio Grande Valley
     PRIMERS UTRGV Lead
   - Ming-Tsan “Pierre” Lu
     Education Researcher
     University of Texas Rio Grande Valley
     PRIMERS UTRGV Co-Lead

3. Research Intensive, PWI
   - Leilani Arthurs
     Geologist & DBE Researcher
     University of Colorado at Boulder
     PRIMERS CUB Lead
   - Amanda McAndrew
     ASSETT
     University of Colorado at Boulder
     PRIMERS CUB Co-Lead
An external evaluator works closely with the team throughout the life of the project.

Jennifer “Jenn” Rudd  
Evaluation Project Manager  
Methodology and Evaluation Research Core Facility (MERC)  
Social and Behavioral Sciences Research Consortium (SBSRC)  
University of Nebraska-Lincoln (UNL)
By the end of this session, attendees will be able to...

1. **Recall reasons why** active learning strategies or student-centered instruction are not widely implemented in STEM courses.

2. **Discuss the advantages and disadvantages** of two end-member types of pedagogical professional development offerings.

3. **Compare approaches** to pedagogical professional development for STEM faculty at three different institutions.

4. **Stimulate discussions** and actionable plans to improve pedagogical professional development for STEM faculty at your home institutions.
What is the PRIMERS project about?

support a shift in instructional practices by incorporating more active learning into undergraduate STEM courses

What is “active learning” anyway?
Gallery Walk
on Active Learning

Part 1 (5 min): Individually tour the Q&A gallery
- Visit each station and reflect on the question(s) posed there.
- On the virtual flipchart sheet (in Padlet) for each station, type in at least one idea or experience for each question posed. [Three stations: your definition, benefits, and solutions to drawbacks]
- While you wait for others, revisit each station and read the ideas that were added since you last visited it.

Part 2 (10 min): Small group discussion (Zoom breakout rooms)
Q1. What common ideas or experiences did you notice (if any)?
Q2. How do others’ ideas or experiences change your ideas about active learning (if at all)?

Part 3 (5 min): Whole group share out
Q1. What ideas or expectations about active learning did you have coming into this Gallery Walk?
Q2. What new ideas about active learning do you have after the Gallery Walk?
Active learning is ...

- the process of **learning through activities and/or discussion**
- emphasizes **higher-order thinking** and often involves **group work**

Freeman et al., 2014

Active learning has positive outcomes ...

- higher **learning gains**
- positive social **relationships**
- improved **retention** in STEM
- other benefits

e.g., Gubera & Arugete, 2013; Johnson & Johnson, 2011; Roseth, 2008
Students learn only about 25% of the most basic concepts in traditional teacher-centered lecture courses.

Students learn significantly more in active learning student-centered courses than in traditional courses.

Students in traditional lecture-based STEM courses are 1.5 times more likely to fail than those in active-learning courses.

Active learning strategies (ALS) have been demonstrated to have positive impacts on student learning ...

- across all STEM disciplines
- with majors and non-majors
- in introductory and upper-division courses
- when even a fraction of class time is dedicated to active learning

Freeman et al., 2014

- with lower- and higher-performing students
- with ethnic/racial minority and majority groups
- with male and female students

e.g., Lorenzo et al., 2006; Fredericksen et al., 2004

Student-centered instruction through ALS supports diversity, equity, and inclusion.
Q. As little as __% class time dedicated to active learning produces higher learning gains compared to lecture alone.

A. 10%  
B. 30%  
C. 55%  
D. 75%  

(Freeman et al., 2014)
Despite the benefits of active learning, undergraduate students in STEM courses continue to be taught through traditional lecture.

- Traditional lecture remains the dominant teaching practice.

Think-Pair-Share 1
on shifting teaching practice

Why do you think traditional lecture remains the dominant teaching practice in undergraduate STEM courses?

Part 1 (5 min): Individually record responses to these two questions. [link]

Q1. What do you think are key challenges that inhibit a shift toward more student-centered instruction and active learning?

Q2. What are some ideas you have for overcoming each of the challenges that you identified?

Part 2 (10 min): In pairs*, share & discuss your individual ideas with others.

Part 3 (5 min): Report out common themes or surprises that came up.

*Instead of pairs, we’ll have small groups in case participants stepped away.
Our project aims to investigate professional development programs as mechanisms for ...

Individual Change

Community Empowerment
Based on our inter-institutional comparisons and research, we found...

### Two end-member types of PD offerings.

<table>
<thead>
<tr>
<th>Practice &amp; Feedback</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Short: None</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Long: Semester-long programs, institutes, or academies</td>
</tr>
<tr>
<td></td>
<td>Short: 1-hr workshops</td>
</tr>
<tr>
<td></td>
<td>Long: Weeks-long book clubs</td>
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</tbody>
</table>

Most PD offerings are short duration.
Think-Pair-Share 2
on professional development offerings

What do you think about different types of teaching-focused or pedagogical professional development (PD) offerings?

Part 1 (5 min): Individually record responses to these two questions. [link]
Q1. What do you think are the advantages and disadvantages to short-duration PD offerings?
Q2. What do you think are the advantages and disadvantages to long-duration PD offerings?

Part 2 (10 min): In pairs*, share & discuss your individual ideas with others.

Part 3 (5 min): Report out common themes or surprises that came up.

*Instead of pairs, we’ll have small groups in case participants stepped away.
Short-duration PD offerings (e.g., 1-hour workshops)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduling flexibility of meetings and topics</td>
<td>Shallow learning experience</td>
</tr>
<tr>
<td>Many offerings/semester possible</td>
<td>Disjointed topics</td>
</tr>
<tr>
<td>Encourage individual change</td>
<td>Absence of community in change effort</td>
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</tbody>
</table>

Long-duration PD offerings (e.g., semester-long programs)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep learning experience</td>
<td>More structured</td>
</tr>
<tr>
<td>Build community of practice with cohort</td>
<td>Single offering/semester possible</td>
</tr>
<tr>
<td>Empower individual and community change</td>
<td>Incentives for longer-term commitment</td>
</tr>
</tbody>
</table>
We proposed an initial series of professional development programs, which was informed by existing research.

- Many STEM faculty have little to no previous pedagogical training
- The program series focuses on providing foundational pedagogical training
- The program series introduces non-SET measures of thinking about and evaluating teaching
- Each program requires a semester-long commitment
- Each program builds on the previous one(s)

Each institution is customizing the initial series of programs with the aim of developing a sustainable model.
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At each institution: (1) What existed before PRIMERS and (2) What currently doing as part of PRIMERS to develop a sustainable model of pedagogical PD at their institution.
PRIOR to PRIMERS, FRCC had the Active Learning Institute
- Developed from a grant by the Colorado Community College System
- Included mandatory redesign of one course
BUT...
- Expensive to run
- Proved to be unsustainable

- Created hybrid Learning by Design/Active Learning Institute PD
- In year two, focused on a problematic course (College Algebra)
- Leveraged Tittle III grant to increase # of participants

- All participants receive off-contract hours to work on course redesign.
- Participants are encouraged to participate in peer mentoring.

- Increasing number of applicants each year.
- College will fund active learning training going forward.
- Both ALI-PRIMERS and a retooled Active Learning Institute will run in 2022.
PRIOR to PRIMERS, UTRGV already had the Center of Teaching Excellence (CTE)
- Supported by Office of Faculty Success and Diversity
- Open to all faculty on campus and PD not mandatory
  BUT...
  - Very limited funding to CTE and PD opportunities for STEM faculty
  - Limited incentives/participations
  - Limited PD and not successive

- Offered PRIMERS Learning by Design/Active Learning PD to STEM faculty
- Year 2/3 impacted by COVID
- Working on leveraging on-campus LxD/AL efforts to increase support for sustainability

- Selected/limited participants receive stipends to work on course redesign.

- Participants are encouraged to participate in peer mentoring.

- CTE re-gained attention and expanded Faculty Learning Communities (FLCs) faculty fellows program (6 positions with stipends)
- CTE re-offered FLCs starting Summer and Fall 2021
- Working on integrating active learning/PD training moving forward.
PRIOR to PRIMERS
- No institution-wide center for teaching
- PD offerings run out of several different offices and grant-funded projects
- To develop sustainable model, partnering with OIT’s ASSETT

RECENT institutional changes
- Last year, CUB created a Center for Teaching and Learning (CTL) with 2-person staff
- Last week, ASSETT downsized and key partner moved to CTL

Yr 1 ran Learning by Design program in person, ASSETT co-facilitator
Yr 2 ran Learning by Design program synchronously, ASSETT co-facilitator and train-the-trainer facilitator
ASSETT Faculty Fellows

Yr 1 Learning by Design folks re/designed courses in Yr 2-3
Yr 2 Learning by Design folks
- ASSETT Course Redesign
- Peer mentoring and classroom observation protocol training
- ASSETT in the works

Plans for sustainable model need to be reconsidered given recent institutional changes
Acknowledgements

Thank you to Connie Della-Piana, our IUSE Program Officer!

Thank you to Lauren Manier and all the AAAS-IUSE team!
Thank you for your participation today!
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Part 2: Working Session
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This material is based upon work supported by the National Science Foundation under Grant No. 1821709.
Today’s working session builds on yesterday’s workshop, where we ...

1. **Recalled reasons why** active learning strategies or student-centered instruction are not widely implemented in STEM courses.

2. **Discussed the advantages and disadvantages** of two end-member types of pedagogical professional development offerings.

3. **Compared approaches** to pedagogical professional development for STEM faculty at three different institutions.

4. **Prepared** to discuss and develop actionable plans to improve pedagogical professional development for STEM faculty at your home institutions.
Today’s working session will focus on providing you time and collaborative support to ...

1. **Develop** an actionable plan to improve pedagogical professional development for STEM faculty at your home institutions and/or influence how professional development programs are designed and implemented at your home institutions.

2. **Receive** feedback from colleagues (familiar and/or new to you) on your draft action plan.

3. **Exchange** ideas and information through inter-institutional cross pollination of ideas and experiences.

Desired Outcomes of Workshop
## Agenda for Working Session

### Part 1 (45 min): Independently or with colleagues at same home institution
- Begin (and maybe finish) an inventory and gap analysis of pedagogical professional development offerings at your home institution.
- Upload and share your inventory and gap analysis to Google database. [link]

### Part 2 (45 min): In small groups (Zoom breakout rooms)
- Access Google database. As a group, select at least two different inventory and gap analyses to read and then discuss.
- Together, compare and contrast the professional development landscape at their and/or other’s institutions.

### Part 3 (20 min): As whole group (main Zoom room)
- Debrief small group discussions, share common themes, and discuss what learned during the workshop and/or working session that might help inform work at your home institutions.
Acknowledgements

Thank you to Connie Della-Piana, our IUSE Program Officer!

Thank you to Lauren Manier and all the AAAS-IUSE team!
Thank you for your participation today!

Best wishes to you all in your institutional transformation efforts!