

The NexSTEM Program: A Community Assets Program that Fosters the Next Generation of STEM Leaders

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History of the NexSTEM Project

- Project idea originated during a trip of Bloomington/Normal, Illinois leaders to Washington, DC
- Builds on prior grantsmanship and community engagement efforts
 - Leadership team brings prior experience with STEM recruitment and engagement
- NSF S-STEM Track 3 Project
 - Design and Development: Multi-Institutional Consortia
 - Heartland Community College, Illinois State University, Illinois Wesleyan University
- Regional focus
 - To the extent possible, students engage in research projects relevant to the region
 - Students share a sense of central Illinois as home
 - Opens doors for regional employers to become project partners

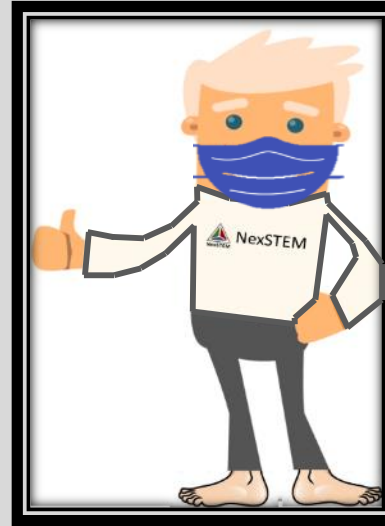
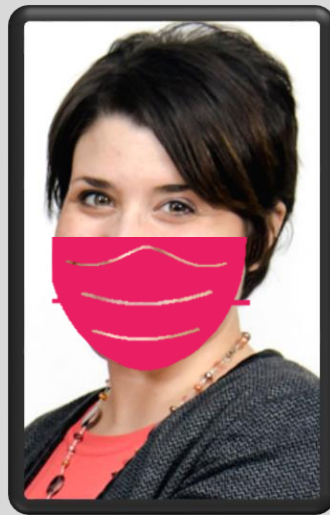


Goals of the NexSTEM Project

- Improve STEM retention by low socioeconomic status individuals in Central Illinois by
 - Reducing financial barriers
 - Reducing academic and social barriers
 - Enhancing student understanding of wider relevance of STEM via community-oriented projects
- Identify most impactful practices and modify/replicate and implement beyond grant



The NexSTEM Leadership Team



IWU

Dr. Rebecca Roesner, PhD
-Associate Provost,
-Professor of Chemistry,
-Principal Investigator (PI),
NexSTEM

ISU

Dr. George Rutherford, PhD
-Associate Professor of Physics,
-Co-PI & Campus Coordinator,
NexSTEM,
-Faculty Research Mentor

HCC

Ms. Lauren Denofrio-Corrales, MS,
-Dean, STEM-B,
-Co-PI, NexSTEM

HCC

Dr. Tom Prudhomme, PhD
-Adjunct Biology Professor,
-Campus Coordinator,
NexSTEM

Dr. Sheri Glowinski, PhD

-NexSTEM Director
-IWU Campus Coordinator,
-IWU Adjunct Assistant
Professor,
-HCC Adjunct Biology Professor



Program Components

- Scholarship Support
- Participation in STEM Research
- Multi-level Mentoring
- Student Support Structures
- STEM Community



Scholarship Support

- Up to \$10,000 per year to meet FAFSA-determined need
- Can be used for any part of their cost of attendance (tuition, room and board, books, etc.)
- **Scholarship moves with students who transfer from Heartland Community College to Illinois State University or Illinois Wesleyan University.**
- NSF guidelines require that recipients
 - Are low income with unmet need
 - Be citizens, nationals, permanent residents, or refugees of the United States
 - Are academically talented and major in an eligible discipline



Eligible Programs

HEARTLAND COMMUNITY COLLEGE

Associate in Science:

- Biology
- Chemistry
- Computer Science
- Earth Science
- Mathematics
- Physics

Associate in Applied Science:

- Industrial Technology
- Computer Networking

Associate in Engineering Science

ILLINOIS STATE UNIVERSITY

Bachelor of Science:

- Biology
- Biochemistry
- Chemistry
- Computer Science
- Geology
- Mathematics
- Physics
- Engineering Technology
- Computer Systems Technology
- Renewable Energy
- Technology and Engineering Education

ILLINOIS WESLEYAN UNIVERSITY

Bachelor of Science:

- Biology
- Biochemistry
- Chemistry
- Computer Science
- Mathematics
- Physics

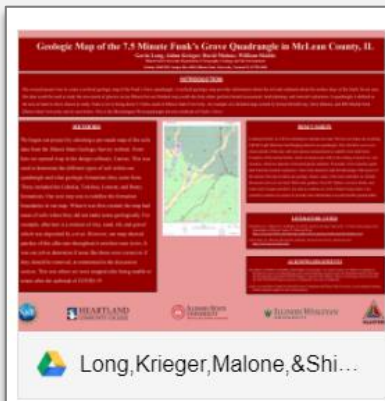
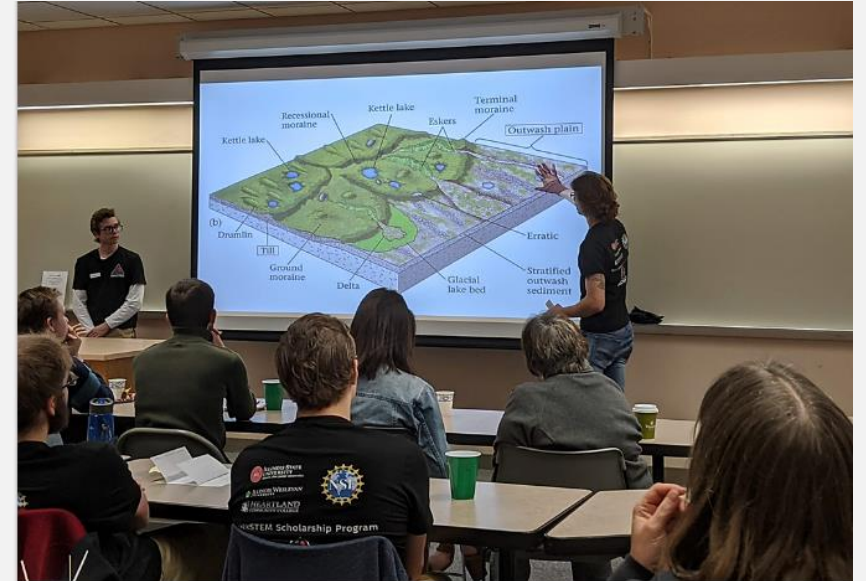
Bachelor of Arts:

- Neuroscience – Cellular and Molecular Concentration *only*
- Environmental Studies – Ecology Track *only*



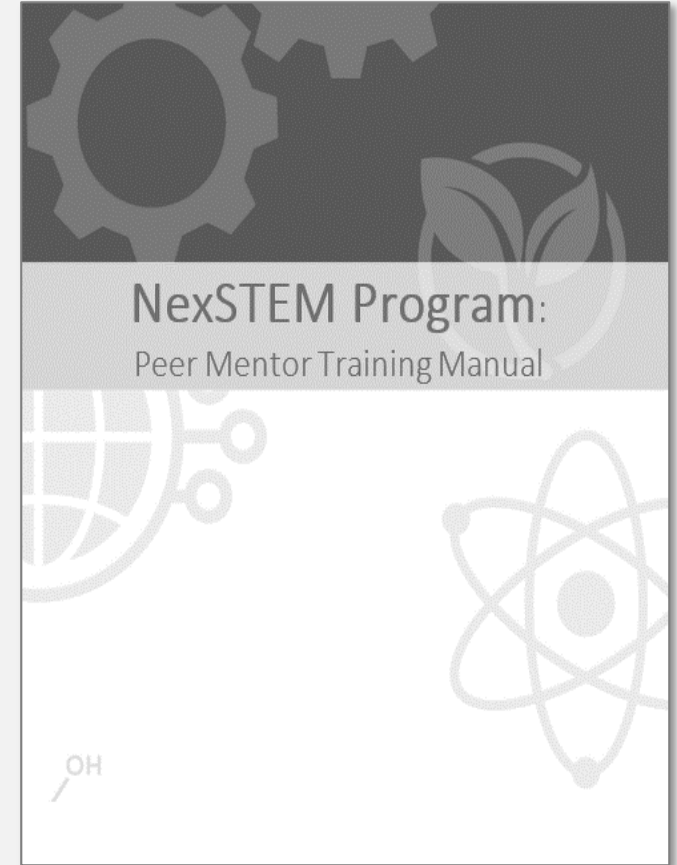
Participation in STEM Research

- Each student paired up with a faculty research mentor
- Participate during first 2 years in college beginning first semester
- Academic credit
- Emphasis on real-world STEM applications
- Present in NexSTEM Research Symposia
- Modest supply and travel budget



Multi-level Mentoring

- Faculty Research Mentor
 - Provide 2 years of research mentoring
 - Provide 2 years of professional development
 - Mentors are compensated
- Peer Mentoring
 - Required first 1-2 years of college
 - Advanced STEM student
 - Weekly touchpoints
 - Socioemotional and academic mentoring
 - Peer Mentors are trained and compensated
- Mentoring by Director and Campus Coordinators



Student Support Structures

- Regular one-on-one meetings with Campus Coordinators
- Grade monitoring
- Tutoring resources, as necessary
- Workshops and other programming

Goals of the Time Management Workshop

You will:

- Learn time management tools that will help you be **efficient, effective, and accountable**.
- **Think** about your **time** differently.
- Be **empowered** to plan and use your time wisely.



STEM Community



Recruitment

- Emails from admissions departments to potential students
- Emails and phone calls directly from leadership team
- Presentations at high schools
- College fairs and college information events
- McLean County Chamber of Commerce newsletter
- Community events

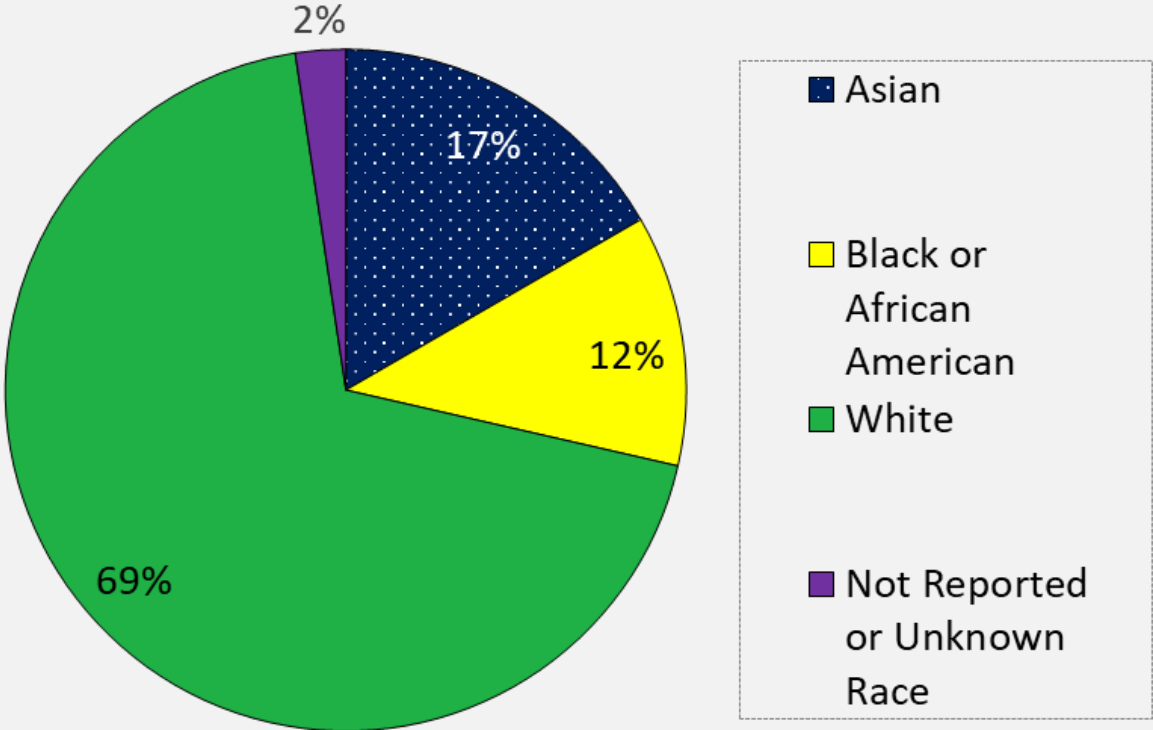
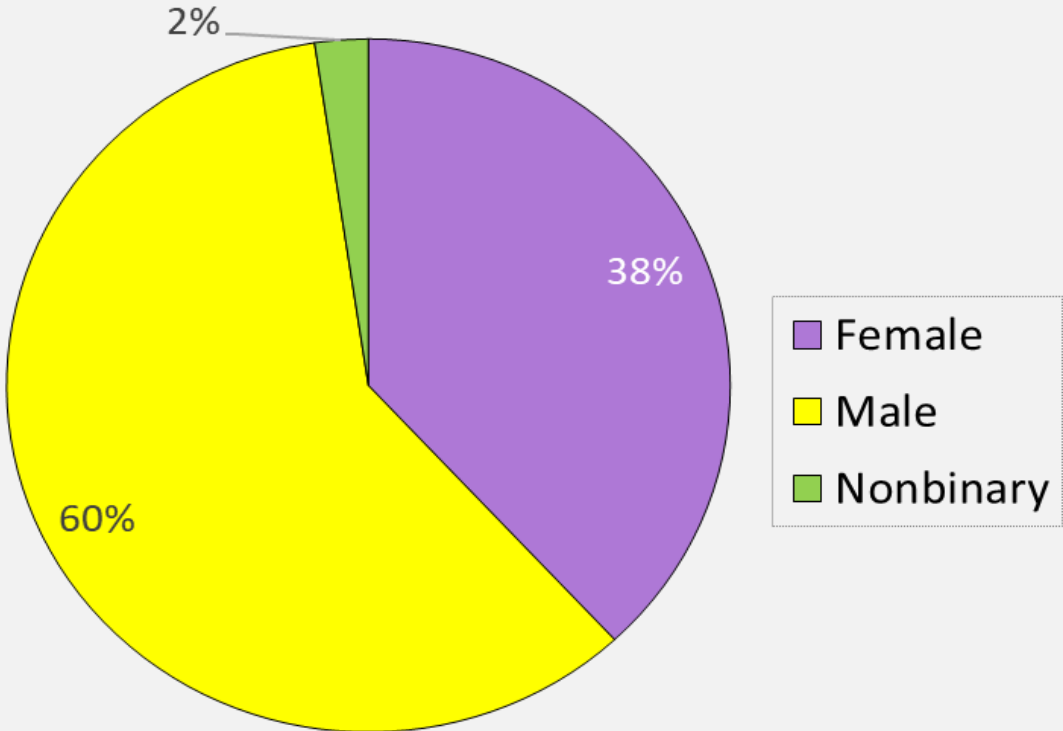


Recruitment



Champaign County	7%
Coles County	2%
Effingham County	2%
Henry County	2%
Iroquois County	2%
Livingston County	2%
Macoupin County	5%
McDonough County	2%
McLean County	57%
McLean County / Out of State	2%
Montgomery County	2%
Peoria County	2%
Piatt County	5%
Will County	2%
Woodford County	2%

Scholar Distribution by Gender and Race (n=42)



Number of Current Scholars per Major by School

Major	HCC	ISU	IWU	Total
Actuarial Science	--	2	--	2
Biology	2	2	5	9
Chemistry / Biochemistry	--	3	3	6
Computer Science	2	8	4	14
Engineering Science	1	--	--	1
Geology	--	2	--	2
Industrial Technology	1	--	--	1
Mathematics	--	--	1	1
Neuroscience (Molecular)	--	--	1	1
Physics		1	1	2
	6	18	15	39



Evaluation

- Monitoring
- Annual program surveys
- Control data
- Knowledge Generation activities



Transfers and Retention by School

	Cohort 1 (Entered Program 2019-2020)	Cohort 2 (Entered Program 2020-2021)	Current Total	Retention from 2019-2020 to 2020-2021	Control Pell-eligible entering STEM degree program 2009-2013 and graduating with STEM degree
HCC	5* [†]	3	6	80% [†]	--
ISU	9	8	18 [†]	100%	24% (149)
IWU	8**	9	15	75%	54% (79)
	22	20	39		

*1 HCC scholar dropped out after transition to remote instruction in Spring, 2020

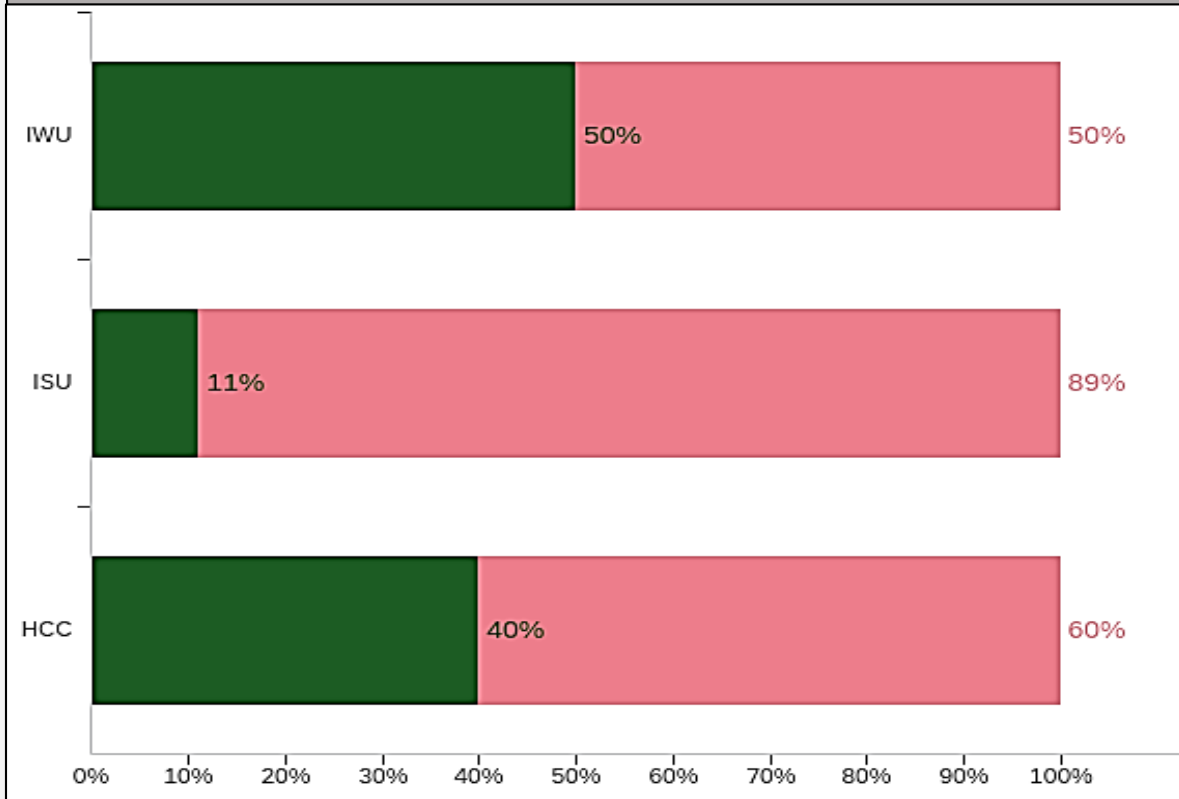
[†]1 HCC scholar transferred to ISU beginning Fall, 2020

**2 IWU scholars transferred to out-of-state universities

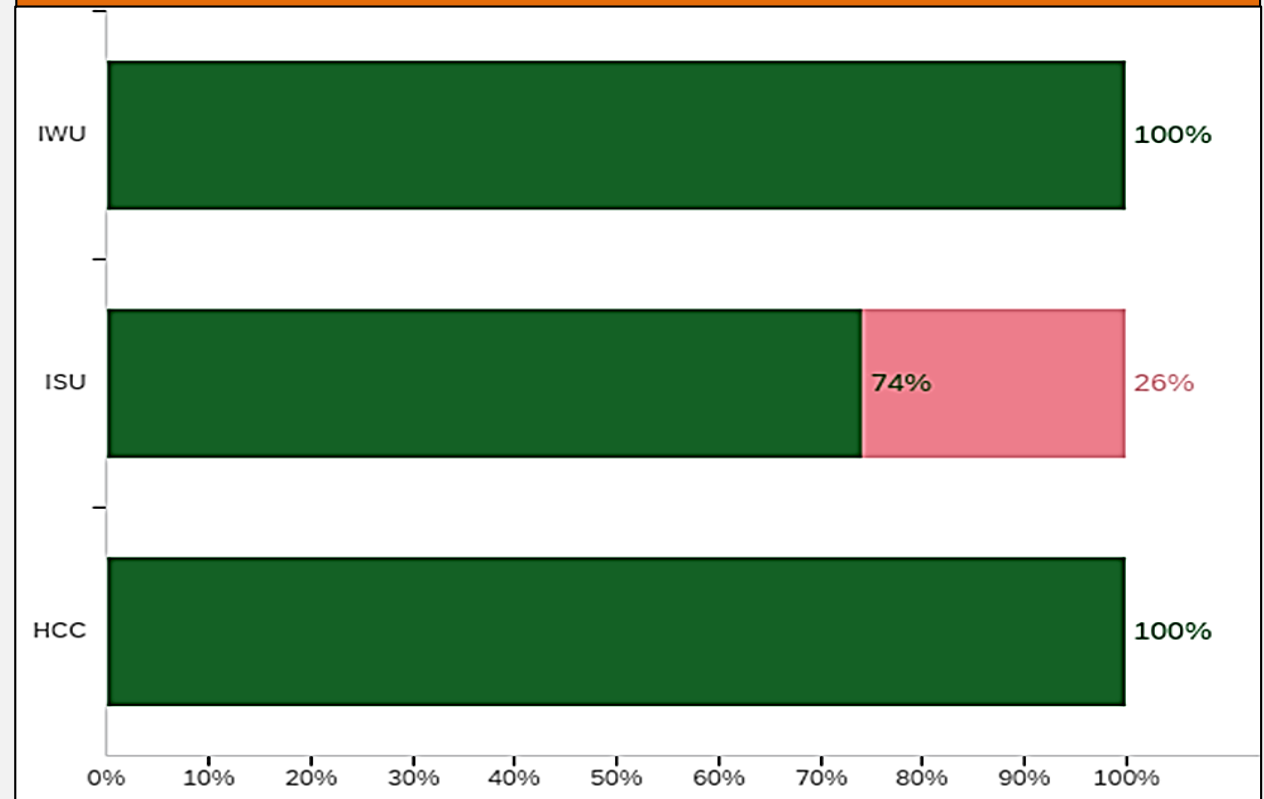


Since entering this college, have you worked part-time (1-30 hrs) while taking classes?

NexSTEM (n=22)



Control Group (n=43)

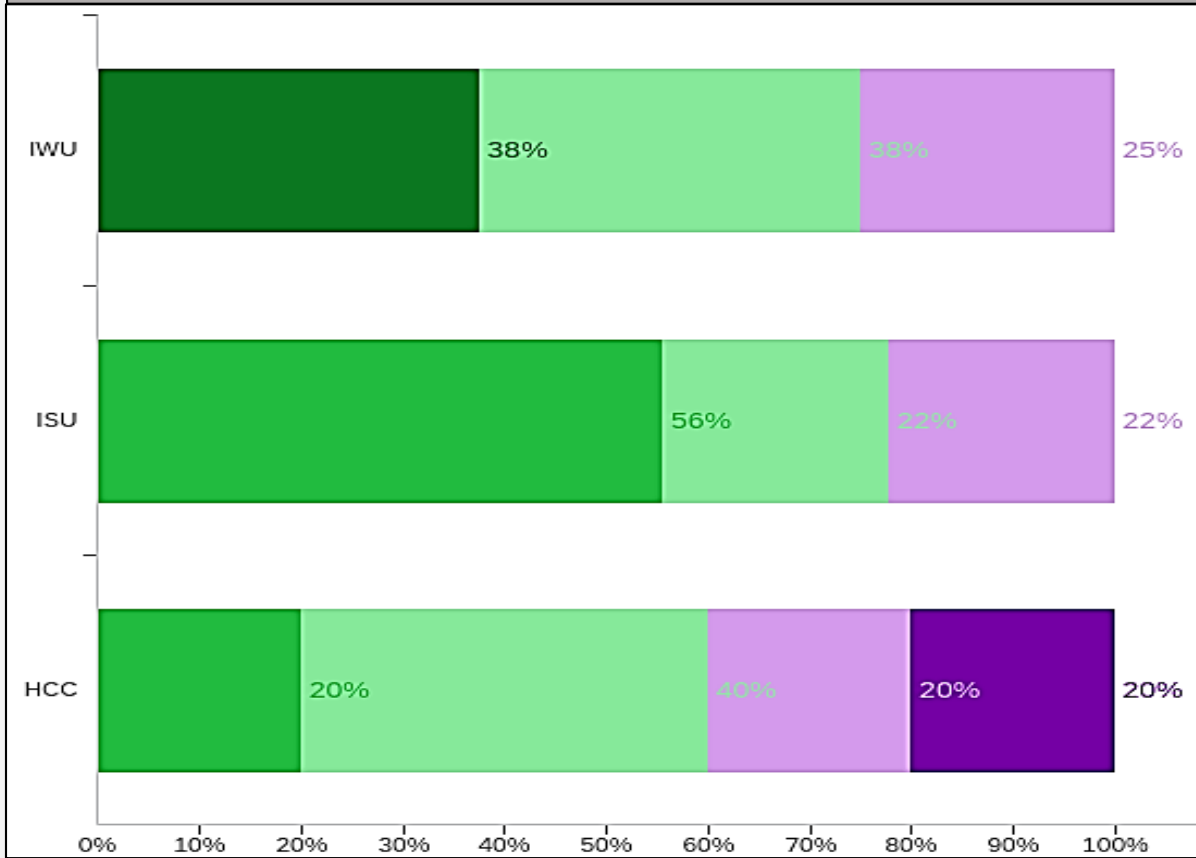


■ YES ■ NO ■ Not Applicable at My School

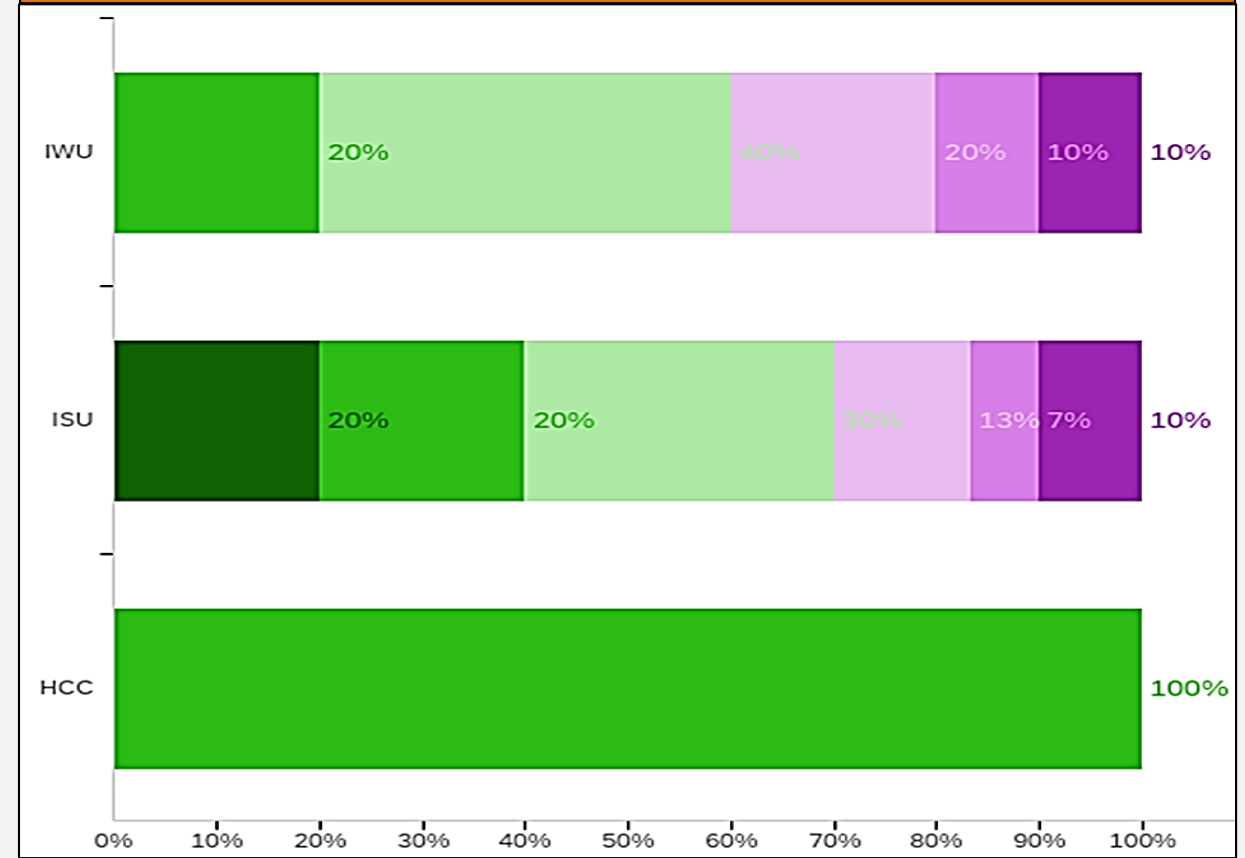


Since entering this college, how has it been to develop a sense of belonging at your school?

NexSTEM (n=22)



Control Group (n=42)



Very Easy
 Moderately Easy
 Slightly Easy
 Slightly Difficult
 Moderately Difficult
 Very Difficult

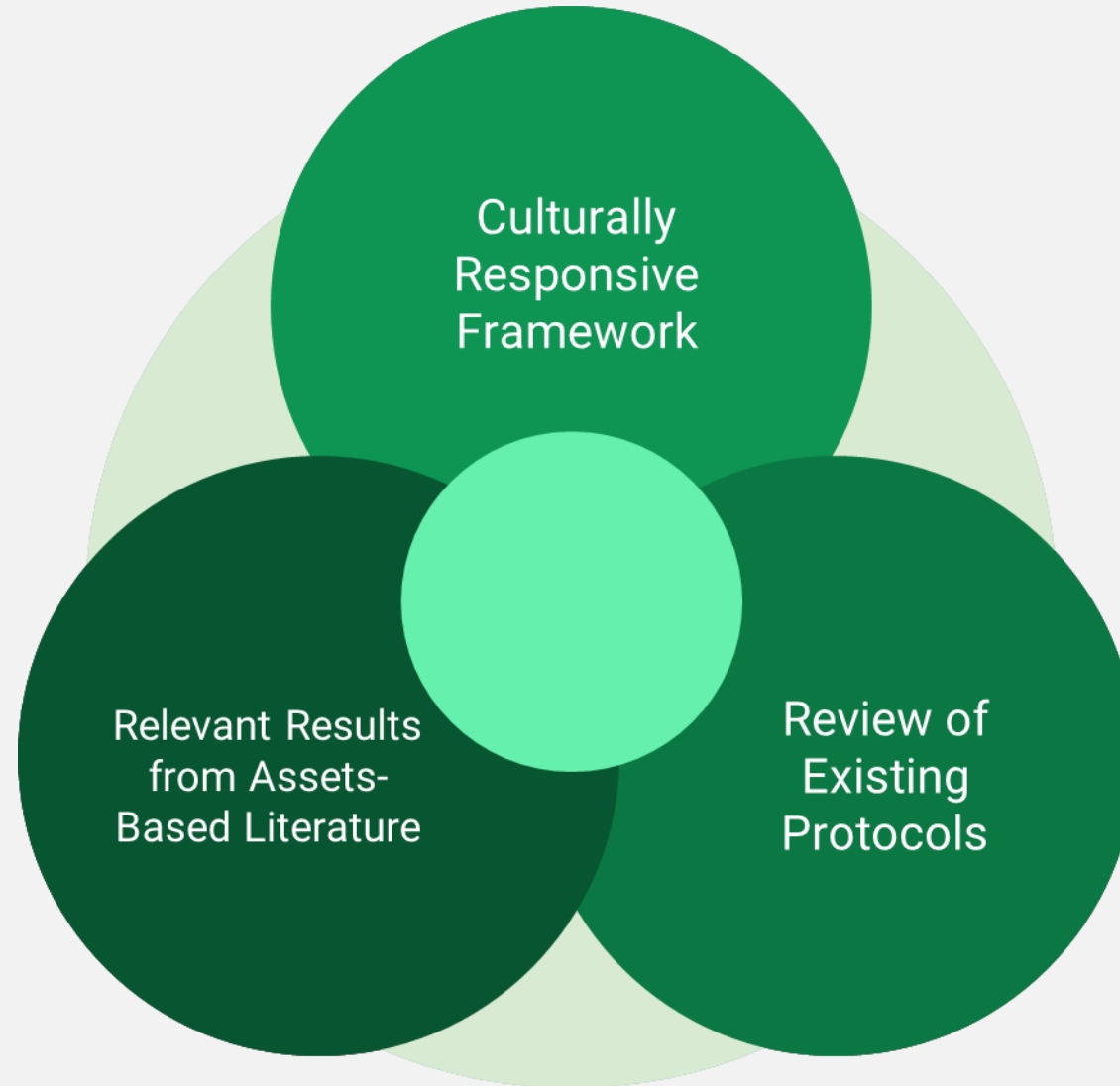


Cohort 1 Cumulative GPA as of Spring, 2020

IWU	ISU	HCC	Control
n=7 $\bar{X} = 3.13$ SD = 0.65	n=9 $\bar{X} = 3.77$ SD = 0.25	n=4 $\bar{X} = 3.60$ SD = 0.36	???



Knowledge Generation Methodology



Qualitative Research Questions

In what ways do students find the key supports of faculty mentoring and community-based research projects meaningful?

Do students experience these key supports differently and does this relate to their identities or academic needs?

Research shows that all students have risk factors for leaving STEM fields, in what ways do these supports counteract/prevent some of these risk factors?



Qualitative Research Methods

17 interviews

First-year students in different STEM majors attending 3 higher education institutions

- Tell us about your research project.
- Describe your relationship with your faculty mentor.
- How did you view your role in this project?

Coding Process

Coding of transcriptions, average interview of 30 minutes

- Identified broad trends individually
- Reviewed literature on identified trends
- Clarified codes and re-coded
- Compared coding amongst researchers

Preliminary Findings

Rich descriptions of undergraduate research projects using discipline-specific language

- Reviewed students' discipline-specific language in light of research on undergraduate research experiences and research on success in STEM fields



Lexicon: Acquired vs Learned

- **Acquired:** natural; unconscious; immersive (Krashen, 1998)
- **Learned:** rule-based; monitored; assessed (Krashen, 1998)
- **Affective filter:** mental block arising from non-optimal conditions or lack of motivation/identification with speakers (Krashen, 1988); Affective filter raised from constant correction (Delpit, 2006)
- **Implications for under-represented students acquiring rather than learning lexicon**



STEM Lexicon: Examples

Participant 1: “We’re doing an environmental project in **eradicating invasive species**, honeysuckle specifically.” After comment about sounding like a scientist: “Yeah, I would say I do. (I’m) definitely using a lot of new terms . . . I’ve never used before.” His work on the project “made me **feel like a biologist**.”

Participant 2: “We put this **ESKAPE pathogen**--well a **safe relative** of the ESKAPE pathogen--on a **plate**. Then we take out bacteria, put it in the middle, and see if there’s a **zone of inhibition** to see that it’s killing it.”

Participant 3: “We train mice and then we **induce strokes** in them. . . Then we train them again, and then we test out different **rehabilitation tasks**. . . so that we know what are the best **rehabilitation techniques**.”



STEM Lexicon: Examples

Participant 4: Learning the “**Hardy-Weinberg Equilibrium**” principle and studying “**ESKAPE pathogens**” which were “**resistant to antibiotics**.” They “were trying to **isolate** a certain **bacterial strain**” and “trying to **isolate mycelia** and then see if we can. . . **eliminate** the not-deadly bacteria.” “After we identify it, I think we’re going to **plate it up** and then. . . observe how they **interact** and see if there’s little dots to see if. . . **mycelia** is actually fighting against **Acinetobacter**.”

Participant 5: “basically looking at the **water quality** and how **turbid** it is. Basically **turbidity** is if it’s dirty, if there’s **sediment** and stuff in it, so we’re studying, Are these animals kicking up the mud and kicking up the dirt and being active in those water areas? Are they the ones that’s causing this **turbidity**?”

Participant 6: “I’m looking into **correlations** between **life insurance** and the **labor percentage rate** and because (the mentor) has a theory that **life insurance** can help people make decisions about whether or not they want to get a job and **how that affects the economy**.”



Preliminary Conclusions

Participants acquired (rather than learned) the lexicon of the STEM field through hands-on research with an expert/faculty mentor

Implications for identity as STEM scholars and as capable of meeting high expectations of the field

Lowering affective filter through familiarity with mentor, ongoing project, and real-world use of lexicon outside of a formal classroom setting and without assessment



Thank You

and

Questions?

