Responses to COVID-19: Adapting Classroom Teaching Techniques and Hands-On Learning to an Online Environment

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Please note: *The discussion break-out groups following the presentations will NOT be recorded or livestreamed.*
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Addressing Interruptions in Applied STEM Environments due to Rapid Social Change: How E-Corps Pivoted to Continue Service Learning during CoVid-19

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About E-Corps

• Environment Corps (E-Corps) is an interdisciplinary service-learning program at the University of Connecticut funded by NSF IUSE.
  – Climate Change, Brownfields, and Stormwater courses
• Each course is taught by 2-3 faculty and runs over two semesters, the first is knowledge-based and the second applied.
• E-Corps helps fill the STEM capacity gap in local municipalities that may have difficulty addressing local environmental concerns.
About E-Corps

- E-Corps enrolled 281 students from 17 majors.
- Student teams worked with 60+ towns and organizations on 76 projects.
- Reports and deliverables, including $1.1 million in funded-EPA grant proposals, have been produced through the courses.
- Last year we re-budgeted to pivot our research component to focus on CoVid-19 effects.
- Learn more about E-Corps: https://ecorps.initiative.uconn.edu/
Research Questions & Methods

- RQ1: How was teaching and learning in E-Corps affected by the pandemic?
- RQ2: How did instructors pivot to address these teaching and learning obstacles?

- Research methods
  - Interviews and observations of students and faculty (Fall 2019-present)
    - 8 faculty interviews (2-3 rounds of interviews with 7 instructors)
    - 12 student interviews (13 total students)
    - 8 project meeting observations (faculty, administrators, CETL, etc.)
  - Thematic Analysis
Obstacles (Interpersonal)

• Making relationships, getting feedback without impromptu discussions
  – Stormwater student, “[We miss] building relationships with instructors.”
  – Brownfield instructor, “Students missed out on interactions with professionals. Before they would converse, interact, ask questions.”
• Connecting in group work
  – Brownfield student, “It's hard to wrangle everybody to get on their computer at the same time. Everybody has a different life.”
  – Brownfield student, “My biggest struggle was just communicating with the group and to make sure that we were all on task for the same point.”
• General lack of student engagement
Obstacles (Personal)

• Learning online is a task in a distracting environment
  – Climate student, “It made everything feel like homework. If I was on campus, I wouldn't think of being in class as homework.”
  – Climate student, “Going to class, you have to clear everything, your computer, make sure connections are good. Focus on lecture without worrying about family, it's an added layer of chaos in the background. When you're in a classroom, it's different. You absorb material.”

• Pandemic impacts on personal lives
  – Climate instructor, “Many students had family or general COVID issues…Having parents or relatives who were sick or treating people.”
Obstacles (Building closures)

• Inability to visit field sites to learn about communities and make relationships
  – Brownfield instructor, “We didn't do any site visits, so the interaction with the town was not the same. All the meetings were through WebEx, [it didn’t] feel as connected to the project as the previous years.”
  – Climate student, “There was supposed to be a trip that to the marinas. We were going to discuss what areas tend to flood if there was a rainstorm, what things generate the most income.”
Obstacles (Building closures)

• Lack of access to closed government buildings/records
  – Brownfield instructor, “We were planning to have visits to the DEEP [Department of Energy and Environmental Protection] file room to search environmental records but we couldn't do it.”
  – Brownfield student, “That would have been a great way to get resources for the inventories and the projects [and they aren’t online].”

• Cannot access computer programs in campus labs
  – Climate student, “Using my laptop with UConn’s Anywhere Software portal made things a lot slower.”
Pivot (Instructor mental orientation)

- Recognizing a change is needed
  - Instructor meetings helpful to discussing general thoughts and ideas
- Planning
  - Climate instructor, “We will be virtual in the beginning. They will do field visits independently. Then, we're going to present at the end virtually.”
  - Brownfield instructor, “We were planning be in-person. But now we can’t bring speakers on campus. We may go hybrid.”
- Accepting that there’s some things lost
  - Brownfield instructor, “We achieved the same objectives that we achieve every other semester. Not as ideally, but still achieved.”
Pivot (Amplify what works)

• Having the course centered around an applied project/outcome
  – Brownfield instructor, “This is community driven, with a deliverable, deadline, and framework. Students feel the town looks for their work.”
  – Climate instructor, “Having a general Scope of Work between us, the town, and the students helps guide things.”
  – Brownfield instructor, “We added questions after guest lectures to keep students engaged.”

• Explaining things more than once
  – Climate instructor, “We detailed what we wanted, rubrics. Written, orally.”
  – Brownfield instructor, “If we tell them to use the reference documents and they don't, I better break it down for them and reinforce it.”
Pivot (Change assignments/visits)

- Alter the format of assessments/assignments for online environment
  - Climate instructor, “Instead of a midterm, we did a project: It's the year 2050, there's been a climate event. Explain the event. What were the impacts, the solution? Pick anywhere, anytime.”
  - Stormwater instructor, “We had them do a final project. Now, we think that's the best warm-up to the second semester that there is.”
- To deal with public building closures, adjust assignments
  - Brownfield instructor, “[To cope with lack of access to DEEP], we had students do what they could via Google Maps and GIS. The students gave a list of local brownfields, they developed a methodology for that.”
Pivot (What can be done virtually?)

• Live **virtual field trips/story maps** hosted by instructors
  – Stormwater instructor, “We filmed some field demonstrations.”
  – Stormwater student, “They did an online tour of green infrastructure on campus of what we would have seen in person. Informative and cool.”

• Moving some components online expanded participation
  – Stormwater instructor, “More attend student talks, even local officials.”
  – Climate instructor, “Students met with community partners by week 2.”
  – Climate instructor, “They went to a virtual town meeting. Students were communicative. For some students, it relieves pressure.”
  – Brownfield instructor, “We increased town interaction through email.”
Bolton Town Senior Services

- The building across the street the “Community Voice Channel” has downspouts dropping rain fall from the roof directly onto the pavement draining across the street to the Senior Services Property.

- Evaluation of the site has determined that installation of a bioretention area is best.

- To maintain integrity of the area as it is along a busy road that does not have curb, a stone strip should be installed within the bioretention area abutting the road.

- Salt tolerant plants are recommended due winter road treatment and lack of curbing.

- To gather runoff from Senior Services parking lot, curb cuts would be required by lower left catch basin.

- Installation of a small fence around the practice would ensure the safety of public, preventing potential fall hazard.
Pivot (Culture of support)

• Consistently being understanding and available
  – Stormwater student, “They're very available through email and willing to meet after class, they made sure our questions were answered.”
  – Climate student, “The professors trust us, ‘You go out and figure it out. If you have any questions, we're here for you.’ I love that.”
  – Stormwater student, “We still had class discussion. Being as understanding as they could, they heard us, and we could talk to them.”

• Small groups
  – Brownfield instructor, “We meet with students once a week. The groups meet in the second slot reserved for class. It is easier to coordinate.”
Discussion

- There was an initial period of shock and evaluation as faculty and students realized the pandemic and social change was not temporary (liminality).
- In sum, obstacles were interpersonal, personal, and a result of building closures. To pivot, the instructors made concerted efforts to amplify what worked, change assignments, modify activities for virtual teaching, and create a culture of support.
- Analysis showed that participants felt the pivot was generally successful, though some elements may not translate to online contexts.
Conclusion

In sum, these pivots offer insight into how applied STEM service learning can be adjusted in various circumstances and contexts.

Takeaways:
- Focus on sustaining relationships and being supportive
- Center on applied projects
- Make practical adjustments (add questions to end of talks)
- Amplifying strategies that work well online (student talks)

A manuscript detailing these findings is in preparation for AERAOpen.

We welcome contact from interested parties on any aspect of this work.
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March 23rd, 2021
What is a Flipped Classroom?

A teaching method where the first contact with new concepts occurs in an individual learning space and the application of content in an interactive guided group space.
What is a Flipped Classroom?

- Lecture content is shifted out of the classroom as homework allowing self-paced learning and preventing cognitive overload
- A student-centered classroom practicing the lecture content, while applying knowledge to analyze and/or solve problems
- Encourages active participation of student and offers opportunities for collaboration with peers
Flipped Classroom Process

**Pre-class: Introduction of content**

Guided readings/lecture slides/lecture video/study guide → Individual assessment over the assigned content

**In-class: Application of knowledge to learn/practice/master content**

Review of Lecture → Active learning session and its assessment → Instant feedback
Bloom’s Taxonomy

- **Remembering**
  - The student can recognize and recall relevant knowledge from long-term memory: define, duplicate, list, memorize, repeat, reproduce

- **Understanding**
  - The student can construct meaning from oral, written and graphic messages: interpret, exemplify, classify, summarize, infer, compare, explain, paraphrase, discuss

- **Applying**
  - The student can use information in a new way: demonstrate, dramatize, interpret, solve, use, illustrate, convert, discover, discuss, prepare

- **Analyzing**
  - The student can distinguish between parts, how they relate to each other, and to the overall structure and purpose: compare, contrast, criticize, differentiate, discriminate, question, classify, distinguish, experiment

- **Evaluating**
  - The student can make judgments and justify decisions: appraise, argue, defend, judge, select, support, evaluate, debate, measure, select, test, verify

- **Creating**
  - The student can put elements together to form a functional whole, create a new product or point of view: assemble, generate, construct, design, develop, formulate, rearrange, rewrite, organize, devise.
Innovative Flipped Learning Instructional Project (IFLIP)
The NSF funded research project aimed at advancing flipped teaching in STEM education

NSF Grant #1821664
Participating Institutions

- Southern Illinois University Edwardsville (SIUE): a public university located in Edwardsville, IL
- St. Louis Community College (STLCC): a community college system with multiple campuses across the St. Louis metropolitan area, MO
(front L-R) Chaya Gopalan, Sharon Locke, (back L-R) Georgia Bracey, Julie Fickas, & Lynn Bartels
2-YI: 2-year institution; 4-YI: 4-year institution
## Cohort 1

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<th>Discipline</th>
<th>Class Size</th>
<th>Years of Experience</th>
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Cohort 2

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<td>SIUE 12</td>
<td>Mathematics</td>
<td>TBD</td>
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Research Questions

1) How do faculty perceive and implement flipped teaching?
   a) What are faculty expectations of flipped teaching?
   b) How do faculty expectations relate to their flipped classroom implementations?
   c) How do faculty perceive the experience of implementing a flipped classroom?
   d) How does the experience of flipped teaching affect faculty attitudes towards, intention to use, and self-efficacy in using student-centered teaching?

2) How does faculty implementation of flipped teaching at a four-year master’s university compare with faculty implementation at a two-year community college?

3) What are the essential design principles for implementing a successful flipped classroom at each type of institution?
Faculty Training

- Session 1: Introduction to Flipped Teaching
- Session 2: Pre-Class Preparation
- Session 3: In-Class Preparation
- Session 4: Team-Based Learning
- Session 5: Managing Barriers
- Session 6: Dissemination of Participant Findings
IFLIP Pre-COVID
Cohort 1: Faculty Knowledge and Self-efficacy

Knowledge

Self-Efficacy

C1 R1 Pre  C1 R1 Post  C1 R2 Post  C1 R3 Post
Cohort 2: Faculty Knowledge and Self-Efficacy

Knowledge

Self-Efficacy

(C= Cohort; R= Implementation round)
Summary of Pre-COVID Faculty Data

- Flipped teaching is beneficial but require an adjustment period that may delay a full successful implementation.
- The perceived barriers decreased after repeated implementations.
- Participants were more comfortable implementing flipped teaching after repeated use.
- Feedback following implementation grew increasingly positive after repeated implementation.
Student Surveys

43 sections of STEM classrooms surveyed:

• STLCC: 22 sections; 195 students
• SIUE: 21 sections; 507 students

Total= 702
Pre-COVID Student Data

Spring 2019:
• 4-YI students responded to flipped teaching favorably compared to 2-YI ($p<0.001$)
• Female students responded more favorably than male students ($p<0.05$)

Fall 2019: No significant differences

Spring 2020:
• Juniors and Seniors were more likely to report an overall favorable experience than Freshmen and Sophomore students ($p<0.05$)
IFLIP during COVID-19
COVID-19 Impact on Course Delivery

Spring 2020

- Faculty participants in cohort 1 were using flipped teaching for the third time
- Faculty participants in cohort 2 were in their first semester of flipped teaching

All classes were online after spring break at both institutions due to lockdown
COVID-19 Impact on Study Design

Additional research question: “How did flipped teaching prepare faculty and students for remote instruction?”
Flipped Classroom Design since COVID

**Asynchronous:** Introduction of Content

- **Guided readings/ lecture slides/ lecture videos/practice questions/study guide**
- **Individual assessment over the assigned content***

**Synchronous:** Application of knowledge to learn/practice/master content

- **Review of Lecture**
- **Active learning session (clicker/Breakout Rooms) and its assessment**
- **Instant feedback**

*Individual assessment could be an asynchronous or a synchronous activity*
Recruitment of STEM Faculty Without Flipped Teaching Training/Experience
Study Participants

TTEs (n=18)
- 2-YI (n=9)
- 4-YI (n=9)

FTEs (n=24)
- Cohort 1 (n=12)
  - 2-YI (n=6)
  - 4-YI (n=6)
- Cohort 2 (n=12)
  - 2-YI (n=6)
  - 4-YI (n=6)

TTEs: Traditional Lecture-format Educators; FTEs: Flipped Teaching Educators;
2-YI: 2-year institution; 4-YI: 4-year institution
STEM course(s) Taught

Traditional Teaching Educators (TTEs)

Science: Biology, Biology of Human Health & Disease, Climatology, General Chemistry, General Microbiology, Genetics, Geology, Human Biology, Introductory Biology, Introduction to Environmental Science, Meteorology, Microbiology

Technology: Mechatronics and Robotics, Biotechnology

Engineering: Mechanical Engineering

Mathematics: Calculus II, Mathematics, Math Literacy, Precalculus Algebra, Precalculus and Statistics, Quantitative Reasoning

Flipped Teaching Educators (FTEs)

Science: Animal behavior, Chemistry, Bacteriology, ENSC, Human Biology, Human Heredity, Introductory Biology, Microbiology, Organic Biology, Organic Reactions

Technology: Computer application, Transport Engineering, Web publishing


Mathematics: Calculus I, Calculus III, Mathematics
Faculty Survey on their transition to Online Teaching
Prior Experience with Online Teaching
Online Teaching Format Chosen during Sudden Transition
Self-confidence in Teaching Online

FTEs were much more confident \((p<0.05)\)
Flipped Teaching Resources

- Instructional Materials
- Pre-Class Assignments & Assessments
- In-Class Activities
- Overall FT Knowledge

Very Useful
Useful
Neutral
Flipped Teaching Resources

- 2-YI faculty rated the benefits of having pre-class assignments and assessments higher than their counterparts at SIUE ($p<0.05$)

- The **training** in preparing resources for flipped teaching was very helpful in moving their classes fully online

- Many of the active learning activities that were planned for the in-person flipped class could easily be converted into the synchronous online format
Teaching Challenges

Three main challenges reported by the faculty participants:

1. Creating effective **online lab** experiences for students
2. Ensuring **student engagement** in the online environment
3. **Assessment** of student knowledge and skills using online testing
Student Transition to Online Learning during COVID
Student Survey Report

The difference in percentage approval between cohorts by topic. Percentages are expressed as decimals.
Student Survey Report

The difference in percentage approval by (a) mode of delivery and (b) gender.
Percentages are expressed as decimals.
Student Benefits

- No major shift in the format allowing for more continuity
  - already had an established routine
  - expectations were clearly laid out
- Ability to continue to learn at their own pace with the added accountability to meet goals each week
- Instructor Presence
- Communication
Student Challenges

- Overwhelmed with the number of emails, due dates, and overall stress of taking a full load of classes online
- Home life distractions
- Internet accessibility issues
- Lack of motivation
Conclusions

- Flipped Teaching provided effective preparation for faculty and students for online instruction at both institutions.
- Flipped Teaching can be effectively adapted to online instruction preserving some aspects of active learning.
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- Co-PIs Drs. Lynn Bartels, Georgia Bracey, Julie Fickas, & Sharon Locke
- Statistician Dr. Carolyn Butts-Wilsmeyer
- Graduate Assistants: Hannah Ruholl, Paige Dickey, and Carlos Serrano
- STEM faculty participants and their students
Questions?
Livestream participants, thank you for joining us!

Facilitated Breakout Rooms:

1. Navigate to the bottom of your screen and click “Breakout Rooms” button
2. Self-select into your breakout group based on your topic interest and last name

*Note: If you do not see the Breakout Rooms button, please wait for the host to place you in a breakout room*
Discussion Breakout Room Recap

Todd Campbell – E-Corps Discussion
Marisa Chrysochoou – E-Corps Discussion
Myron Jones – Flipped Classroom Discussion
Thomas Peters – Flipped Classroom Discussion

Rebecca Campbell-Montalvo – E-Corps Discussion
Chaya Gopalan – Flipped Classroom Discussion
Thank you for attending!

Slides and recording will be available in the coming weeks.

We value your feedback, please take a few minutes to complete the survey.

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