Enhancing Equity with Course-Based Undergraduate Research Experiences

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Goals of this presentation

To share:

• What a Course based undergraduate research experience (CURE) is

• Benefits of CUREs to students

• Steps that were used to implement a CURE in my courses

• Best practices - Lessons learned to have a successful CURE experiences in a course - in different modalities.
The Maricopa Community Colleges
What is a CURE?

• Short for Course-based Undergraduate Research Experiences

• Why CUREs

Dashboard from Maricopa Analytics: Phoenix College 2022-2023 Fact Facts
What is a CURE?

• Short for Course-based Undergraduate Research Experiences

• Equity through CUREs
  • MCCCD STEM-CURE
The Context

Equity through CUREs

- Integrating research experiences to increase student access to and success in STEM careers
- All students in class participate in the CURE

<table>
<thead>
<tr>
<th>Live Feed STEM-CURE IMPACT : DATA</th>
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<tr>
<td>CUREs Developed</td>
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What is a CURE?

• Short for Course-based Undergraduate Research Experiences

• Equity through CUREs
  • MCCCD STEM-CURE

Next part of Presentation

• Sources of Inspiration

• Its Implementation in my Statistics Course

• Capstone Project
My journey to CUREs

... and lessons learned
Sources of Inspiration

An AMATYC Conference Presentation

Previous collaborations with colleagues outside of discipline
Benefits of CUREs

• Student interest and engagement
  • All students in the class benefit

• Mutual benefit
  • For students
  • For student success specialists
  • For industry/community partner
Benefits of CUREs

- Resilience
- Persistence in Science
- Scientific Identity
- Pursue 4-yr STEM degrees or STEM occupational programs

- Scientific literacy
- Self-efficacy
- Motivation in science
- Interest in STEM and STEM careers

- Develop content knowledge
- Technical and analytical skills
- Interest in science
- Sense of ownership
- Collaboration and communication skills
- Deeper understanding of scientific process

- Training and Mentoring
- STEM CURE Curriculum
- Assessment of Learning
- Partnerships and Resources
Partners

STEM-CURE

ARIZONA DEPARTMENT OF HEALTH SERVICES

PHOENIX COLLEGE
A MARICOPA COMMUNITY COLLEGE

ADEQ
Arizona Department of Environmental Quality
Some Previous CUREs

Spring 2020

- Lead In The Water Of Arizona Schools
- Stay-At-Home Order Effects on Air Quality
- Causes of Death in Pediatric Leukemia Comparing COVID-19 in the Five Most Populated Countries
- Carbon Monoxide Levels in Phoenix
- Arsenic in Arizona Water
- Levels of Lead in the Drinking Water of Phoenix Union Schools
- MAP Water Systems vs. State’s Largest Water Systems
- Nitrates Vs. Water Quality
- Farms and the Effects of Air Quality
- Maricopa and Pima Counties Ozone and PM10 Levels in Relation to Hospitalizations Due to Asthma
- What Makes Water Hard?
- Wasteland
- Coral Reefs: The Heart of the Ocean
Some Previous CUREs

Fall 2020

• How Covid-19 has Changed the Air Quality Around Us
• How does the COVID-19 pandemic affect the air quality near Six Flags parks in Arizona?
• How does Social Media Affect Teenagers?
• Opioid Mortality and Primary Care Score
• Carbon Monoxide Poisoning in Arizona Compared to Other States
• Water Hardness in Arizona
• Effect of PrEP Prevention Program and HIV/AIDS Contraction
• Correlation between Asthma and Ozone
• Alzheimer’s Disease - Does it matter where you live?
• The Relationship between the Air Quality in Phoenix and its Surrounding Areas
Some Previous CUREs

Spring 2021

• Mental Health
• Agricultural Methane and Increasing Global Temperature
• Suicide Rates in the United States
• Water Toxicity and Temperature
• Is it Safe to Float?
• To River Raft or Not?
• Homicide and Healthcare
• Breast Cancer in Arizona
• The Effects of S.A.D.
• Relationship Between the Human Population, Mule Deer and Game Hunters
• Depressive Disorder Rates Between White vs Other Racial/Ethnic College Students During the COVID-19 Pandemic
Some Previous CUREs

Fall 2021

• Distracted Driving in Rural/Urban Areas in Arizona
• Hospitalization due to Asthma in Relation to Ozone, PM2.5, and PM10 Levels
• Arsenic Concentration in Water Quality of Yuma and Maricopa
• Ozone Suppression & Temperature Dependence
• Water Quality & Median Household Income
• DUI Fatalities: College Towns vs Non-College Towns
• Drought in Arizona
Some Previous CUREs

Spring 2022

• Drinking Water Quality an Incidence of Thyroid Cancer
• The Relationship Between Melanoma and UV Radiation
• Stroke And Primary Care Area

Fall 2022

• Comparing Childhood Vaccinations Rates and Political Affiliation
• Fetal Mortality & Ethnicity
• Pandemic "Poo-llution" at Lake Pleasant

Spring 2023

• Population and Ozone Levels
Sequencing

16 week course

Compressed 10 week course
• With OER textbook
• Online homework and videos
• Small group projects
• Course competencies covered

Fall 2019 Pilot
Sequencing

16 week course

Followed by 6 week capstone project
• Project chosen should be of interest to them
• Have easily acquirable data*
• Be of social relevance beyond a niche interest
• To be done as a team of 2 or 3 (at most)

Fall 2019 Pilot
Resources for Students

Resources

Student success specialist
• Former student of the CURE class
• Has the content knowledge/empathy
• Is a partner in the implemented lessons

Previous student posters (pdfs)
Resources for Students

Resources provided to students

Previous student presentations (videos, slides)

- Zoom Presentations
  - Spring and Fall 2020
    https://youtube.com/playlist?list=PLnx0808B5TiuyYjWfMRGH-Cmk6OpwD9jx
  - Spring 2021
    https://youtube.com/playlist?list=PLnx0808B5TiupbUsRmauxux9psUgE-QiE

- In Person Presentations
  - Fall 2021
    https://youtube.com/playlist?list=PLnx0808B5TitF_OiH9iZMG1elgbHEfvF4
  - Spring 2022
    https://youtube.com/playlist?list=PLnx0808B5TisEasWwlD7N33CO4_dvNeJn
  - Fall 2022
    https://youtube.com/playlist?list=PLnx0808B5TiufhrO-Z-KdzBI2a1c8zAE
Resources for Students

Resources provided to students

• Poster template

• Downloadable from:
  https://docs.google.com/presentation/d/1qHxkFqLUKO-TDS81_c6joE6zwUJUBF3Swn0Prv896hw/edit?usp=sharing
Resources for Students

Resources provided to students

• Poster template

• A “poster demystified” document
  • Created in collaboration with student success specialists over multiple semesters
Resources for Students

Resources provided to students

• A “poster demystified” document
  • Created in collaboration with student success specialists over multiple semesters
  • An iterative process

Current iteration of “poster demystified”
• https://docs.google.com/document/d/1ngIKuj4MoJnZLBZBZcCaj89x8t0ijPvIlSaq_2u nFCK/edit?usp=sharing

Other Resources:
• The industry/community/government partners
• Buy in and aligned goals are important
Lessons Learned

Fall 2019 Pilot

• Introducing your CURE – pacing, timing, and milestones
Lessons Learned

Spring 2020 Implementation
• Adapting your CURE – when things do not go according to plan
Lessons Learned

Fall 2020
• A new normal – what worked in the previous semesters?
• What was still needed?
Lessons Learned

Fall 2020 - results

• Unusual/unexpected stubbornness of students regarding feedback
• Some teams not effectively practicing their pacing (too short/long)
• Invited guests leaving after the presentations portion of the capstone.
• Another lesson learned was that some students were resistant to the idea that the scope of a capstone project should go beyond personal interest to something members of the community might actually care about.

A plan was made!
Lessons Learned – Spring 2021

May 25, 2021 (excerpt from direct message):

“Dr. Marfai, They were talking about doing a research internship with me. I am fine with that. They loved my teams poster, I shared my poster and slides with them. Thanks for making us do it. They were talking about the intern before me, and the interns didn't understand how to do a poster. So, I guess they gave the mentors slides instead.

You are right about NASA .... I met them, we had an off camera chat.”

-Cybersecurity Intern at NASA Ames Research Center Summer 2021
Lessons Learned – Spring 2021

Aug 27, 2021 (excerpt from email)

"PS Dr. Marfai, I've wanted to say this. The work we are doing in stats is so advanced, I'm so impressed with us. For real.

FOR. REAL.

I was able to go into the internship and hold my own in conversations with graduate students and my mentor professor with confidence about research, and volley back questions and have them pause to search for answers."

-NSF-REU Intern: Biological Data Science for Community College Students at James Madison University Summer 2021
Lessons Learned - Fall 2021 through Spring 2023

In person classes
• Students enrolled in person sections fully engaged with projects
• In person sections are really small classes
• Lack of in-person enrollment (leading to class cancellation) post-Covid remains a current challenge

Online (asynchronous) classes
• Students do not reliably engage each other nor communicate effectively in this modality
• A CURE in this format (online asynchronous) has not been successfully implemented (thus far)
• This modality represents both a challenge and an opportunity....
Future Directions

• Further revising and improving the developed resources
• Involving the partners (communication) and finding viable alternatives when partnerships discontinue
• Staying open to adapting
• Determining what works / doesn’t work in fully synchronous and asynchronous online modalities
• Continuing to studying the effect on student retention, persistence, self-efficacy, and pro-STEM attitudes


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Thank you!
~May the 4th be with you!~

- Questions?
- Frank Marfai
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- More about the MCCCD STEM-CURE project
  - https://sites.google.com/phoenixcollege.edu/mcccdstemcure/home