

MAKING MATHEMATICS MEANINGFUL

How learning about local injustices develops undergraduate students' criticality, identities, intellect, skill, and emotion

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REACH OUT

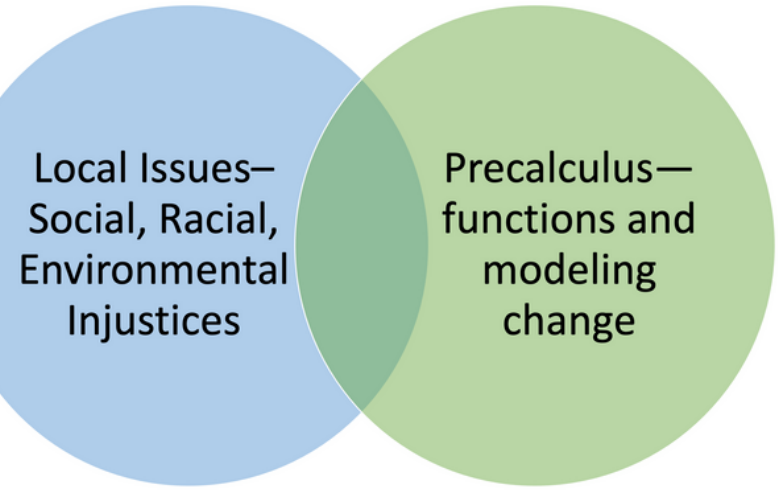
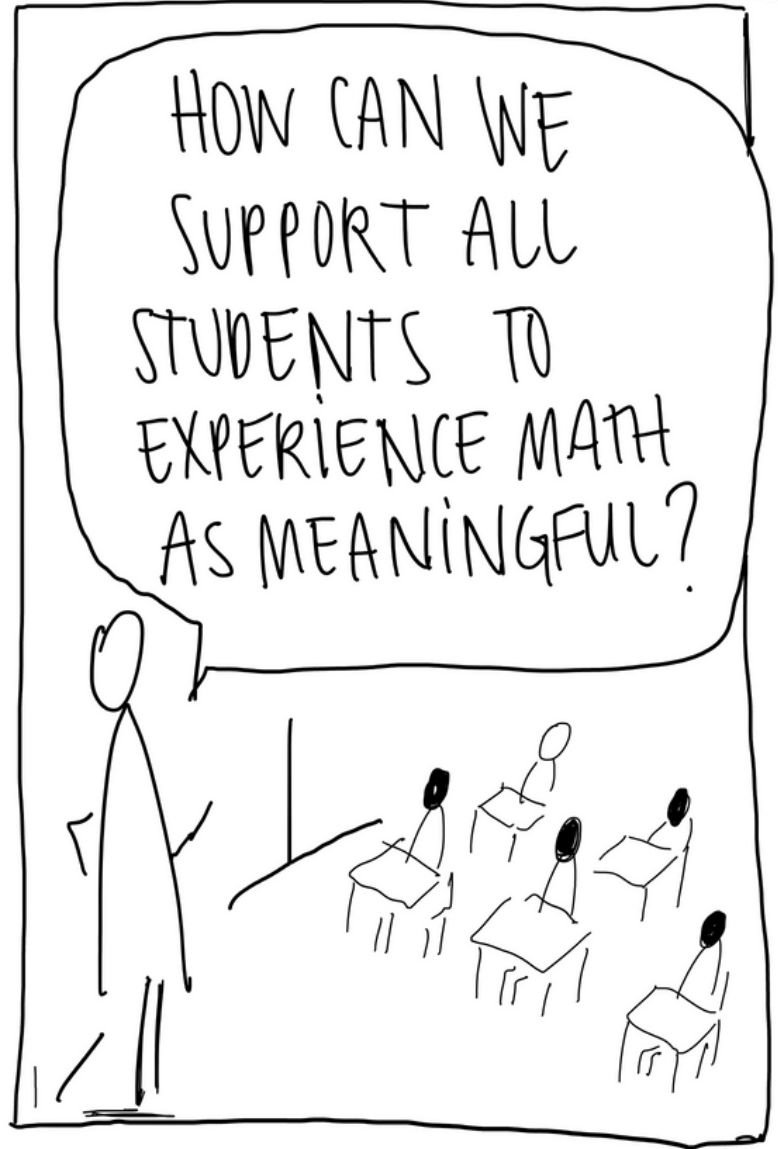
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WHY SOCIAL JUSTICE MATH?

What: The goal of the research is to analyze different ways of connecting mathematical concepts to real-life situations and experiences, allowing students to see the practical relevance and value of what they are learning beyond the confines of the classroom.

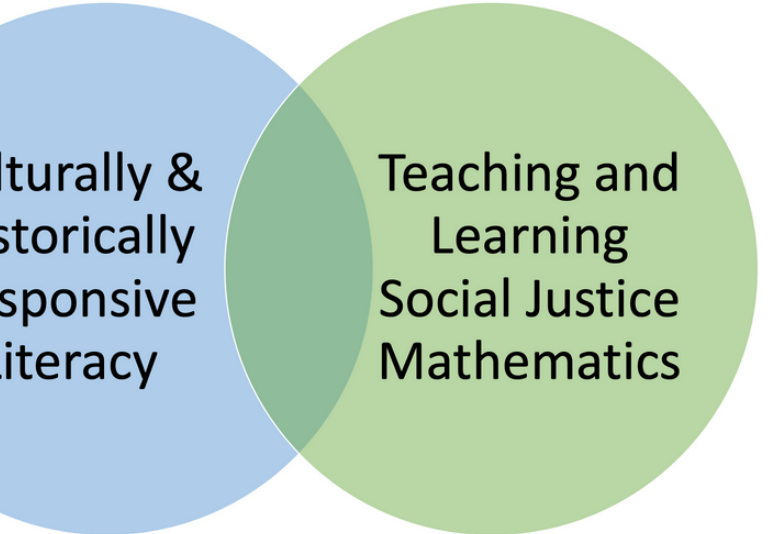
Why: Relating topics such as inequality, discrimination, and human rights to students' lived experiences enables them to grasp the significance of these concepts in real-life contexts and empowers them to become more informed and empathetic members in their communities.

How: By examining local injustices through a mathematical lens, educators create contexts that resonate with students' backgrounds and identities, facilitating critical thinking and dialogue about systemic inequalities and societal challenges while making math relatable and applicable to their lives in a way that makes students more likely to develop a positive attitude towards the math subject and recognize its importance in various contexts.

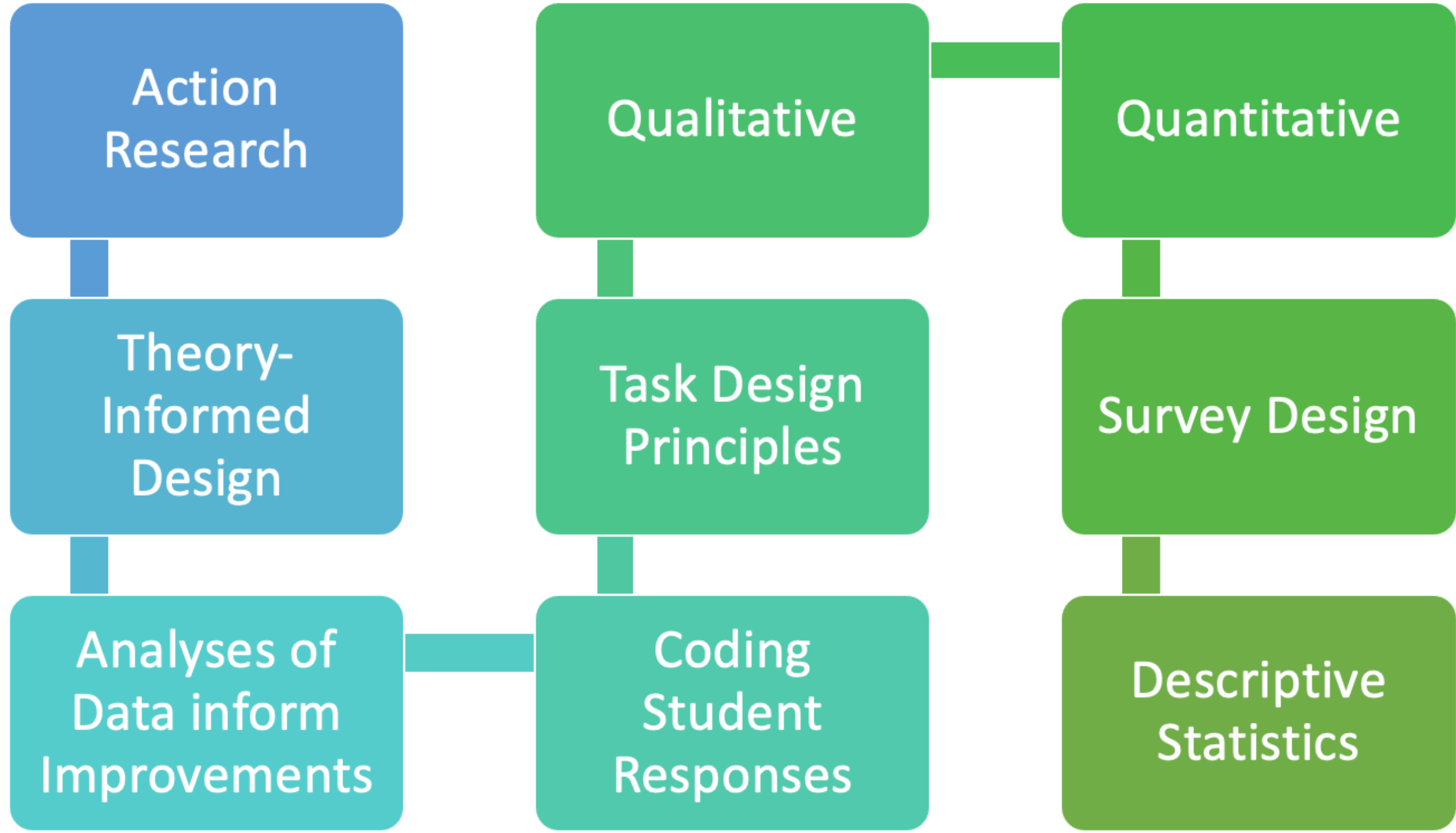


BACKGROUND THEORY

Muhammad (2018) argues that mathematics education should focus on identity and criticality in addition to skill and intellect (knowledge), defining identity as “notions of who we are, who others say we are, and who we desire to be” (Muhammad, 2018, p. 138) and criticality as “the ability to read print and nonprint text with a lens of understanding how power, oppression, and privilege are present” (Muhammad, 2018, p. 139). In practice, combining culturally and historically responsive teaching and teaching for social justice produces a new definition of identity that overlaps more with criticality and better aligns with real data from student responses.

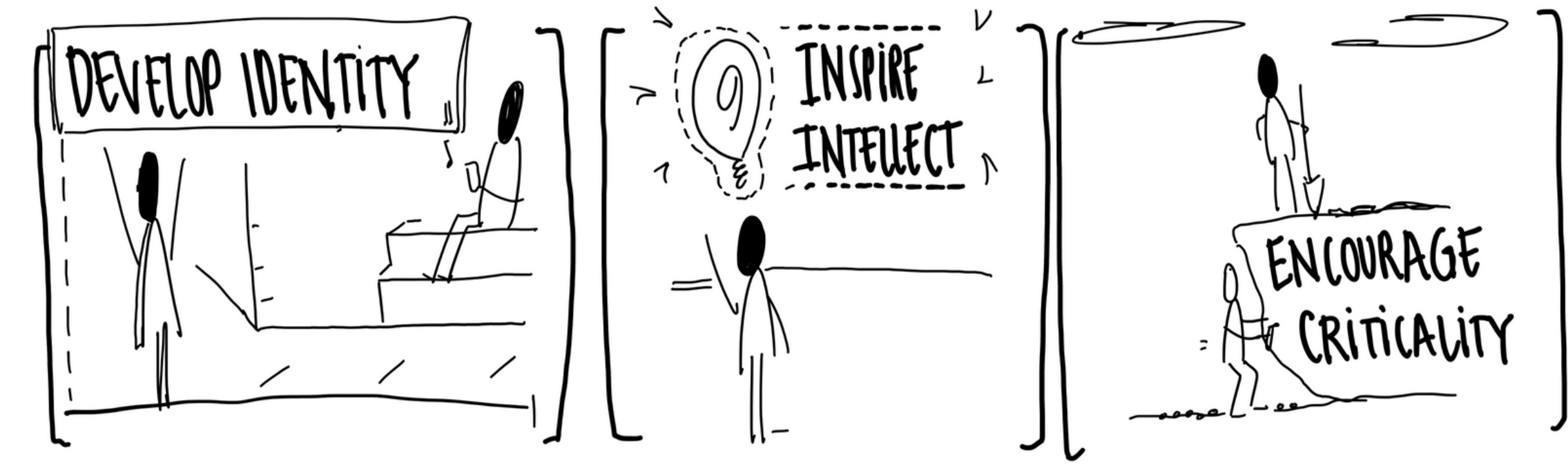


METHODS



RESULTS

QUALITATIVE ANALYSES OF TASKS



QUANTITATIVE ANALYSES OF SURVEYS

POST LAB SURVEY, RESULTS, AND FINDINGS

We asked 57 students to rate their level of agreement or disagreement with the following statements on a scale of 1 to 5

- model local data: $\bar{x} = 4.62069$
- appreciate math connection: $\bar{x} = 4.637931$
- inspire righteous indignation: $\bar{x} = 3.706897$
- linear equation, predictions: $\bar{x} = 4.172414$
- city planning predictions: $\bar{x} = 4.413793$



Scan the QR code to see the full survey and results

This suggests that students found these tasks meaningful in improving their mathematical literacy.

We also done the correlation test. Here we found three strong correlations ($\text{Cor} > 0.69$)

- $\text{Cor}(Q2, Q7) = 0.722555$

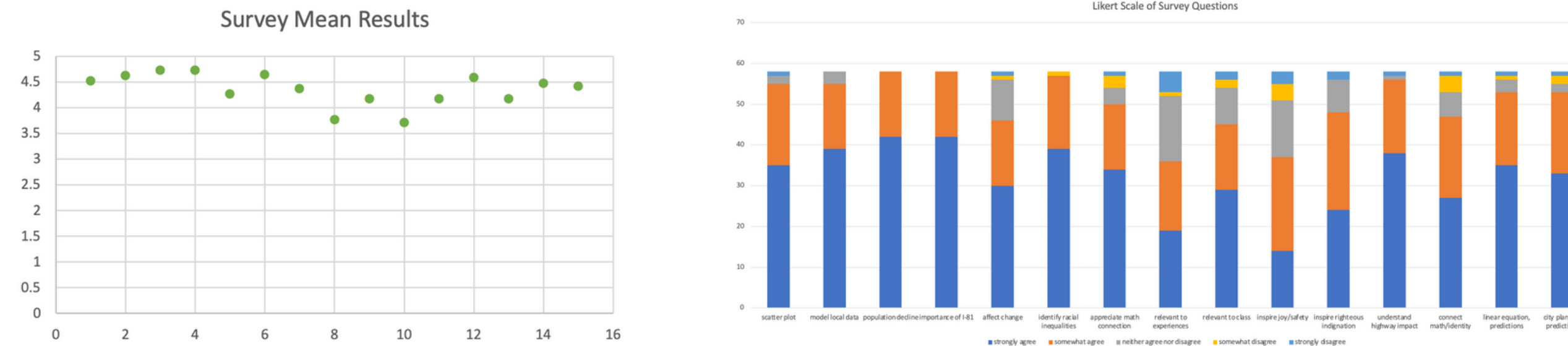
This might indicate that the Lab successfully linked hands-on tasks (like data modeling) to broader skills.

- $\text{Cor}(Q11, Q12) = 0.710057$

It appears the Lab effectively tied these socio-political issues together in students' perceptions.

- $\text{Cor}(Q14, Q15) = 0.866167$

This is a good demonstration of students integrating mathematical knowledge with real-world applications.



IMPORTANCE OF FINDINGS

Undergraduate students found their experience with social justice mathematics tasks meaningful and supportive of their learning, critical thinking, and understanding of societal issues

LESSONS LEARNED AS RESEARCHERS

- Team work and collaboration
- Process and problems faced during qualitative coding
- Social science research is connected to community-engagement

IDENTITY

Students describe something about themselves or others in the social context of the lesson (Muhammad, 2020). Students may express a broad range of identities including race, family, religion, community, or geographic location.

Task: What stood out to you as important in the I-81 video?

I didn't realize the health problems that come with being under a highway, and how much a highway can disconnect people from society. (C1_Lab81_Sp23_Slide 02, Pos. 1)

INTELLECT

Students apply their knowledge about mathematics to predict, explain, or otherwise express understanding of a social issue or policy.

Task: List three ideas, events, or dates that seem important

The construction of I-81 tore down 90% of the 15th Ward, which housed eight of every nine black resident in Syracuse. The construction displaced 1,300 - 2,200 families and relocated 75% of Syracuses black population of other areas White residents living on the south and east side of Syracuse also sold their homes (C1_Lab81_Sp23_Slide 03, Pos. 1)

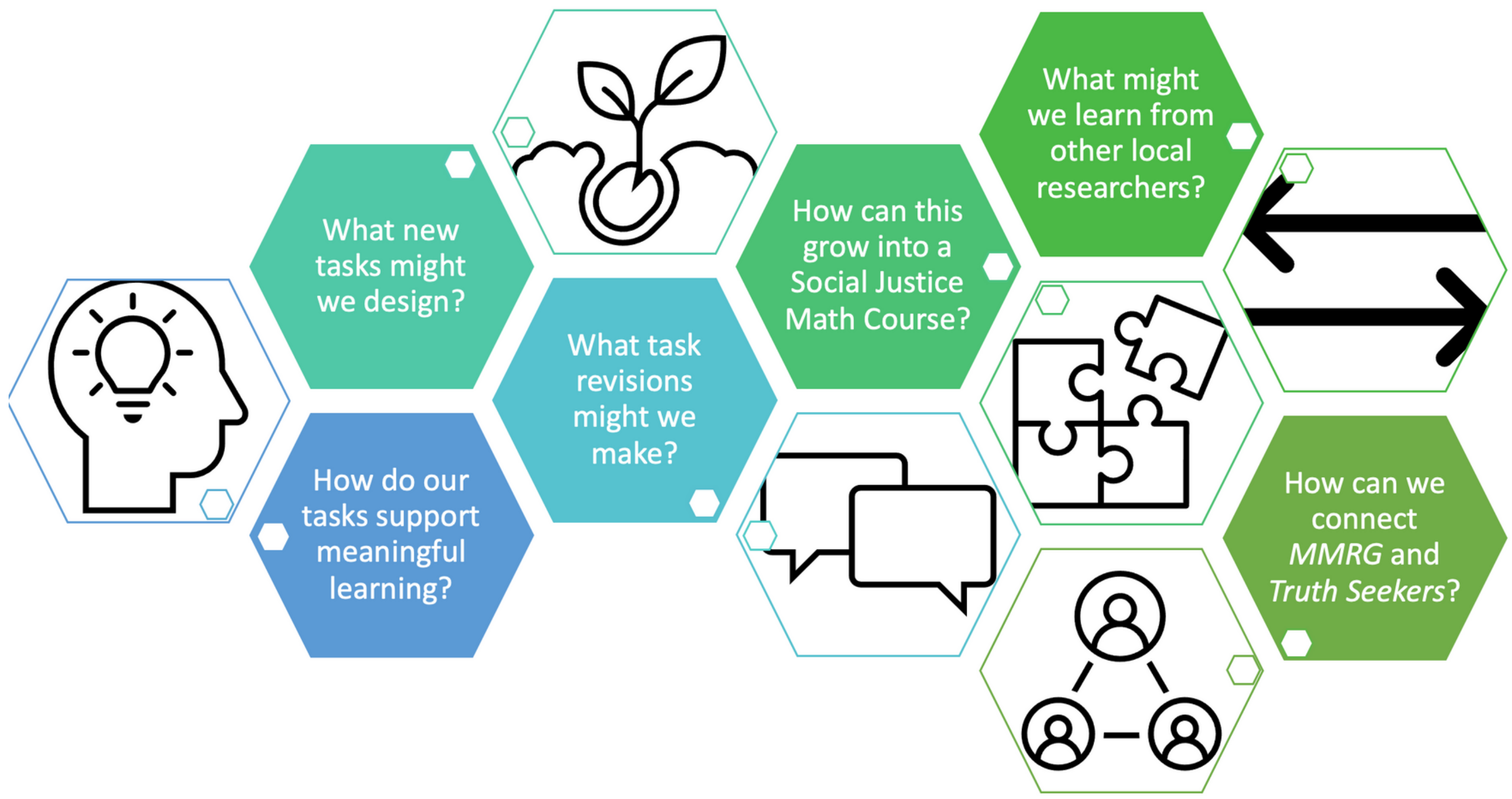
CRITICALITY

Students express awareness of a specific or general injustice and/or power structures that shape communities and consider addressing injustices.

Task: What stood out to you as important in the I-81 video?

It is in a predominantly black neighborhood. People were kicked out from their homes in order for the highway to be built. People don't have a voice to what is going on. The people who live there, their health is being affected negatively. (C1_Lab81_Sp23_Slide 02, Pos. 1)

NEXT STEPS & RESEARCH AGENDA



RELATED LITERATURE

ACKNOWLEDGEMENTS

Please scan the QR Code for a complete reference list.

This work represents a collaborative effort of the Meaningful Mathematics Research Group at Syracuse University led by Associate Professor Nicole L. Fonger. Team members during Summer 2023 include (alphabetical order by last name): Emanuel Boutros, Stephen Caviness, Nicole Fonger, Sankalp Gautam, Winnie Naggar, Karley Voyias, Qiong (Mars) Wu, Hanyi Xu. Our work is informed by collaborations with the Antiracist Algebra Project and Engaged Communities Team including: Lauren Ashby, Ken Keech, Jonnell Robinson, Betty Routhouska. We are grateful to the SOURCE for student funding, the Mathematics Department for resource support, and the Engaged Humanities Network for grant funding.