Preparing Preservice Teachers to Engage in NGSS Science and Engineering Practices: The *Pathways to Science Teaching* Program

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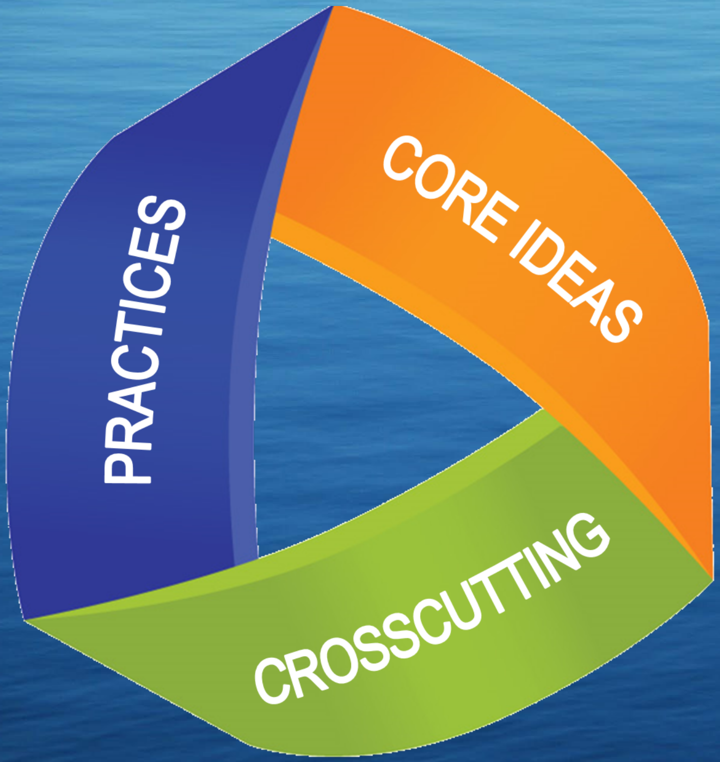
Why *Pathways to Science Teaching*?

Diverse and well-prepared K-12 teachers are critical to expanding participation in the geoscience workforce

Pathways is an NSF GeoPATHS project aimed at:

1. Preparing diverse students to become K-12 science teachers
2. Engaging future teachers in authentic research and teaching science to youth
3. Enhancing identity of preservice teachers as both geoscientists and as educators

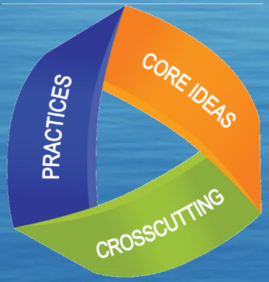
Why *Pathways to Science Teaching*?



- Next Generation Science Standards emphasize three dimensions of science
- BUT, engaging in science and engineering practices is often lacking in teacher preparation programs
- *Pathways* emphasizes:
  - Science and Engineering Practices
  - Nature of Science
  - Identity as geoscientist and teacher

https://www.nextgenscience.org/three-dimensions

Why *Pathways to Science Teaching*?



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1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

A 10 week summer program themed around water quality:

- Week 1: Meet local water quality stakeholders
- Weeks 2-5: Design and conduct water quality research
- Weeks 6-9: Teach youth in summer camps themed around water quality
- Week 10*: Communicate results (*BONUS - present at national conference)

Who were *Pathways* participants?

Three cohorts, total of 23 participants

- 10 secondary science education, 6 elementary education, 7 science majors
- 16 women, 10 underrepresented in science teaching by gender
- 9 students of color (Black/African American, Asian, Hispanic, 2+ races)
- 2 LGTBQ+, 2 Military veterans, 1 with disability
- Half attended community college, 6 first generation college

Cohort 1: 2018

Cohort 2: 2019

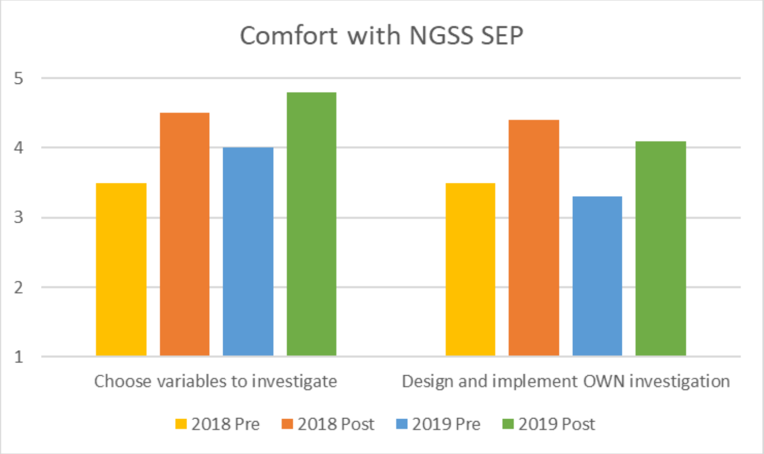
Cohort 3: ~~2020~~ 2021

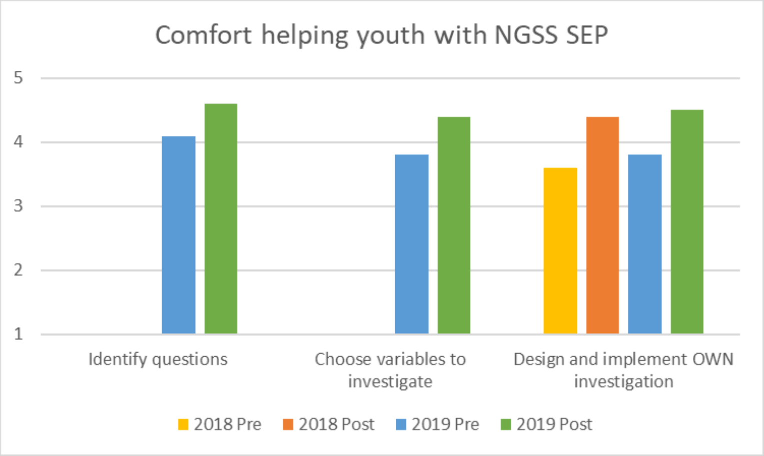
How did we measure program success?

Project goal – data measures participants'	Data source	When collected
Understanding of the nature of science (NOS) and scientific inquiry (NOSI)	SUSSI (Liang et al., 2006; 2008)	First day of program, at transition, last day of program
Knowledge of and comfort with using NGSS science and engineering practices in the classroom	SIPS (Hayes et al, 2016)	First day of program, at transition, last day of program
Identity as a scientist and as a teacher	Survey developed by SAMPI	First day of program, at transition, last day of program
General experiences, most and least impactful parts of the program, suggestions for improvement	Individual participant interview	Last day of program

Evaluation conducted by SAMPI at WMU

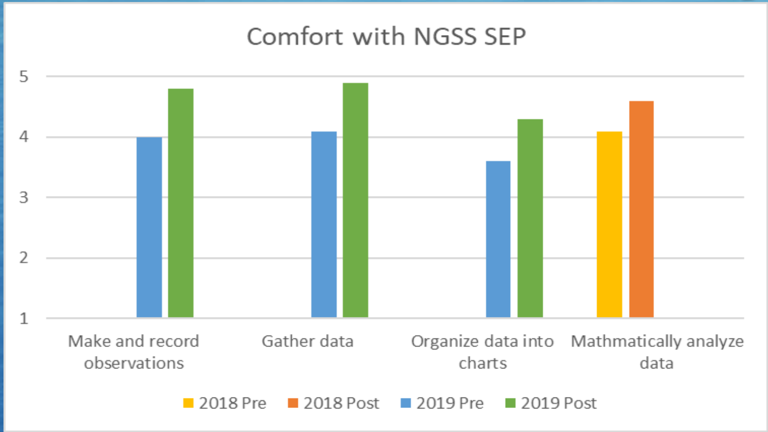
How did we impact participants' SEPs?

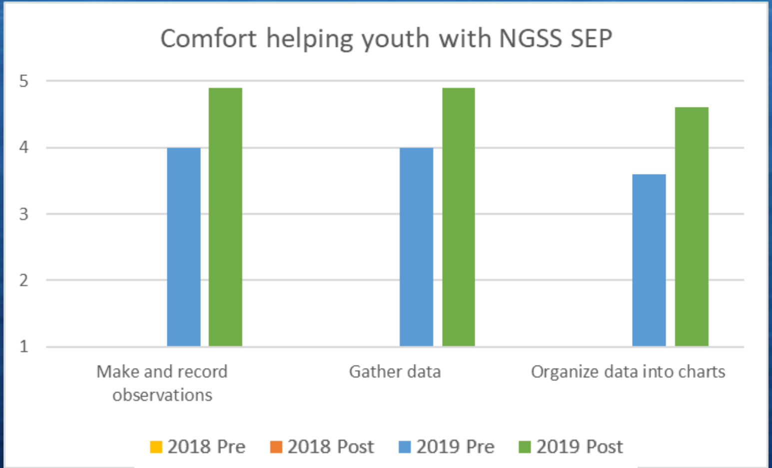


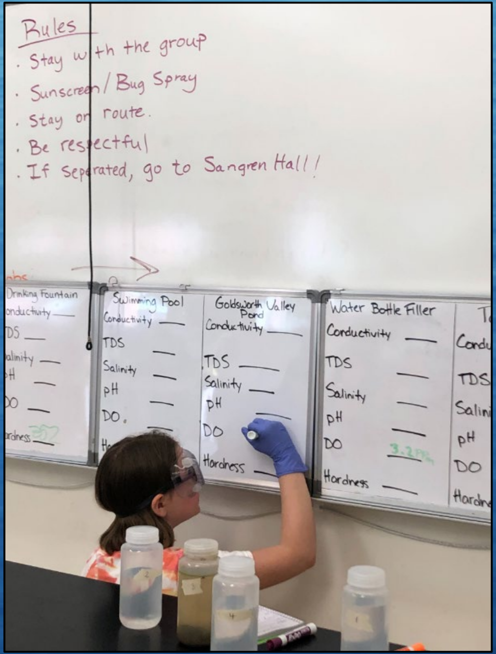


Preservice teachers designed their own water quality investigations and had youth design and conduct investigations.

How did we impact participants' SEPs?







2019 Cohort emphasized recording, gathering, and analyzing data.

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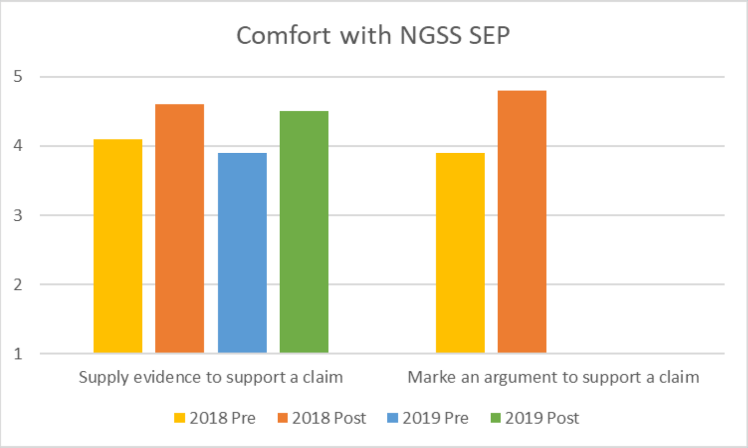

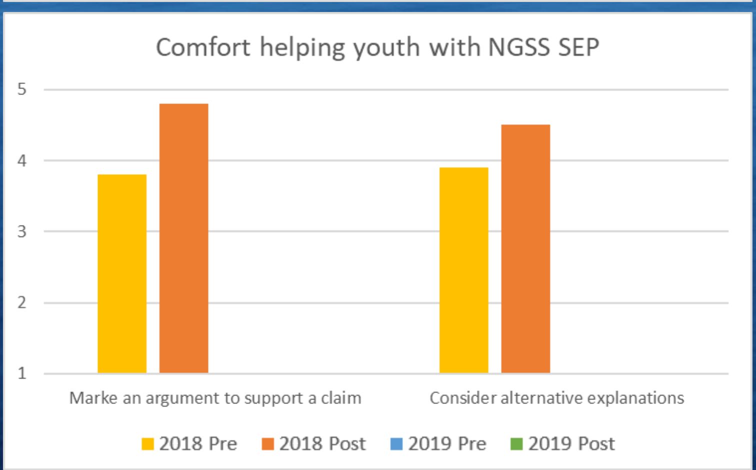

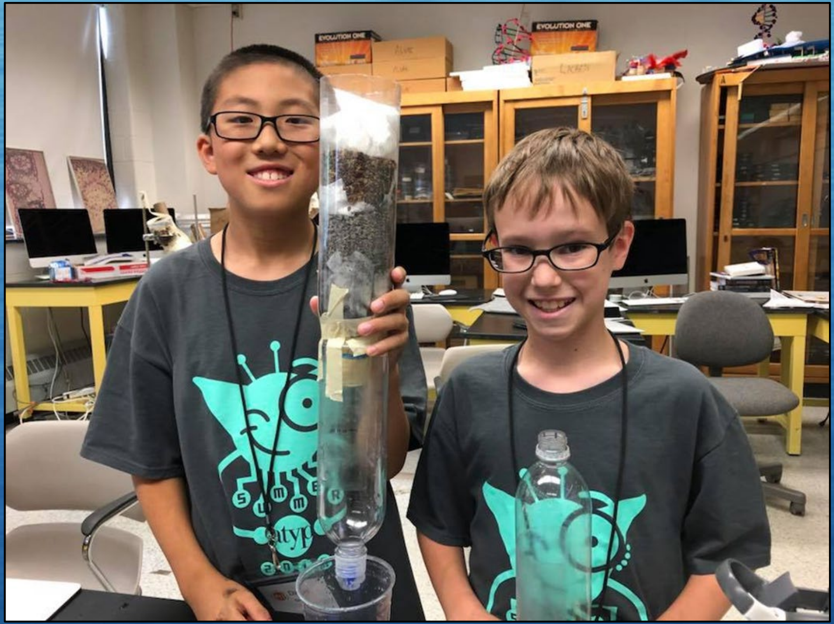

All cohorts gained experience in using evidence to support claims; 2018 cohort emphasized argumentation.

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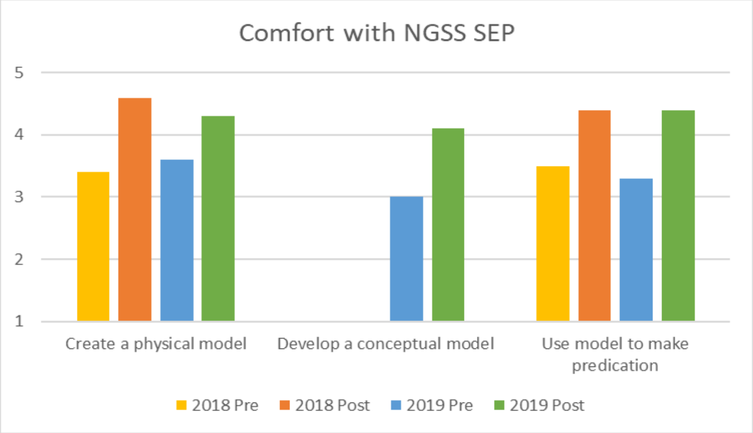
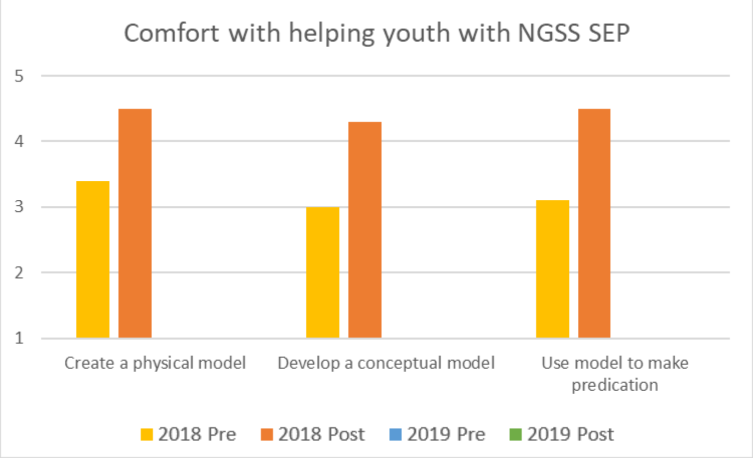




All cohorts created and used models; 2018 cohort emphasized models

How did we impact participants’ SEPs?

“We focused a lot on scales and models so were able to use water cycle models and other models we had on campus.” -2018

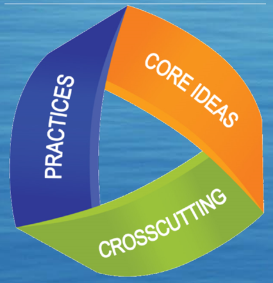
“models … represent big picture concepts.” -2019

“They [the NGSS] reflect what scientists are actually doing in the field” -2019

“The practices stress finding solutions for problems and that is a big part of geoscience careers.” -2018

“With real life research in my pocket, I feel I can provide students with a more complete experience by modeling conditions that we came across in the field, such as open ended discovery.” -2018

Impact of *Pathways to Science Teaching*



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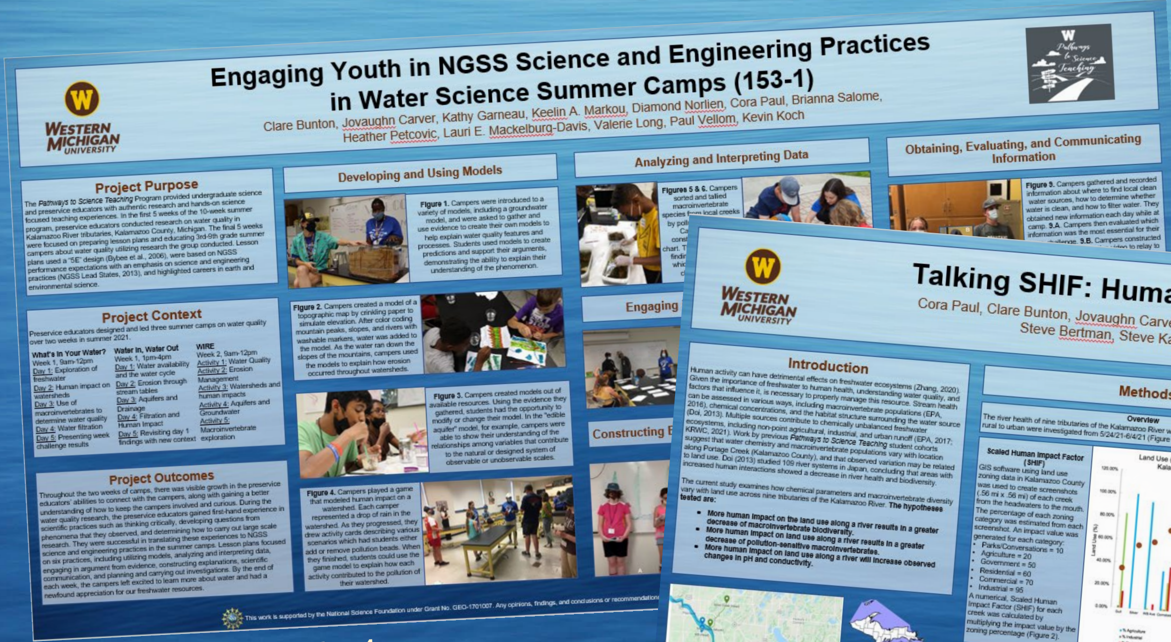
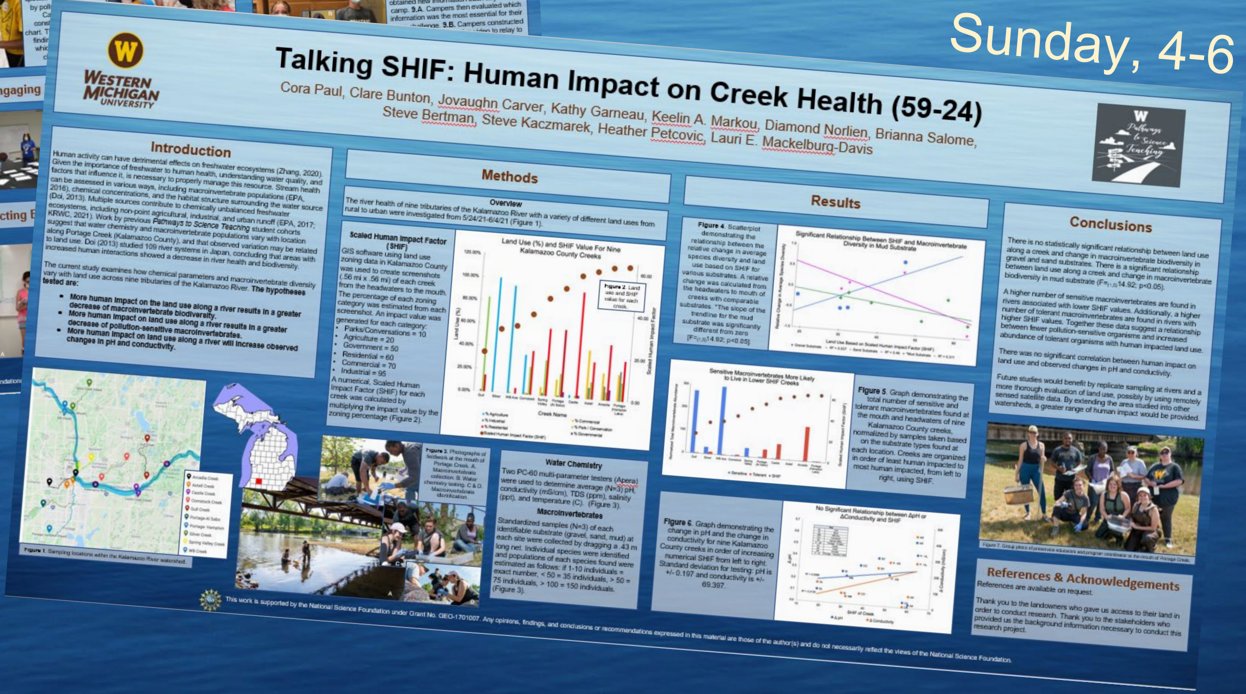
Want to hear more?



Tuesday, 11-1



Sunday, 4-6