



**Nurturing Nature:
Connecting STEM Research, Education &
Social Justice to Broaden Participation in STEM**

Lenora M. Crabtree & Adam Reitzel
University of North Carolina Charlotte



@SciEd4SocImpact

Our Agenda



- Who are we?
- What does the research say?
 - Science and Communication
 - Broadening Participation
 - Critical Pedagogies
 - Culturally Relevant Teaching
- Teaching Science through the lens of Social Justice
- Research Findings
- Making connections



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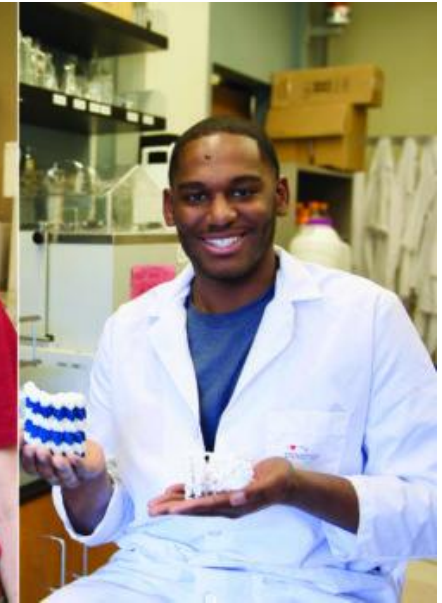
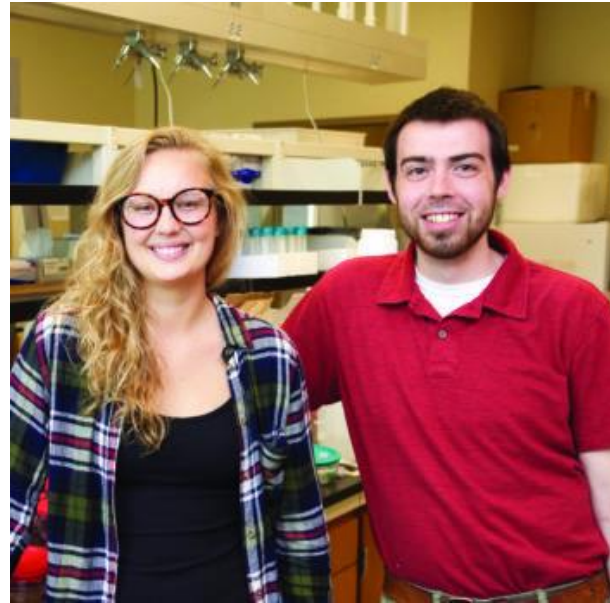


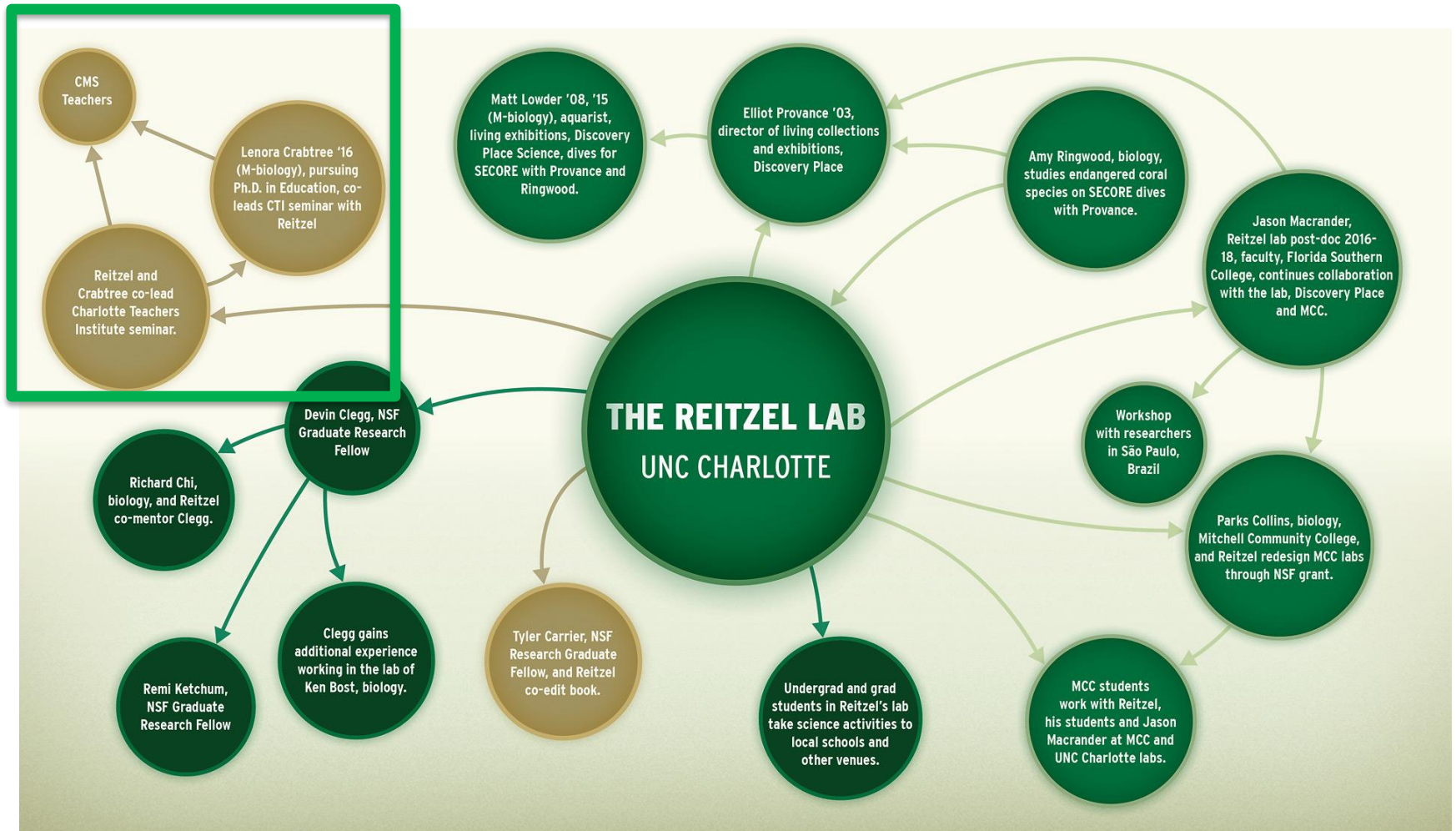
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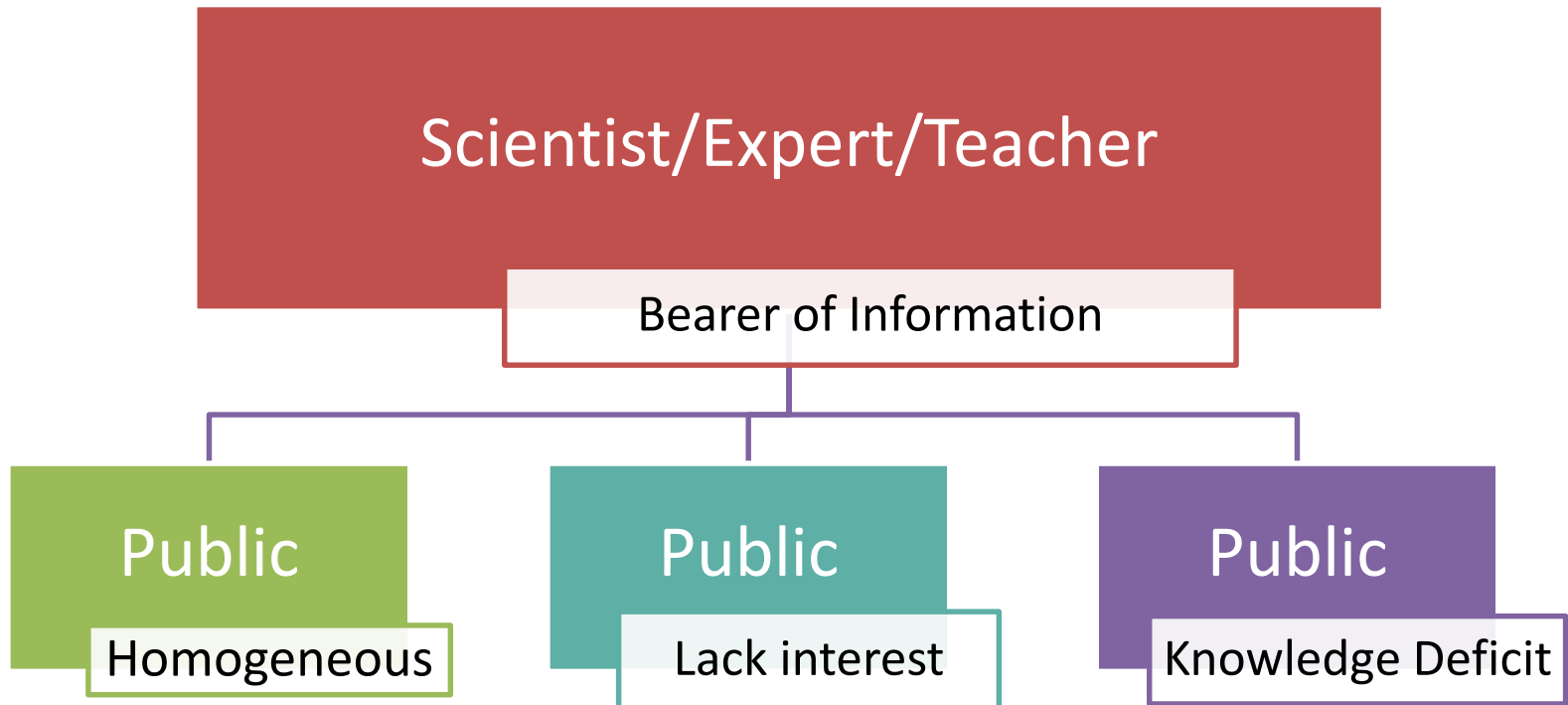




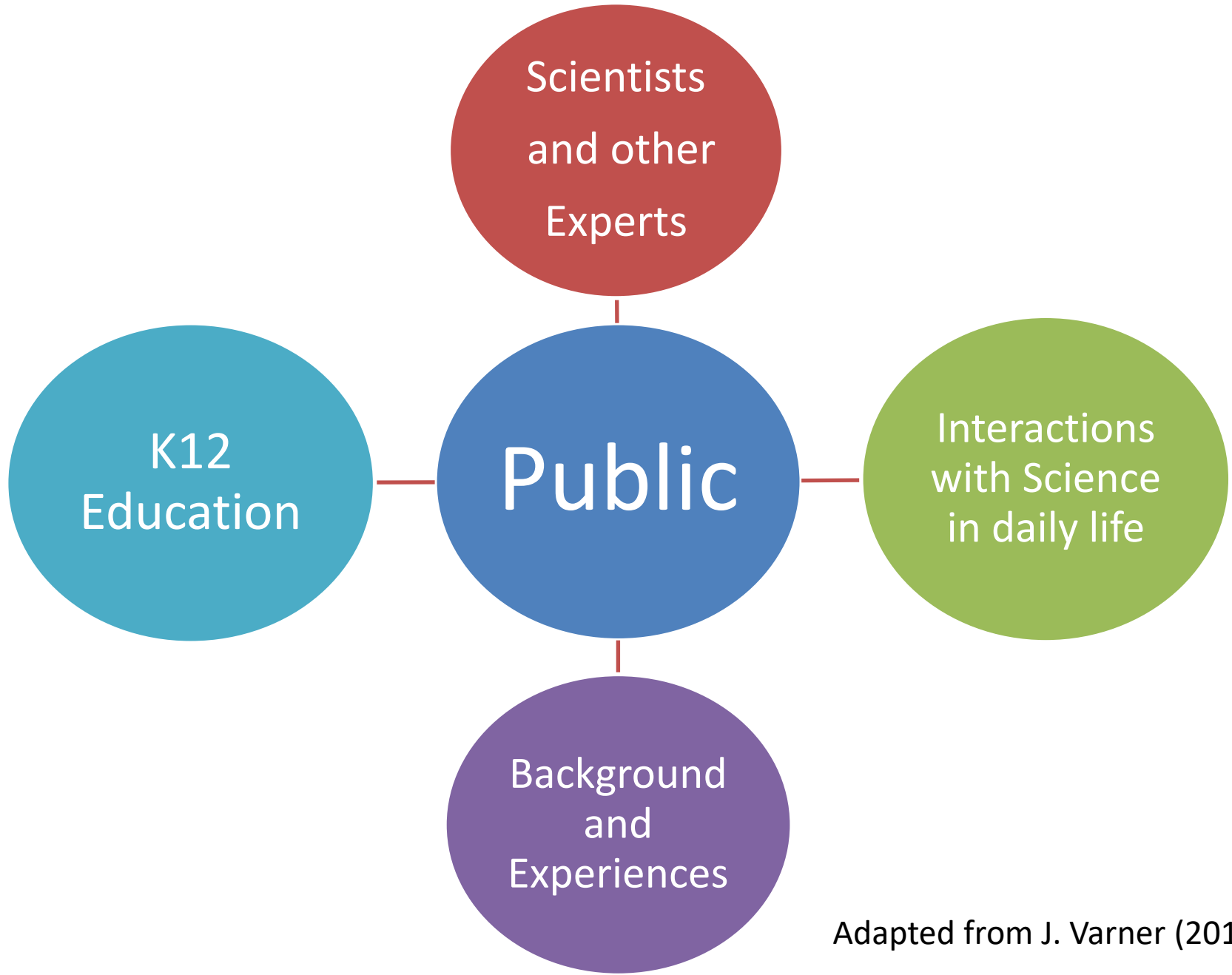
How did research guide this work?

**How do Scientists
communicate?**

Deficit Model Thinking



A more effective approach?



Adapted from J. Varner (2013)

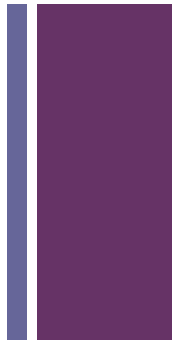
+ Current Research at the Undergraduate and Graduate level:

- Student *engagement in research and interest in STEM careers increases* when research supports their altruistic goals. (Thoman, Brown, Mason, Harmsen, & Smith, 2015; Jackson, Galvez, Landa, Buonora, & Thoman, 2016).
- Students are *less likely to persist* in STEM majors that they perceive to lack social value and relevance to the community. (Hurtado, Newman, Tran, & Chang, 2010).
- Qualitative study involving 50 scientists-in-training at R-1 universities (Campbell et al., 2015)

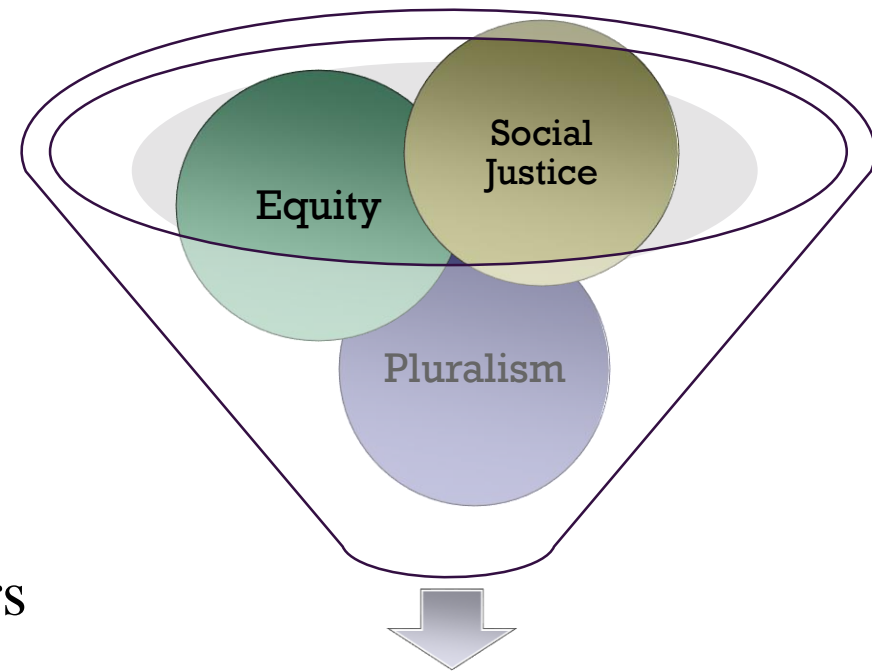
“Adapt STEM training to include or make room for a social justice component.”




Critical and Asset Pedagogies Support New Approach



- Critical Pedagogies (Freire, 2000; Giroux, 2011)
 - Emphasize inequities, injustice and oppression
- Culturally Relevant Pedagogies (Ladson Billings, 1995)
 - High expectations for all learners
 - Cultural Competence
 - Support development of students' socio-political consciousness



Critical Pedagogies



+ “...most of the teachers I encounter have not developed a sociopolitical consciousness of their own.”

Ladson Billings, 2011

+ The setting:



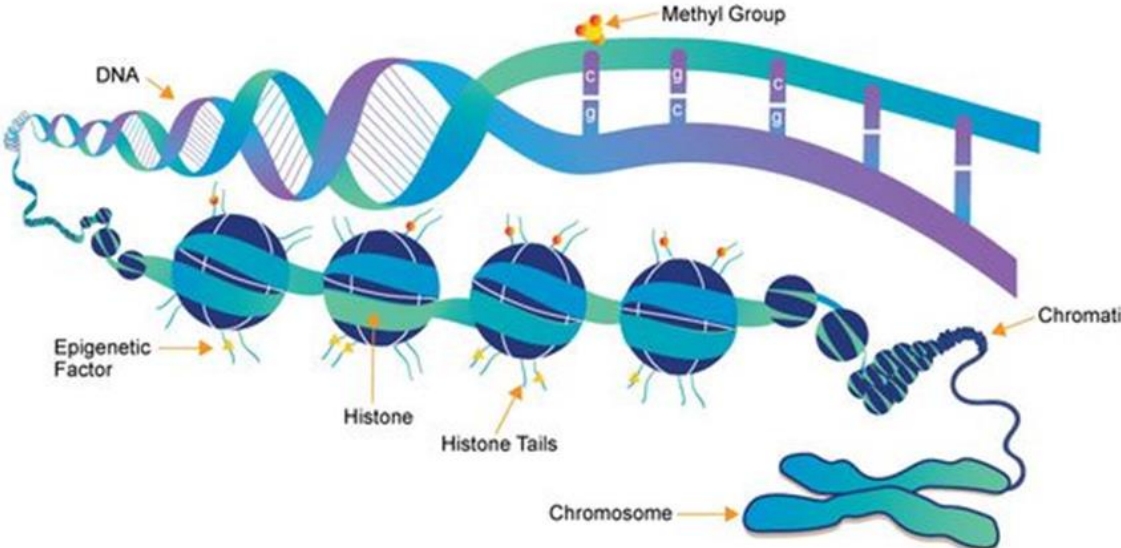
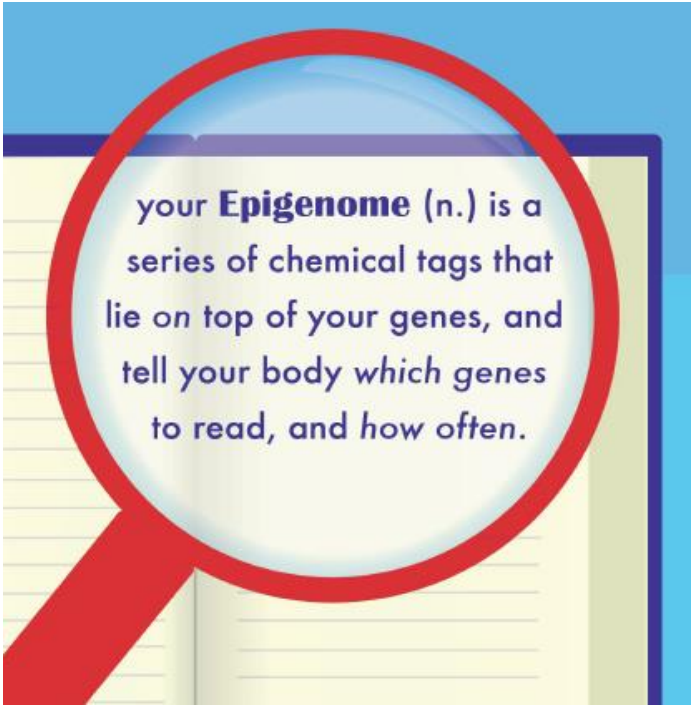
+ The setting:



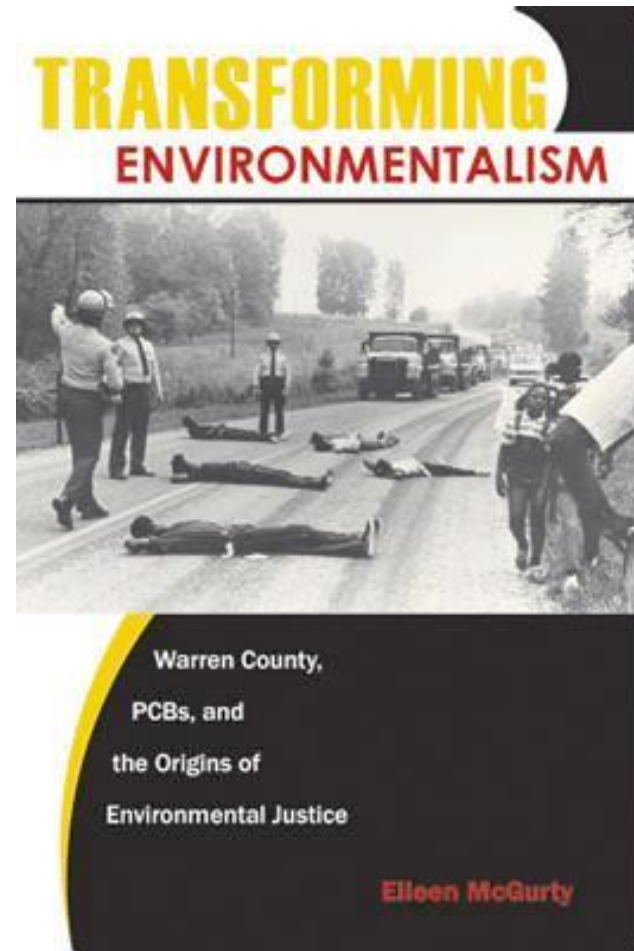
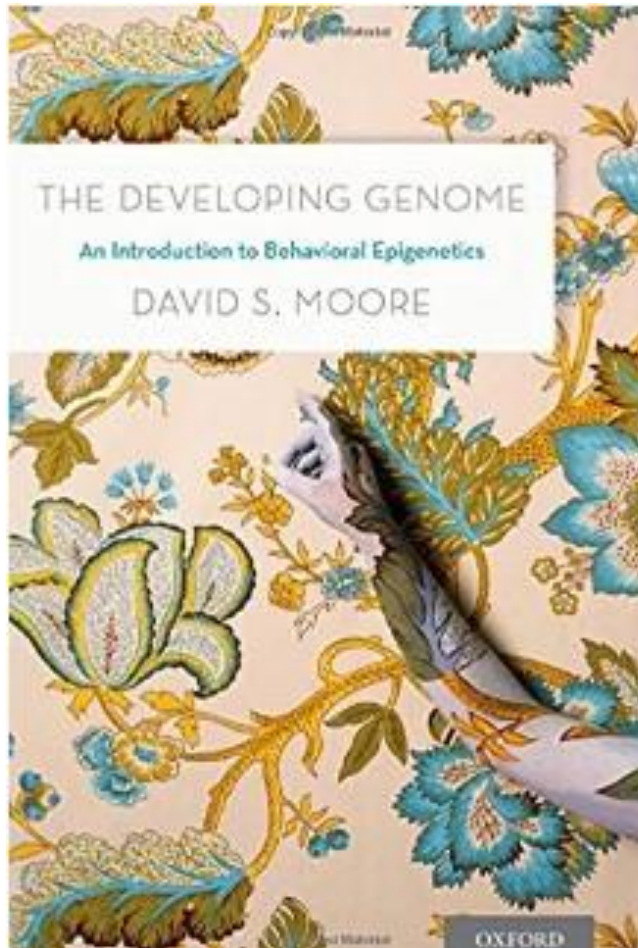
Nurturing Nature: Epigenetics as a way to explore Social Justice



Epigenetics: the study of changes in organisms caused by modification of gene expression rather than alteration of the genetic code itself.

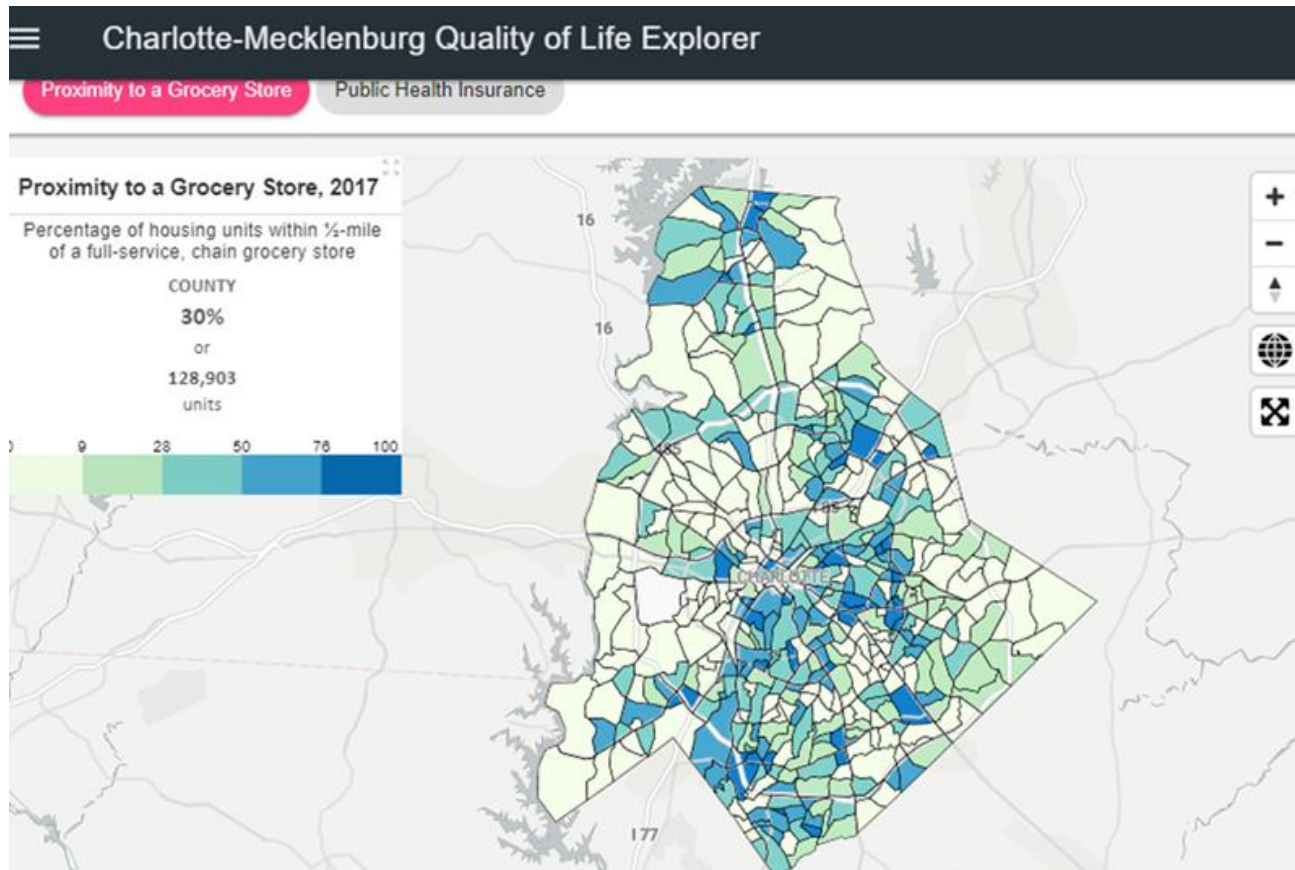


+ Seminar Texts



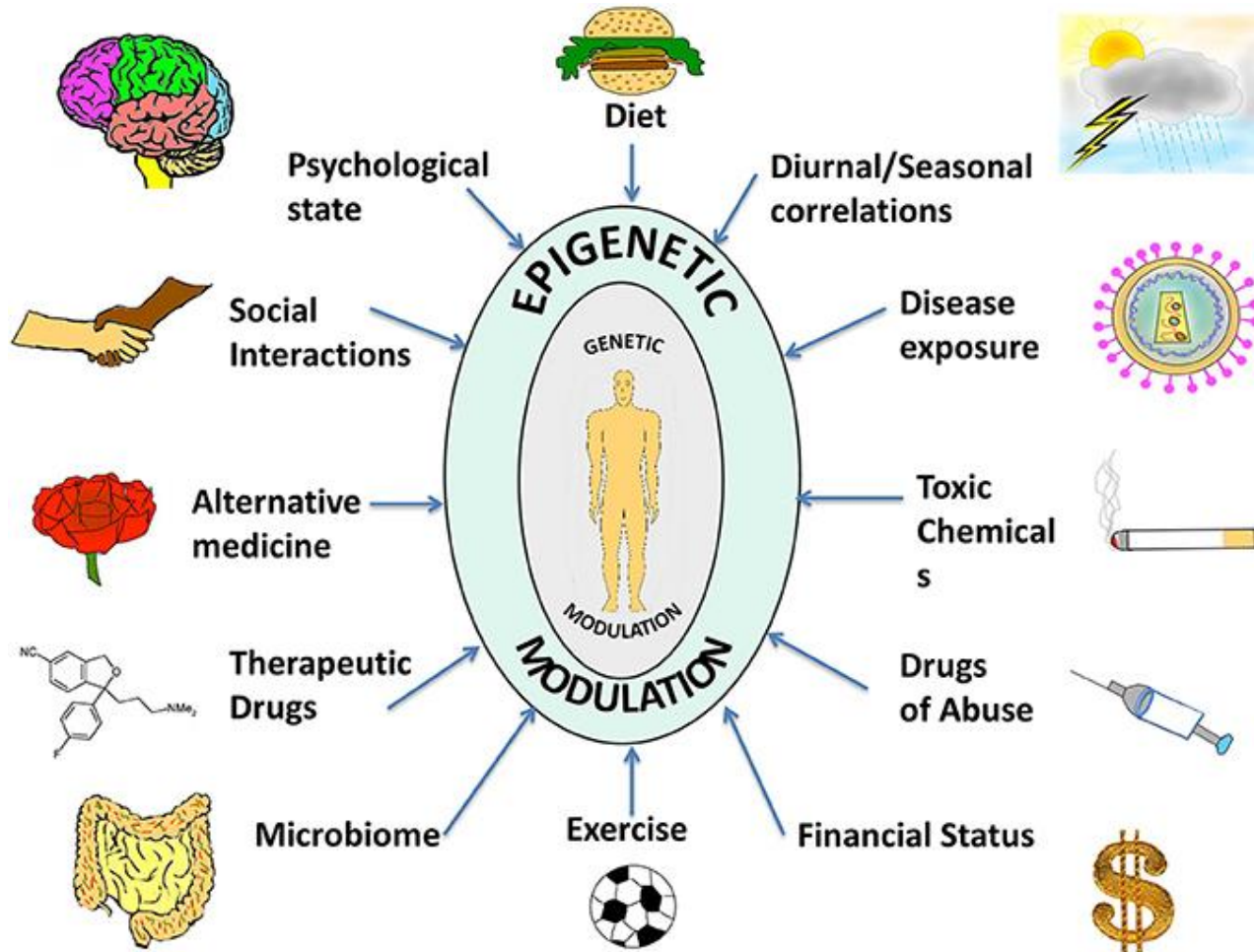


Critical pedagogies of place:

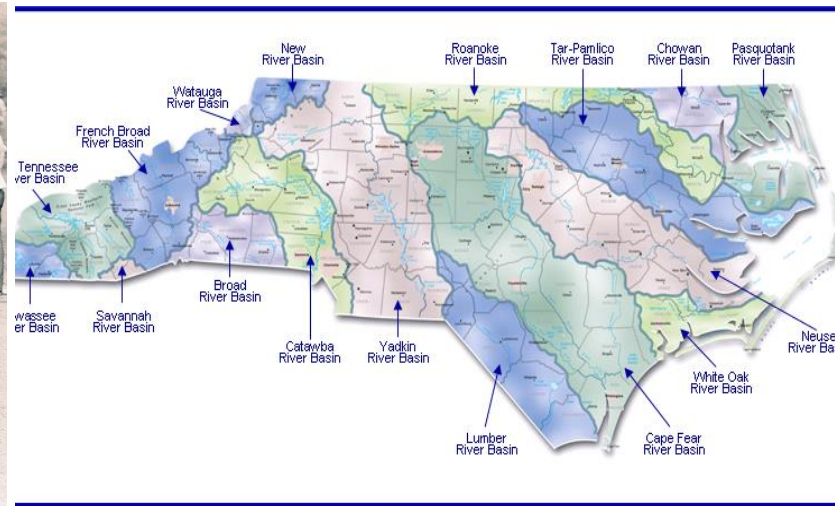


(Gruenewald, 2003)

+ Seminar Topics:



+ Seminar Topics



+ Climate change is a social justice issue:



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NATURAL DISASTERS

Florence's Floods Reveal Exposure of Rural Areas to Climate Change

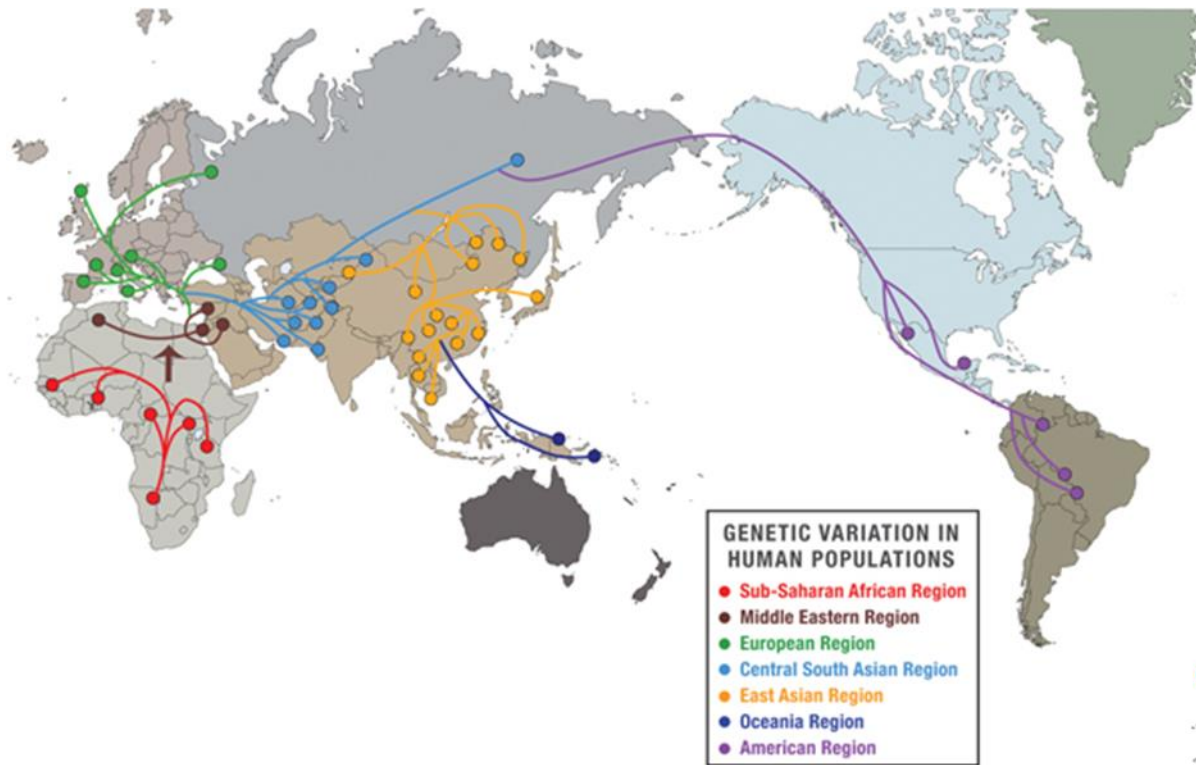
For cash-strapped communities, planning for a warmer future is a luxury

A street flooded by Super Typhoon Mangkhut in the Philippines. (NOEL CELIS/AFP/Getty Images)

The Unequal Burden of Climate Change

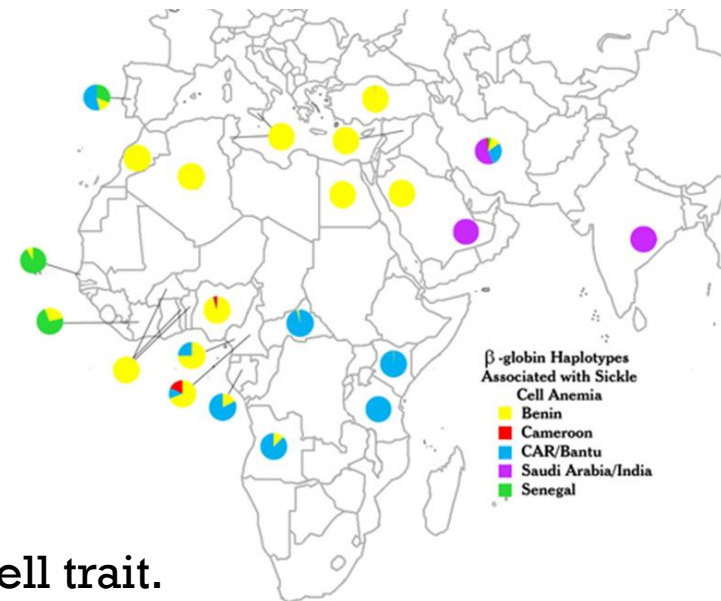
Hurricane Florence and Super Typhoon Mangkhut laid bare the disproportionate consequences for poor communities.

+ “Race” is a social construct.



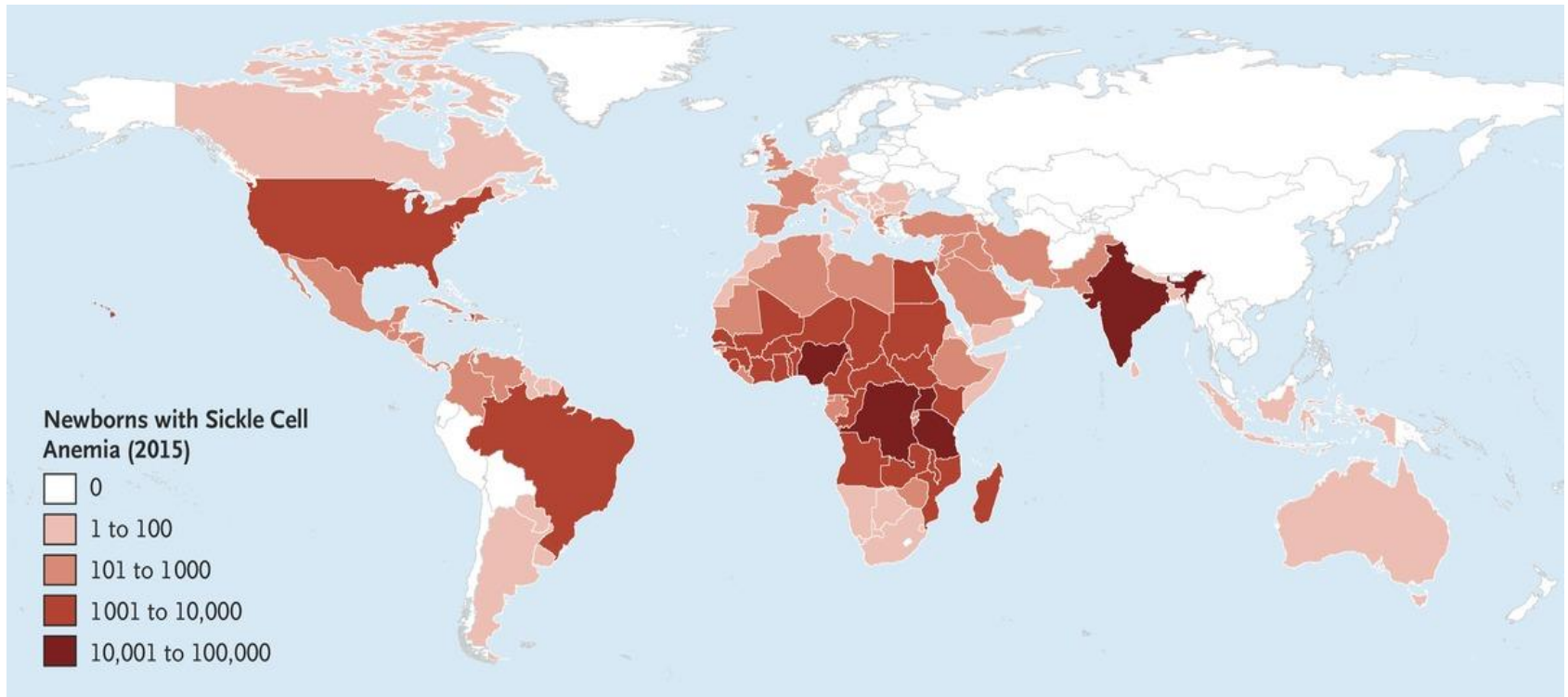
DNA in all humans is 99.9 percent identical.

There are many alleles for sickle cell trait.





How we teach about genetic diseases matters:



(Donovan, 2016)

+ Qualitative Research Study:



■ Research Questions:

- 1) How do teachers experience learning advanced science concepts through critical pedagogies?
- 2) How do teachers think about applying critical pedagogies in their own teaching?



+ Conceptual Framework

■ Critical Pedagogies

- Reject the Banking Model of education
- Learning as Problem Posing
- Teachers as Learners/Learners as Teachers



■ *Promote the development of critical consciousness*

- a deepening awareness of an person or group's situated reality
- Emancipatory Knowledge
- Learning to “Read the World”

+ Sampling and Participants

■ Purposive Sampling

- Science Teachers
- Diverse grade levels
- Diverse teaching experiences
- Two White Females
- One Black Female

■ Ms. Brady

- Elementary Science – Title 1 School
- 6th year in education
- White, early 30's, middle income background
- Business major with a minor in Education

■ Ms. Witherspoon

- Middle School Science – Title 1 School
- 2nd year in education
- White, mid-20's, affluent background
- Business major
- Alternative Certification

■ Dr. Harris

- Early College High School
- Chemistry, Physics, Environ. Science
- 4th year in education
- Black, late 30's, affluent background
- PhD in Science; worked in industry before teaching; “lateral entry”



Findings: Social Justice as an Invitation to Explore Novel Science Content



- All three participants emphasized that their interest in the course was based on their interest in social justice:
 - “The fact that this particular seminar combined civics and science, that’s what drew me to it.” (Dr. Harris, HS)
 - “So like whatever is happening in the cell... I’m not going to find as interesting as I do like the implications of it for that person, for their community, for legislation, for policy.... if you’re not doing anything with it, what contribution are you making?” (Ms. Witherspoon, MS)
- The acquisition of new knowledge was influenced by the participant’s previous science background.
 - “I’m still kind of struggling with like what’s methylation and that type of thing.” (Ms. Brady, ES)



Findings: Learners as Teachers/Teachers as Learners



- Class discussions were highlighted by participants as playing a significant role in their learning.
 - “I’ve really appreciated the perspectives of the other people in the seminar because my perspective as a White lady from an affluent background is not the same as like [a black male teacher] who talks... about his family heritage and how it affects his perspective... I feel like I’ve learned a lot from that ...about the narratives of the children in my room and their families.” (Ms. W)
 - “I really don’t know what my students are going through... We have some outspoken [teachers in the seminar] who have pointed out like all the different things that they deal with being black and like I don’t think I’m a racist but I don’t have to deal with these things and I didn’t think about them before.” (Ms. B)



Findings (RQ1): Learners as Teachers/Teachers as Learners



"And then with [another teacher] making these connections from slavery... It's like all this occurred but yet everyone thinks it had no effect. That you are supposed to dust yourself off and be like, OK, so we're good now... I always hear we are still feeling the effects of slavery but I never really thought it was on a molecular or genetic level... So now I see what everyone is talking about when they say slavery is still generational and we're still feeling the effects." (Dr. Harris, HS)



Findings: Addressing Inequity, Injustice and Oppression through Science Content



- “It just woke me up like I was sort of dropping the ball. I was focusing a lot on my data and focusing a lot on the standards... I think so much of education is giving someone power and purpose and you can’t just like give it to someone. You have to help them figure out how they’re going to use it.” (Ms. W)

“We never really talked about them from the perspective of the have and the have nots so I’m going to be more intentional looking at that... and saying who’s responsible for this?” Dr. Harris

+ An opportunity to hear from a teacher...



Epigenetics and the Curious Journey into Education – Eli Davis

<https://cms-foundation.org/our-work/teacher-talks>

+ Areas for Future Research



- New seminar (four days) will be conducted this summer.
 - How can the experience related to science content knowledge acquisition be improved?
 - How will the different group composition affect the findings?
- In the future, research is needed to explore how teachers translate the new pedagogical approach in the classroom.
- How do students respond?



Questions for Discussion:



How are you building connections between potential partners in the College of Education and the research faculty you support?

Question for Discussion:



What connections could be made between the content of the research you support and social justice?

+ *Critical pedagogies encourage students “to use the knowledge they gain both to critique the world in which they live and, when necessary to intervene in socially responsible ways in order to change it.” (Giroux, 2011)*



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