This work is funded, in large part, by the National Science Foundation (Award #s 1758238 and 210217).


# Working Together to Center Justice in Science Education

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Warner Graduate School of Education
University of Rochester, Rochester NY

November 17, 2023 Northern Arizona University

Rochester, NY, USA

# Rochester

New York
USA

Rain · 9°C
1:46 PM

Directions | Save | Nearby | Send to your phone | Share

## Quick facts

Rochester is a city on Lake Ontario, in New York State. Old industrial buildings cluster near the Genesee River's High Falls. A vast collection of toys and dolls forms the core of the Strong National Museum of Play. The George Eastman Museum, on the early-1900s estate of the Kodak founder, has photography exhibits, film archives and gardens. Rochester Museum & Science Center has hands-on displays and a planetarium.

## Iconic Rochester

Restaurants | Hotels | Attractions | Museums | Transit | Pharmacies

ONTARIO
QUEBEC
Winnipeg
Quebec City
MINNESOTA
Minneapolis
Ottawa
Montreal
WISCONSIN
MAINE
VERMONT
MICHIGAN
Toronto
NEW HAMPSHIRE
NEW YORK
MASSACHUSETTS
IOWA
Chicago
CT
RI
PENNSYLVANIA
New York
ILLINOIS
INDIANA
OHIO
Philadelphia
NJ
Indianapolis
Cincinnati
Columbus
MARYLAND
St. Louis
DE
MISSOURI
WEST VIRGINIA
Washington
KENTUCKY
VIRGINIA
Nashville
OKLAHOMA
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NORTH CAROLINA
Charlotte
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# TABLE OF CONTENTS



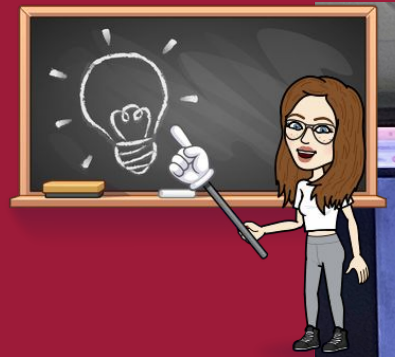
GET REAL! Science

WARNER SCHOOL UNIVERSITY OF ROCHESTER

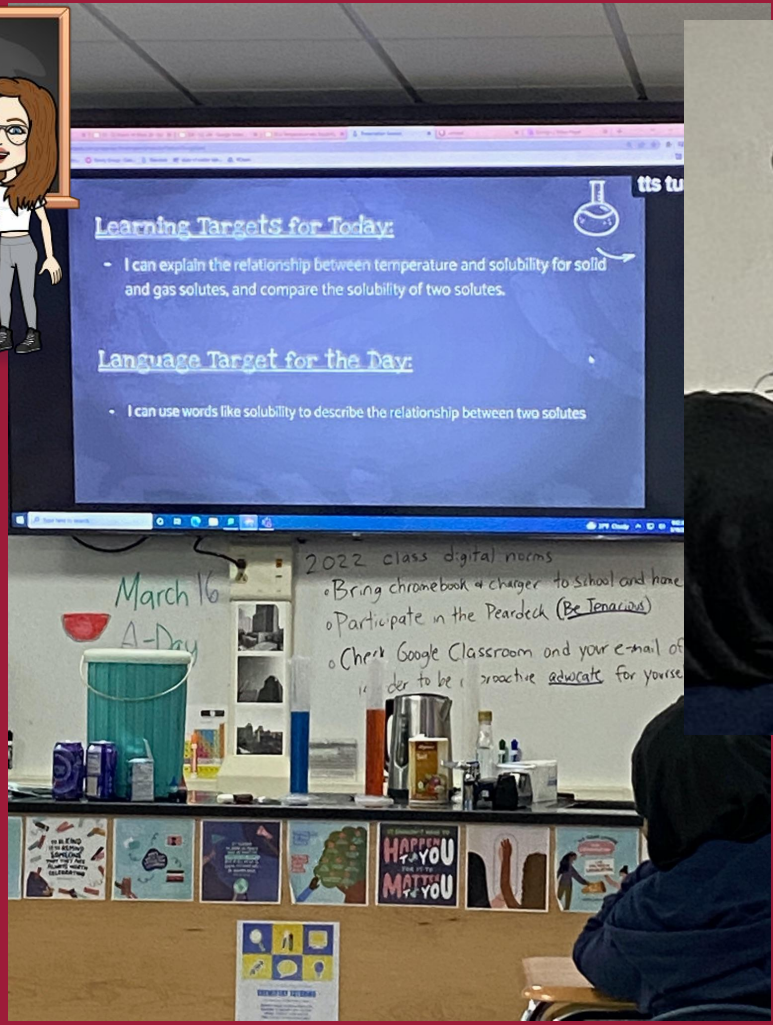
# 01 Get Real! Science Teacher Education

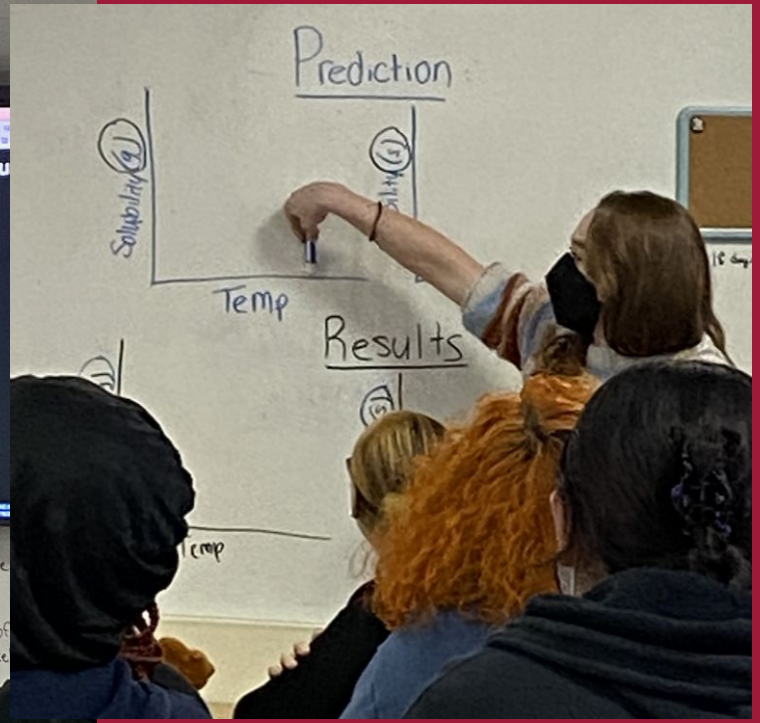
15-month Scaffolded Master's Program: Outside of School learning to teach as precursor to School-based learning to teach.

# What do you want to see?

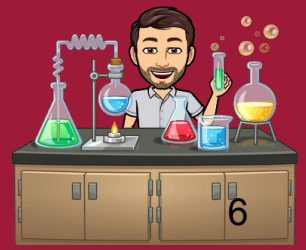


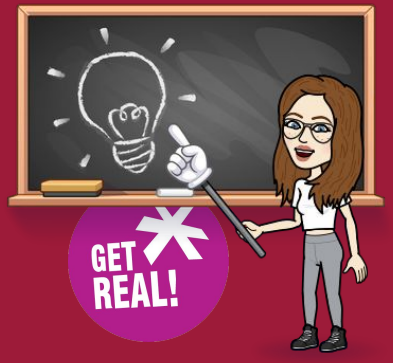
*Start with student ideas*

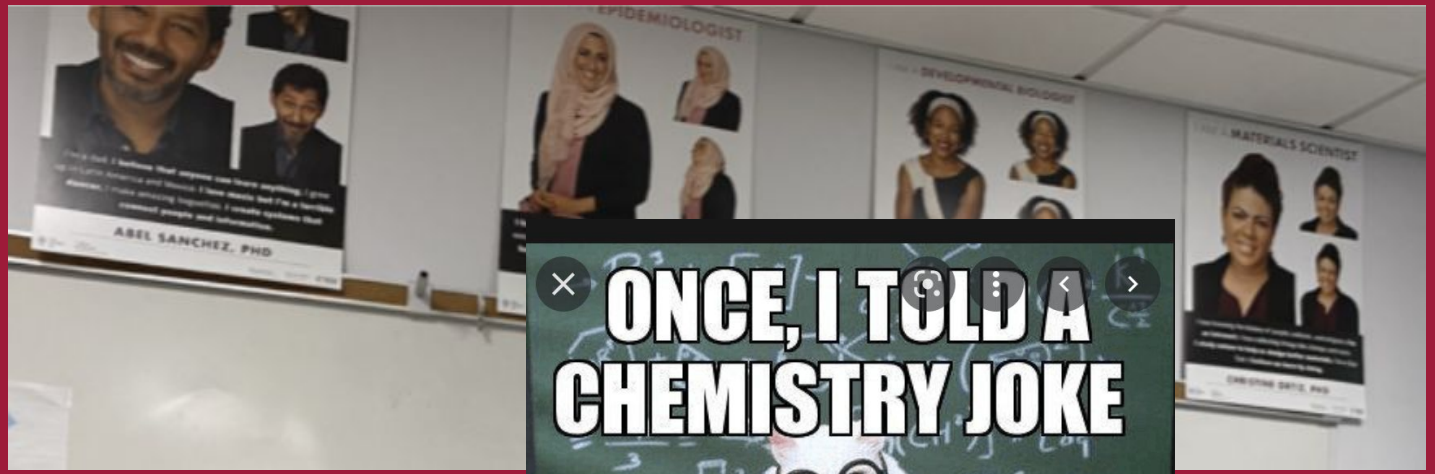


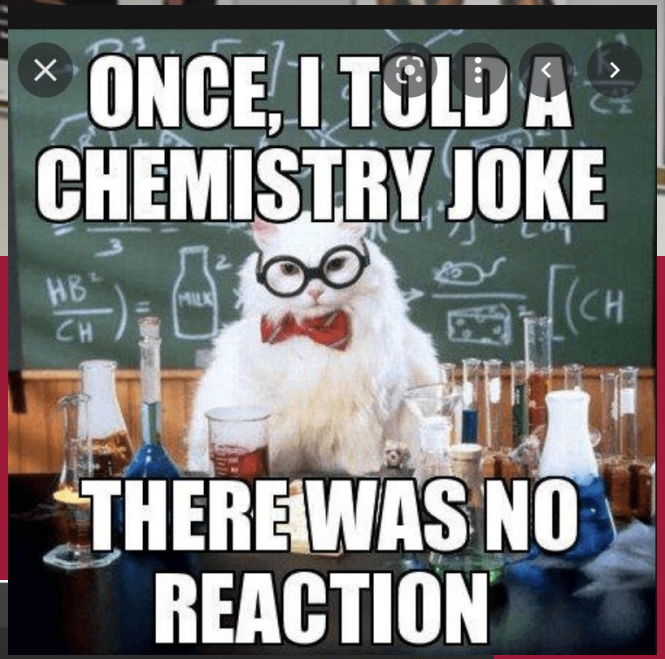




Practice-Based Teacher Education

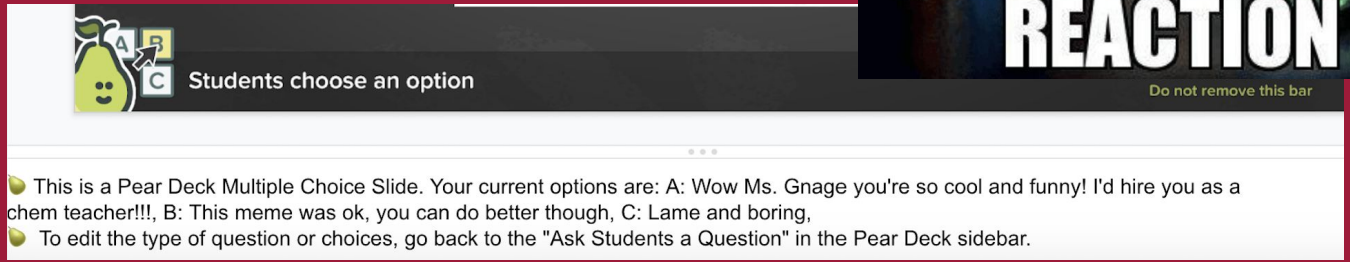




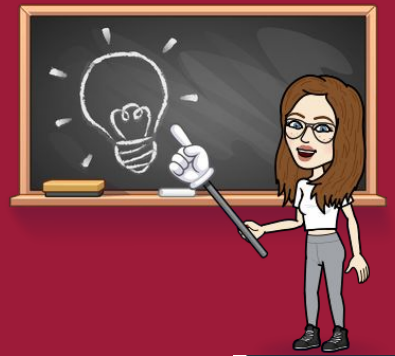




*Sense of belonging; laughter*

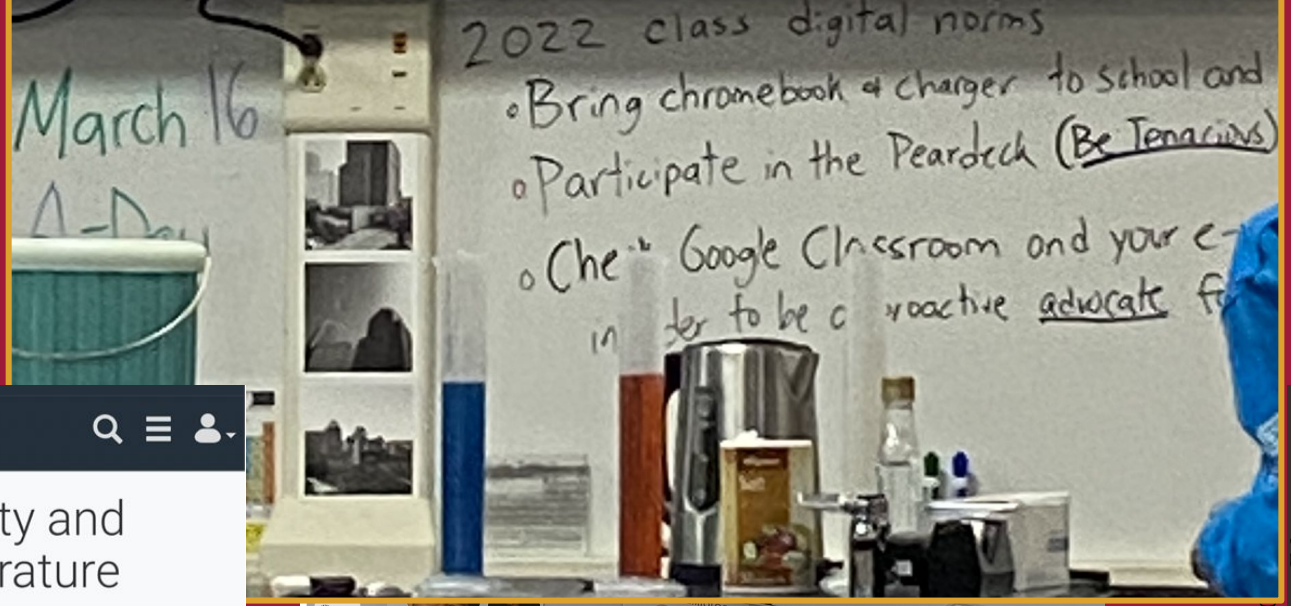



Practice-Based Teacher Education



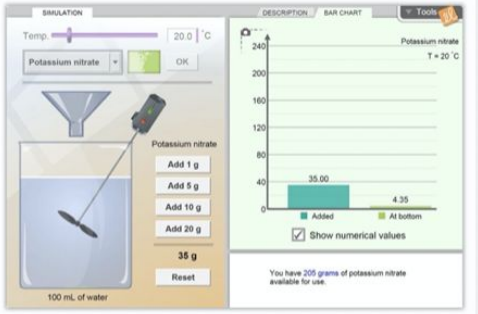
*So much is happening!*

GET REAL!

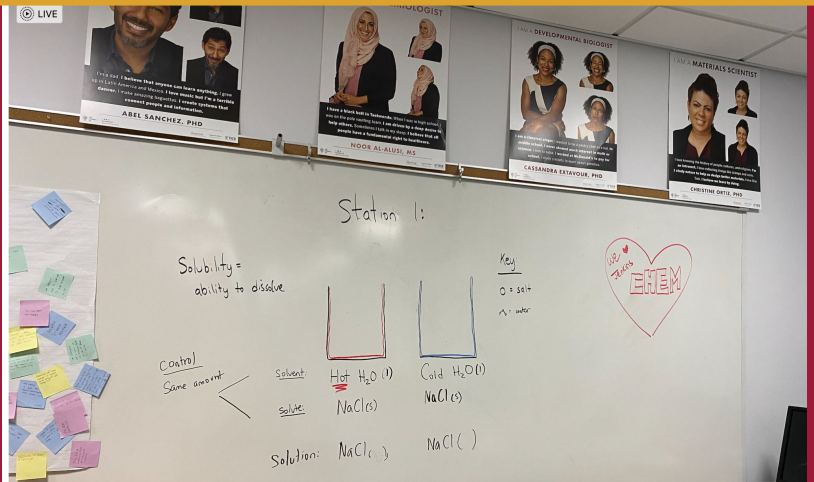



Gizmos

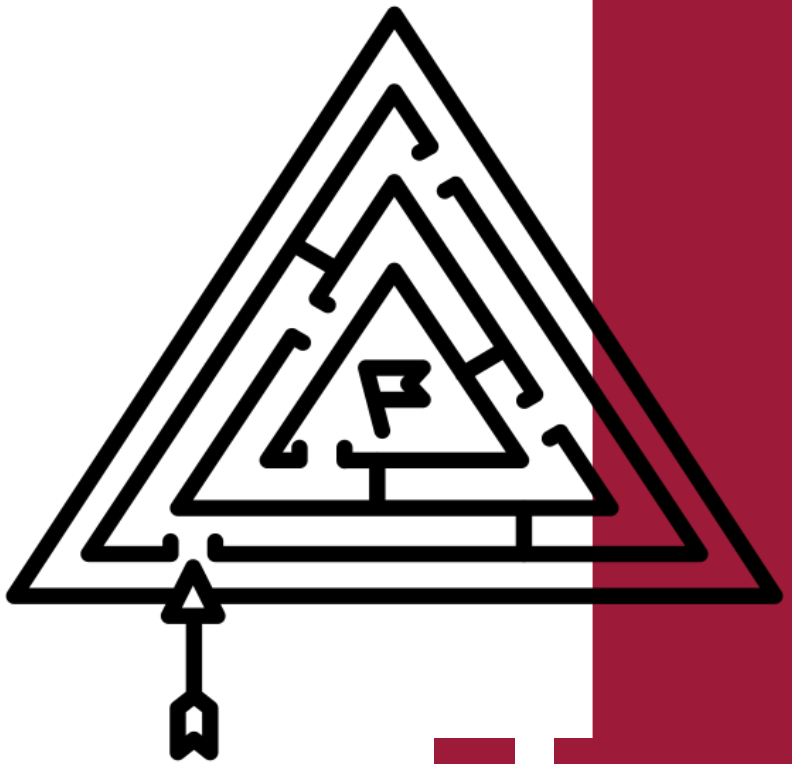
## Solubility and Temperature




Add varying amounts of a chemical to a beaker of water to create a solution, observe that the chemical dissolves in the water at first, and then measure the concentration of




Practicum
Teacher Education



# Challenges

- “Apprenticeship of observation” (Lortie, 1978)
- Institutional inertia
- Challenges of enactment and complexity
- Inequity - students bring diverse sensemaking repertoires; those not aligned with dominant culture are often ignored and erased.

"Teaching well depends on having a flexible repertoire of high-leverage strategies and techniques that can be deployed quickly with good judgment."

**Matsaumoto-Rovo & Ramierz-Montova (2021)**

*What counts and how do we decide?*

## Identity Development As a Lens to Science Teacher Preparation

APRIL LYNN LUEHMANN
*Warner Graduate School of Education and Human Development, University of Rochester, Dewey Hall 1-160L, Rochester, NY 14627, USA*

*Received 15 August 2006; revised 30 January 2007; accepted 31 January 2007*

*DOI 10.1002/sce.20209*
*Published online 6 March 2007 in Wiley InterScience (www.interscience.wiley.com).*

**ABSTRACT:** Concepts and findings from research on identity development are employed to better understand why current science teacher preparation programs are failing to prepare teachers who are able and choose to implement the vision for science education articulated in professional standards. Identity theory is used as a theoretical lens to make sense of and better address some of the unique challenges of becoming a reform-minded science teacher, a professional identity that does not reflect the common norm in the profession; these challenges include the emotional risk and possible need for "repair work," lack of familiarity with and buy-in into complex practices of inquiry, and the need for opportunities to participate in competent practice and have this participation acknowledged. Two basic design principles for science teacher preparation are identified as a result of this analysis: (a) the need to create safe places and scaffolded ways for beginning science teachers to try on and develop their identities as reform-minded science teachers, which may include capitalizing on the unique opportunities of practice teaching in out-of-school contexts; and (b) the need to offer opportunities to be recognized, by self and others, as reform-minded teachers through ongoing, structured, and supported reflection.  *Sci Ed* **91:**822–839, 2007

### INTRODUCTION AND OVERVIEW

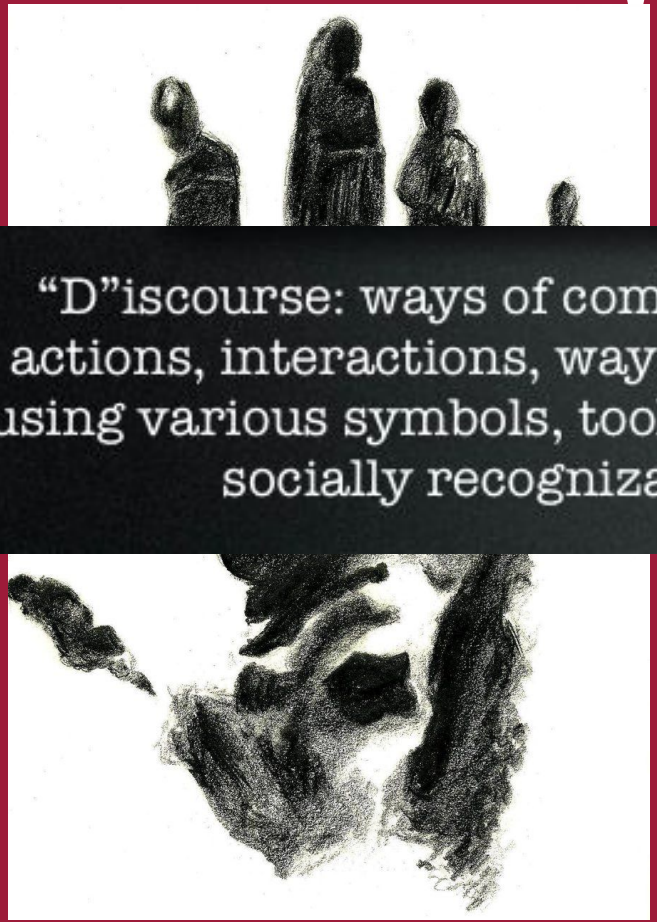
A number of influential documents (e.g., American Association of Advancement of Science, 1993; National Research Council [NRC], 1996, 2000) advocate for a new vision for school science, comprising principles, standards, and practices that are grounded on research in the learning sciences. However, this vision is still far from becoming a reality, as there are very few "reform-minded" science teachers currently implementing this type of practice (Anderson, 2002; Tobin, Tippins, & Gallard, 1994; Wells, 1995). Even more troublesome is the realization that today's teacher preparation programs are usually not well equipped to prepare a new generation of reform-minded science teachers, able and willing to engage in the practices identified as most promising to improve science learning for all students (Windschitl, 2002b). Why is this the case, and what can we do about it?

*Correspondence to:* April Lynn Luehmann; e-mail: april.luehmann@rochester.edu

# Teacher Learning as Identity Development

More than knowing & doing, it's about *becoming* a certain kind of teacher

*Luehmann, A. L. (2007). Identity development as a lens to science teacher preparation. Science education, 91(5), 822-839.*



# Participation

"D"iscourse: ways of combining & integrating language, actions, interactions, ways of thinking, believing, valuing, using various symbols, tools & objects to enact a particular, socially recognizable identity. -Gee, 2001

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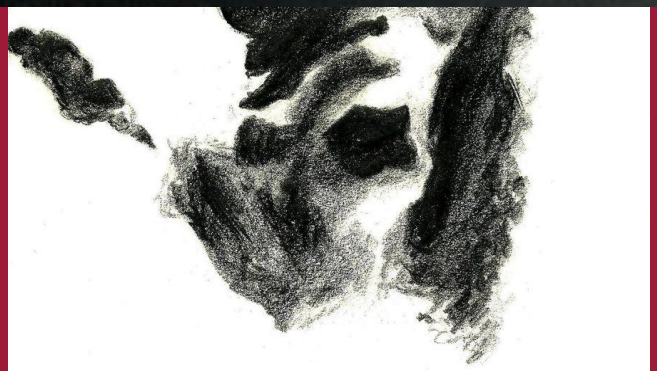
"D"iscourse: ways of combining & integrating language, actions, interactions, ways of thinking, believing, valuing, using various symbols, tools & objects to enact a particular, socially recognizable identity. -Gee, 2001



# Recognition

# Not All Opportunities are Equal

- Positioning (activity, agency, accountability)
- Support (expertise, feedback, recognition)

Luehmann, 2008; Nasir & Hand, 2002

# Identity Work
## Participation that is Authentic

- Messy, complex, unpredictable, non-linear, long-term
- Use of authentic tools: cognitive as well as physical & social
- Collaborative & creative
- Prioritizes relationships

**Challenges**

- Novices engaging in the complexity of experts
- “Institutional inertia” over time and across participants

# Identity Work
## Recognition that is Meaningful

- Identity = the stories that are told
- Most impactful are the stories one tells about oneself
- Role of “significant narrators”

*Sfard & Prusak, 2005*

**Challenges**

- Opportunities to construct “stories”
- Feedback & assessments that align with ambitious practice

# Nurturing Damaged or New Identities

- Multiple opportunities to try & fail
- Reasons to invest a lot of effort
- Likelihood of experiencing meaningful success

*Gee, 2003*

# Science GET REAL!*

WARNER SCHOOL UNIVERSITY OF ROCHESTER

About Get Real!

Contact Us

Site Map

NEWS

Summer Camp

# GRS PARTICIPATION WORK

- **Phase 1: Summer A - Conceptual - Place-based core practices as learners (rural)**


Windschitl, 2002

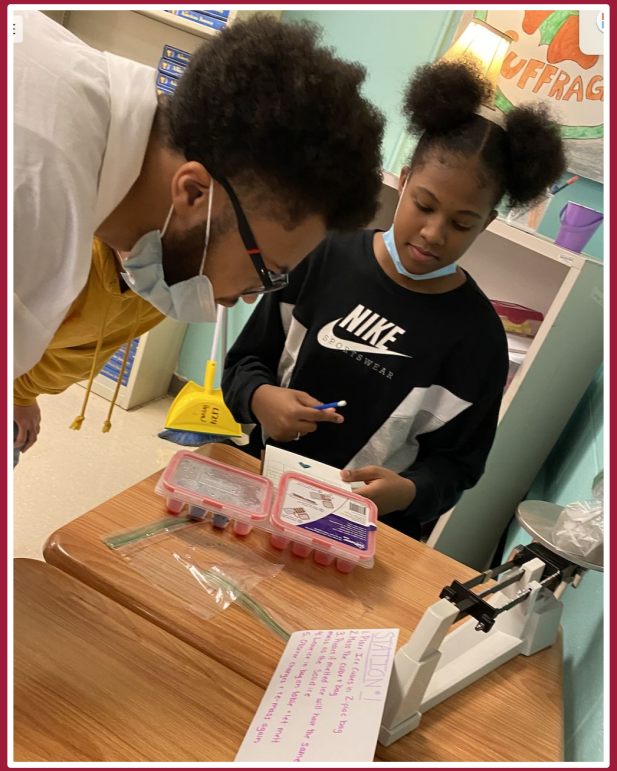
# GRS PARTICIPATION WORK

- Phase 1: Summer A - Conceptual - Place-based practices as learners (rural)
- **Phase 2: Summer B - Conceptual & pedagogical: Place-based core practices as teachers in camp (rural)**


Windschitl, 2002

# GRS PARTICIPATION WORK

- Phase 1: Summer A - Conceptual - Place-based practices as learners (rural)
- Phase 2: Summer B - Conceptual & pedagogical: Place-based practices as teachers in camp (rural)
- **Phase 3: Fall - Conceptual, pedagogical & cultural: Place-based core practices in afterschool club (urban)**

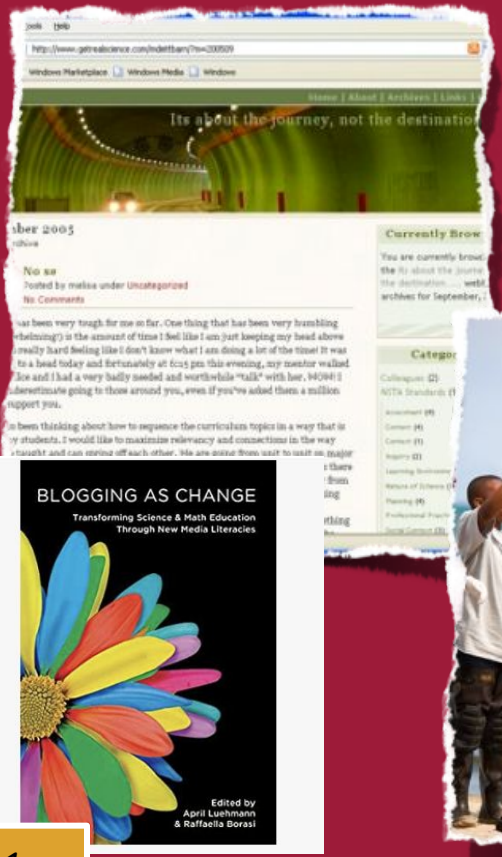



Windschitl, 2002

# GRS PARTICIPATION WORK

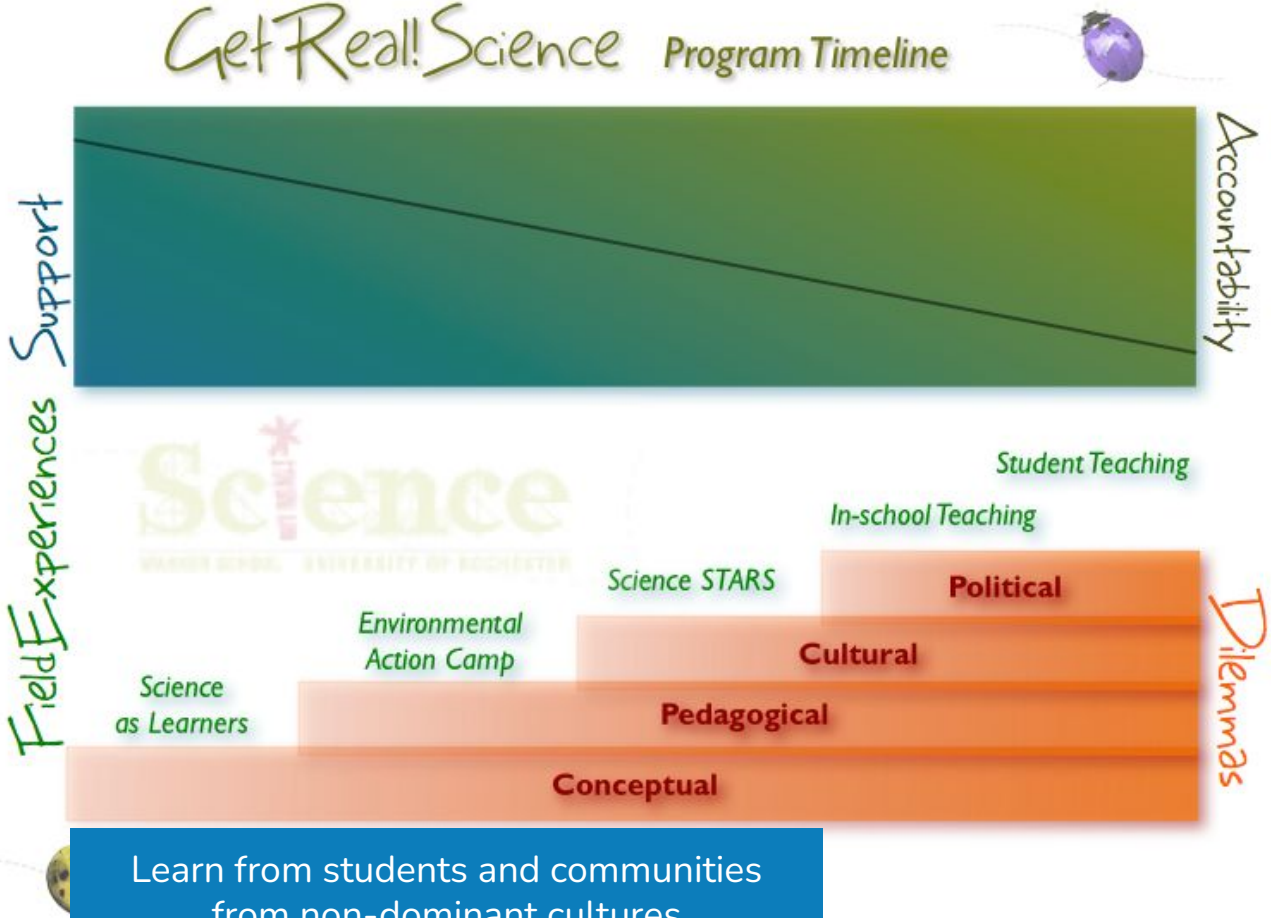
- Phase 1: Summer A - Conceptual - Place-based practices as learners (rural)
- Phase 2: Summer B - Conceptual & pedagogical: Place-based practices as teachers in camp (rural)
- Phase 3: Fall - Conceptual, pedagogical & cultural: Place-based practices in afterschool club (urban)
- **Phase 4: Spring - Conceptual, pedagogical, cultural & political: Core practices as teachers in school (edu 448, spring)**

# GRS RECOGNITION WORK





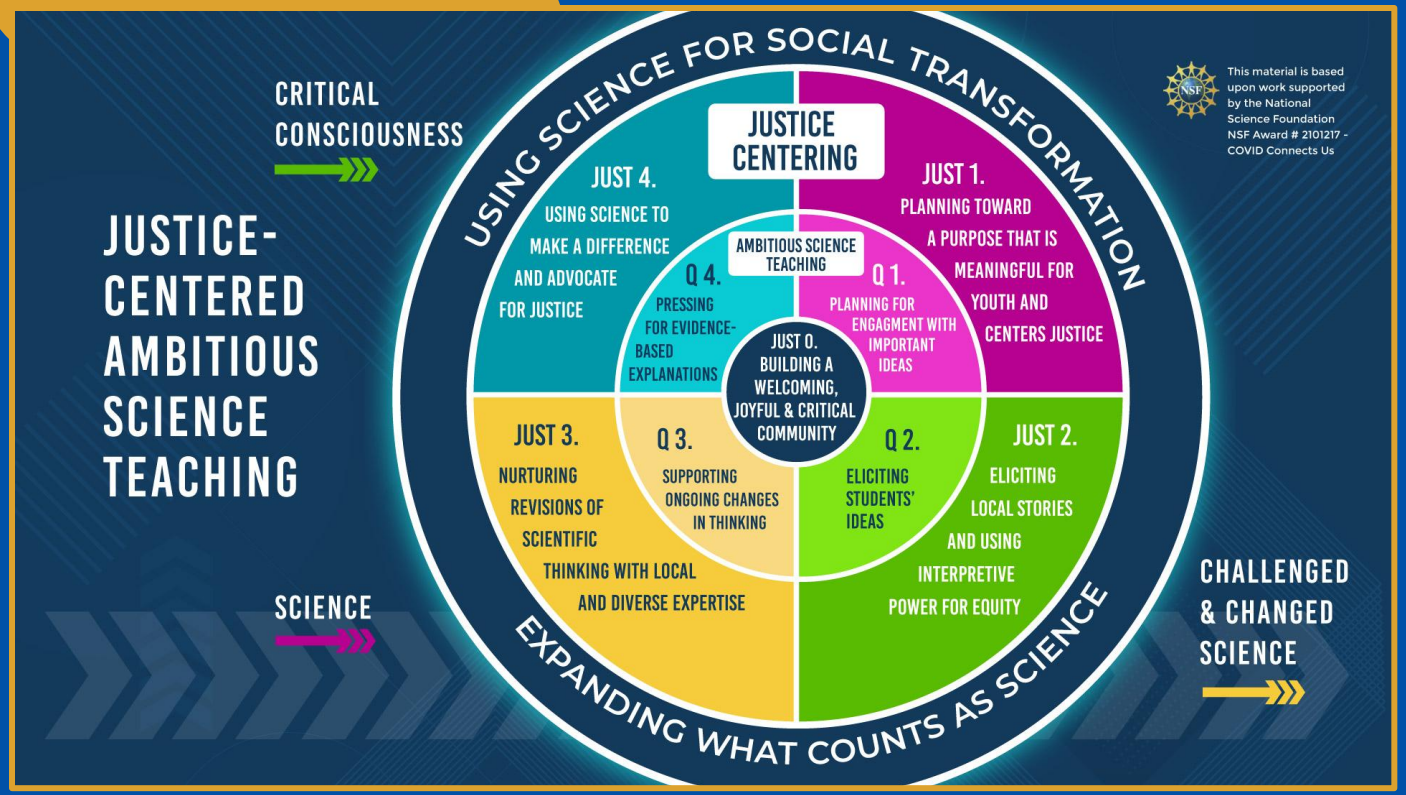
*Luehmann & Borasi, 2011*




Learn from students and communities from non-dominant cultures


# Identity Work

## Opportunities to Try; Reason to Invest; Meaningful Success




# 02

# The JuST FRAMEWORK

Our Sacrificial Text and Anchor

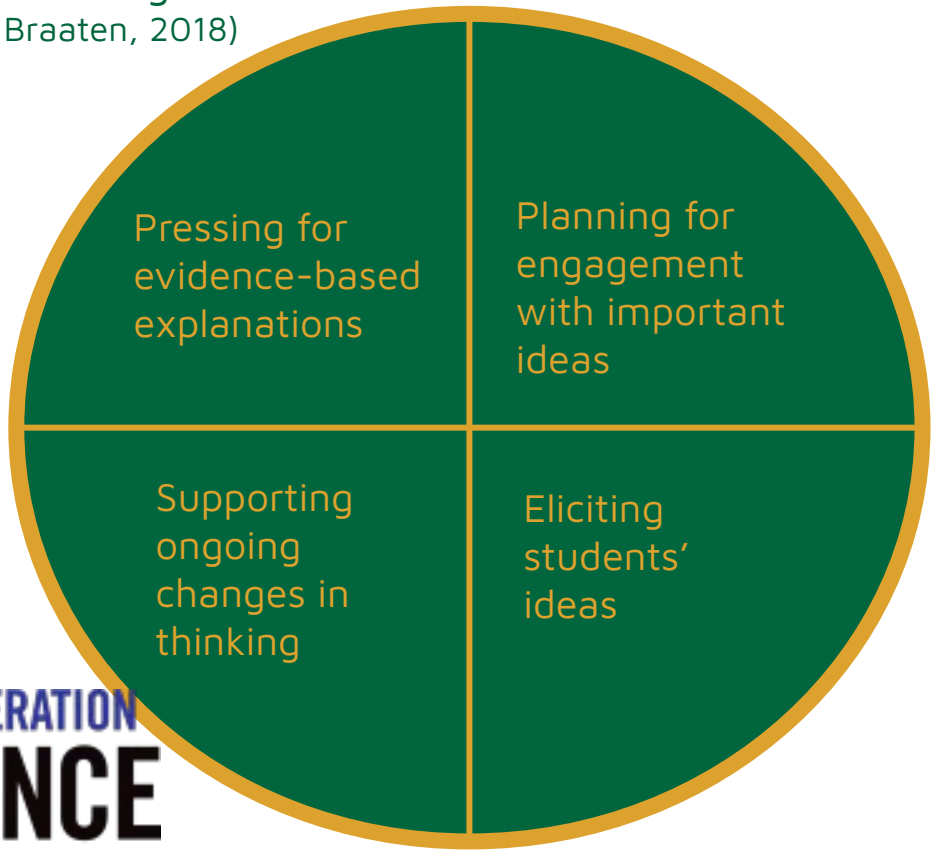
# What is Justice-Centered Ambitious Science Teaching (JuST)?

Sets of high leverage practices that synthesize Ambitious Science Teaching (Windschitl, et al., 2018) with those of justice-centering (e.g. Morales-Doyle, 2017)

- Grounded in critical consciousness
- Responsive to and sustains students' cultures and communities
- Dependent on teachers' interpretive power to invite, recognize and build on students' expansive sensemaking repertoires
- Committed to naming and disrupting oppression and injustice in society.

Luehmann, et al., under review

# Ambitious Science Teaching
(Windschitl, Thompson & Braaten, 2018)

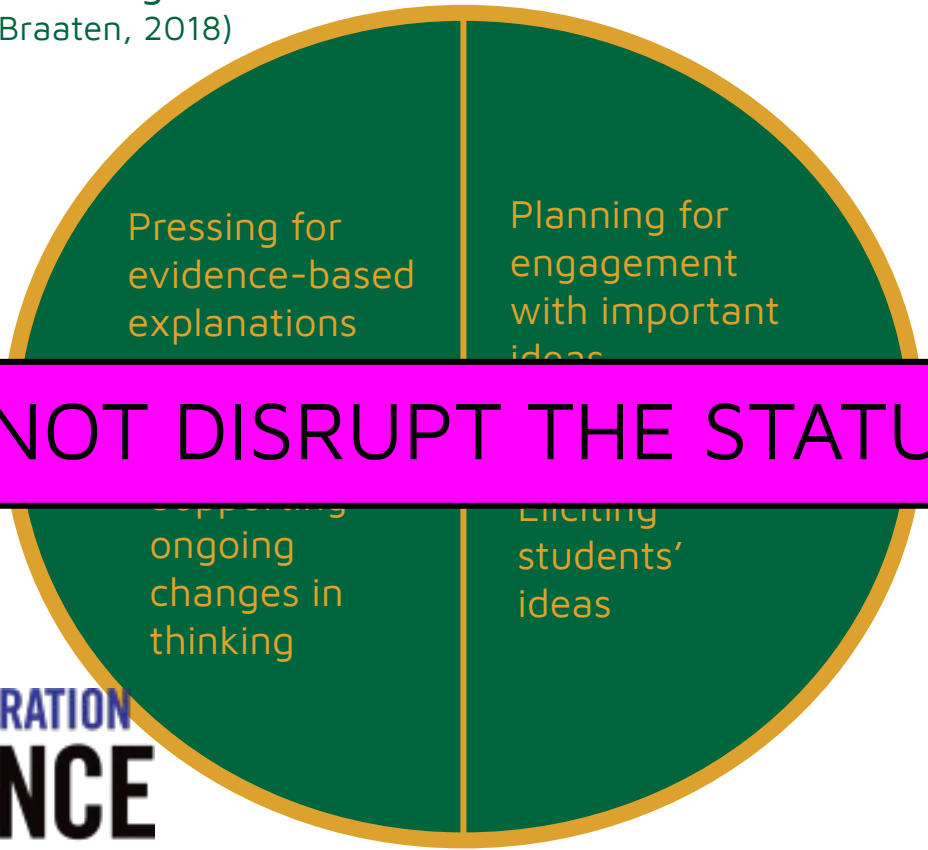



Access to the "Culture of Power" (Delpit, 1988; Ladson-Billings, 1995)

Nurturing Positive Identities with Science through Authentic Engagement (Brown, 2005; Chapman & Feldman, 2017)

NEXT GENERATION SCIENCE STANDARDS
For States, By States

# Ambitious Science Teaching
(Windschitl, Thompson & Braaten, 2018)




DOES NOT DISRUPT THE STATUS QUO

Access to the "Culture of Power" (Delpit, 1988; 995)

Identities with Science through Authentic Engagement (Brown, 2005; Chapman & Feldman, 2017)

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Access to the "Culture of Power"

Nurturing Positive Identities with Science through Authentic Engagement

EQUITY DISCOURSES

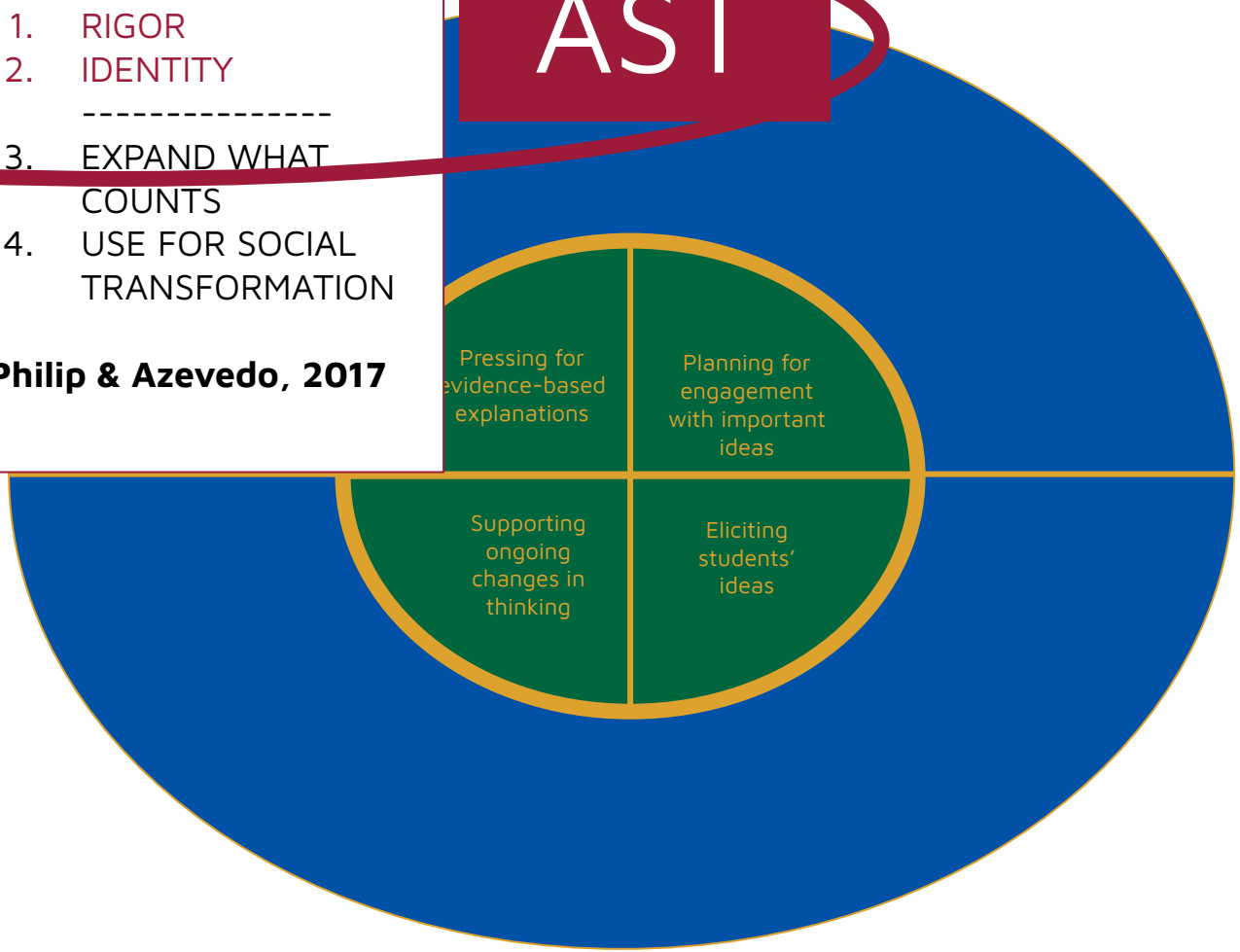
1. RIGOR
2. IDENTITY

---

3. EXPAND WHAT COUNTS
4. USE FOR SOCIAL TRANSFORMATION

**Philip & Azevedo, 2017**

AST



Access to the "Culture of Power"

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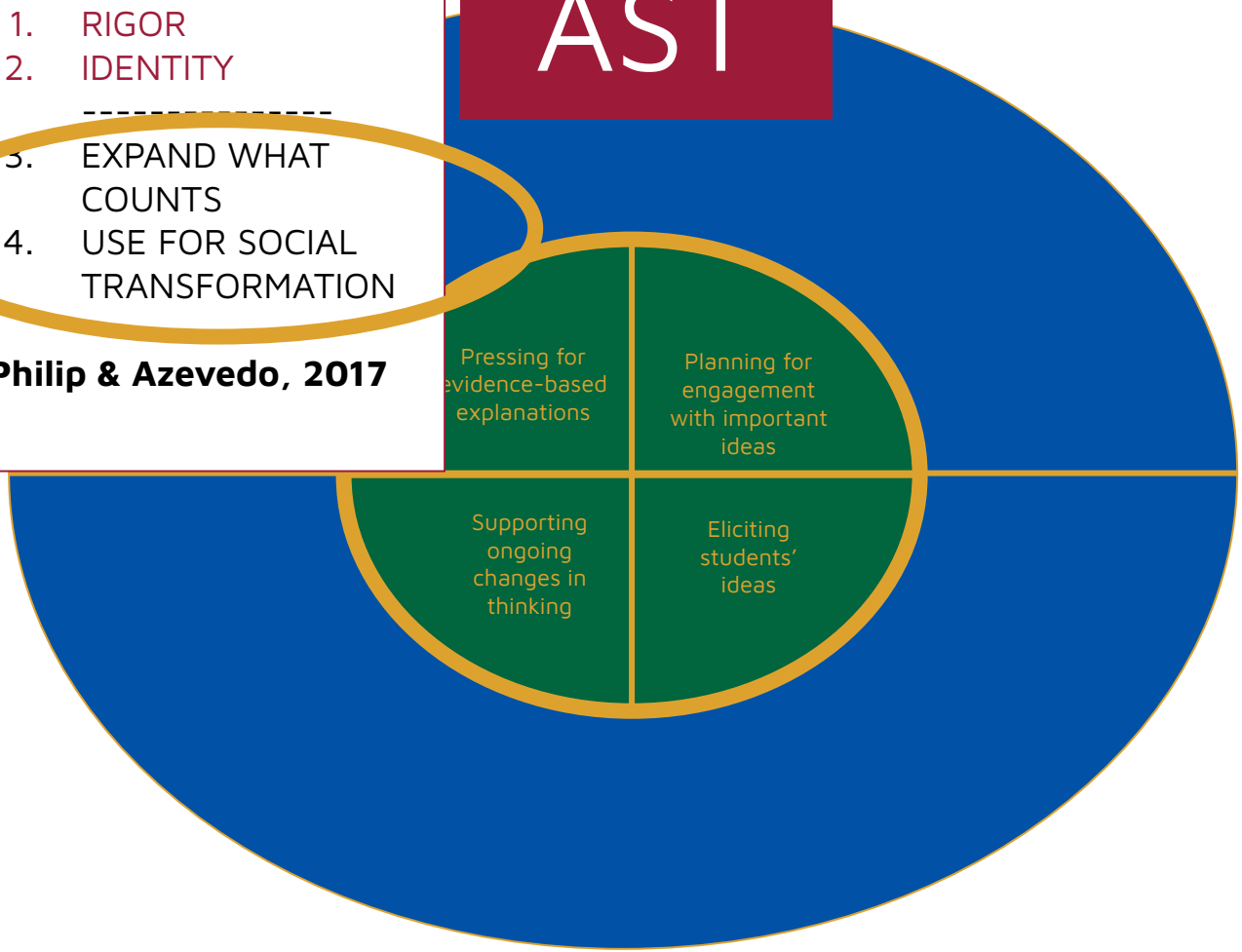
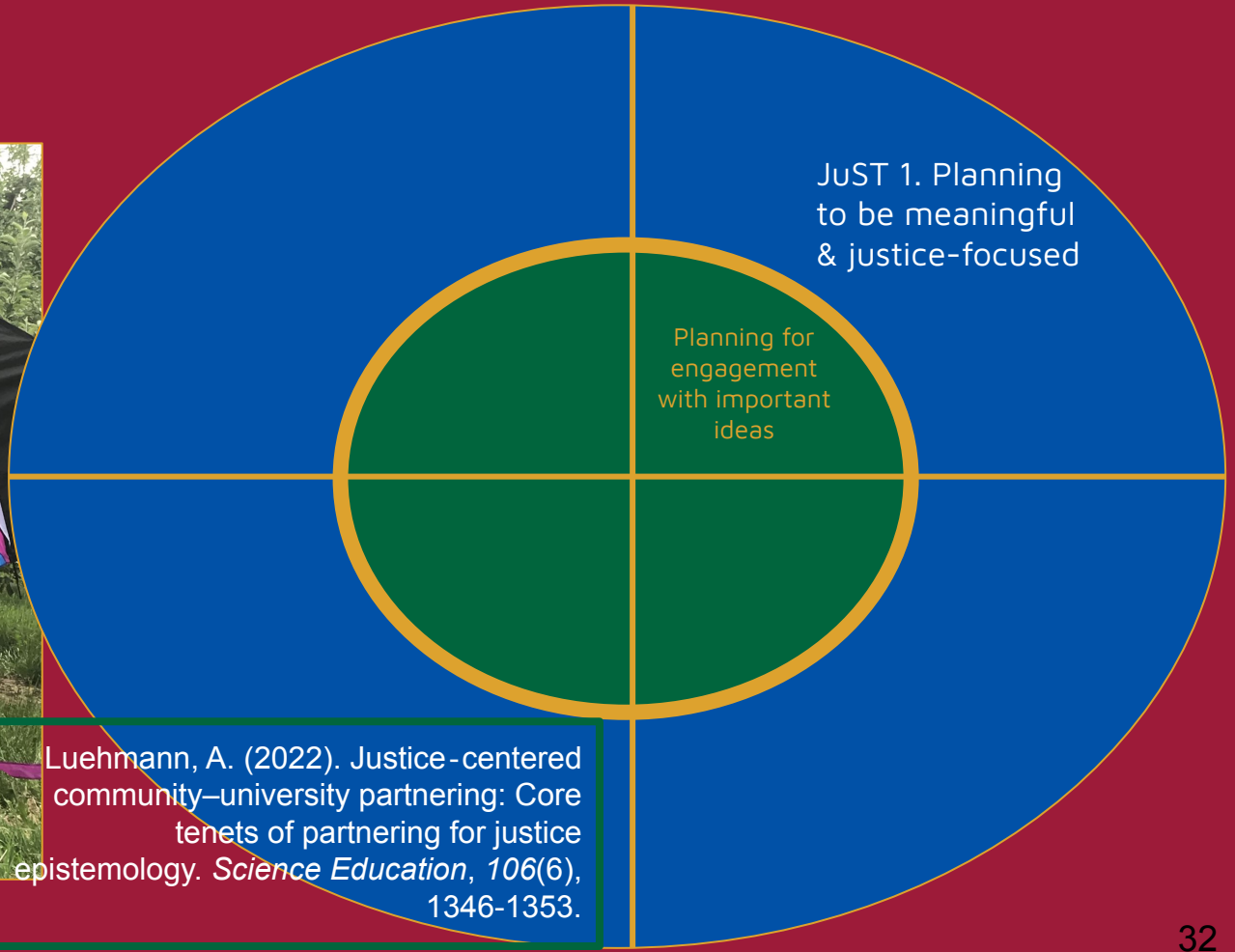


# JuST 1


Luehmann, A. (2022). Justice-centered community–university partnering: Core tenets of partnering for justice epistemology. *Science Education*, *106*(6), 1346-1353.

# JuST 2

"Jesus Water" sensitivity - "better than Gatorade"

JuST 1. Planning to be meaningful & justice-focused

Planning for engagement with important ideas

Eliciting students' ideas

JuST 2. Legitimizing Community Stories

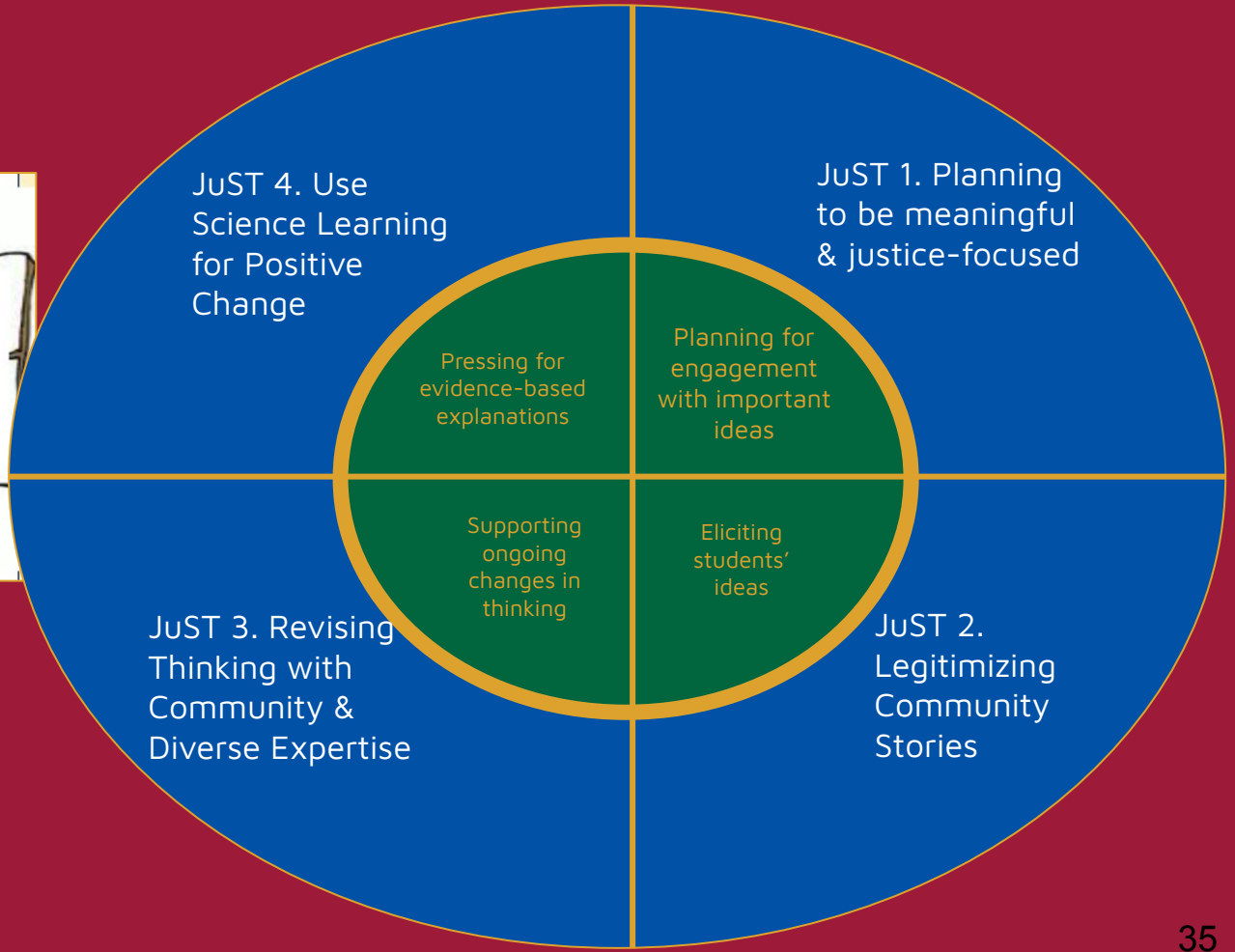
# JuST 3


JuST 1. Planning to be meaningful & justice-focused
Planning for engagement with important ideas
Eliciting students' ideas
Supporting ongoing changes in thinking
JuST 2. Legitimizing Community Stories
JuST 3. Revising Thinking with Community & Diverse Expertise

# JuST 4


"We don't trash your home, so don't trash ours. We live here."
-Silo Student, published on a sign displayed in the community.


Our Ecosystems
Nuestros ecosistemas
Field
Forest
Orchard
El campo
El bosque
El huerto


JuST 4. Use Science Learning for Positive Change
JuST 1. Planning to be meaningful & justice-focused
Pressing for evidence-based explanations
Planning for engagement with important ideas
Supporting ongoing changes in thinking
Eliciting students' ideas
JuST 3. Revising Thinking with Community & Diverse Expertise
JuST 2. Legitimizing Community Stories

- Kang, 2022;
- Morales-Doyle, 2017
- Philip & Azevedo, 2016
- Paris & Alim, 2017
- Steele & Jeong, 2023

**Practice Brief 67 :**

**Focusing Science and Engineering Learning on Justice-Centered Phenomena in K12**

# Using Science for Social Transformation

JuST 4. Use Science Learning for Positive Change

JuST 1. Planning to be meaningful & justice-focused

Pressing for evidence-based explanations

Planning for engagement with important ideas

TEAM: Teens Engaged in Action that Matters

Teachers must first be learners - of youth and local culture.


EQUITY DISCOURSES

1. RIGOR
2. IDENTITY

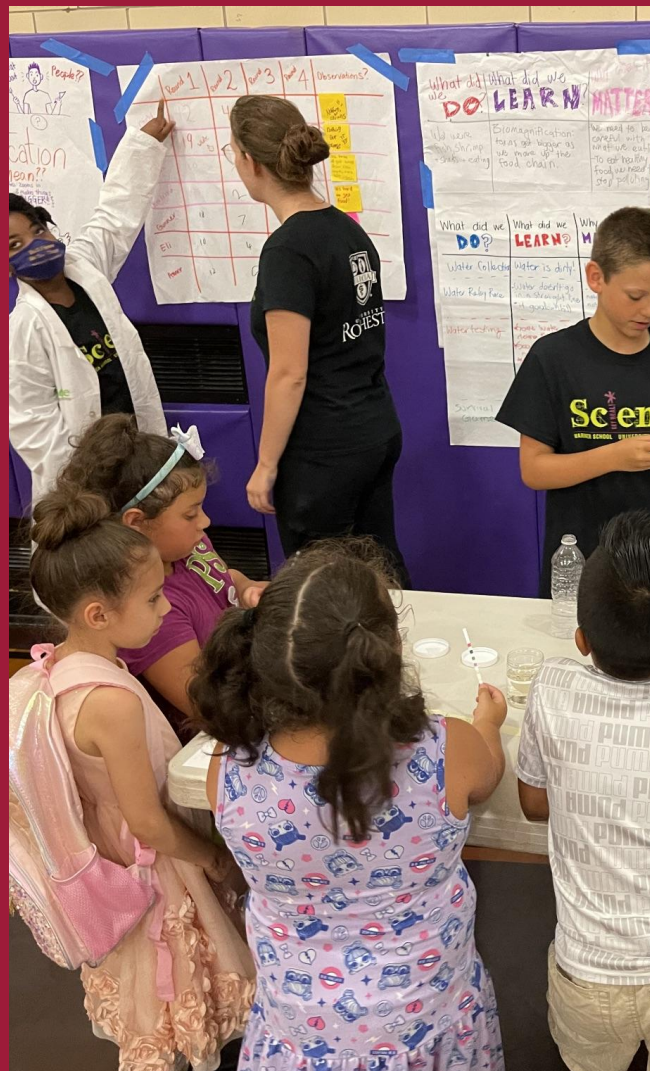
---

3. EXPAND WHAT COUNTS
4. USE FOR SOCIAL TRANSFORMATION

Philip & Azevedo, 2017

*The students who presented at family science night were positioned as* ***producers of scientific knowledge.*** *Through this experience, students' commitments to their communities and cultures of origin were strengthened as* ***they recognized the value of their cultural competence.*** *Meanwhile they also reflected upon their* ***agency to impact issues in their community and in the broader world.***

Morrales-Doyle, 2017, p. 1054-1055



Pressing for evidence-based explanations

Supporting ongoing changes in thinking

Eliciting students' ideas

Expanding What Counts as Science

Farm Worker as Scientist; good vs. great strawberry fields

"Jesus Water" sensitivity - "better than Gatorade"

JuST 3. Revising Thinking with Community & Diverse Expertise

JuST 2. Legitimizing Community Stories

EQUITY DISCOURSES

1. RIGOR
2. IDENTITY

---

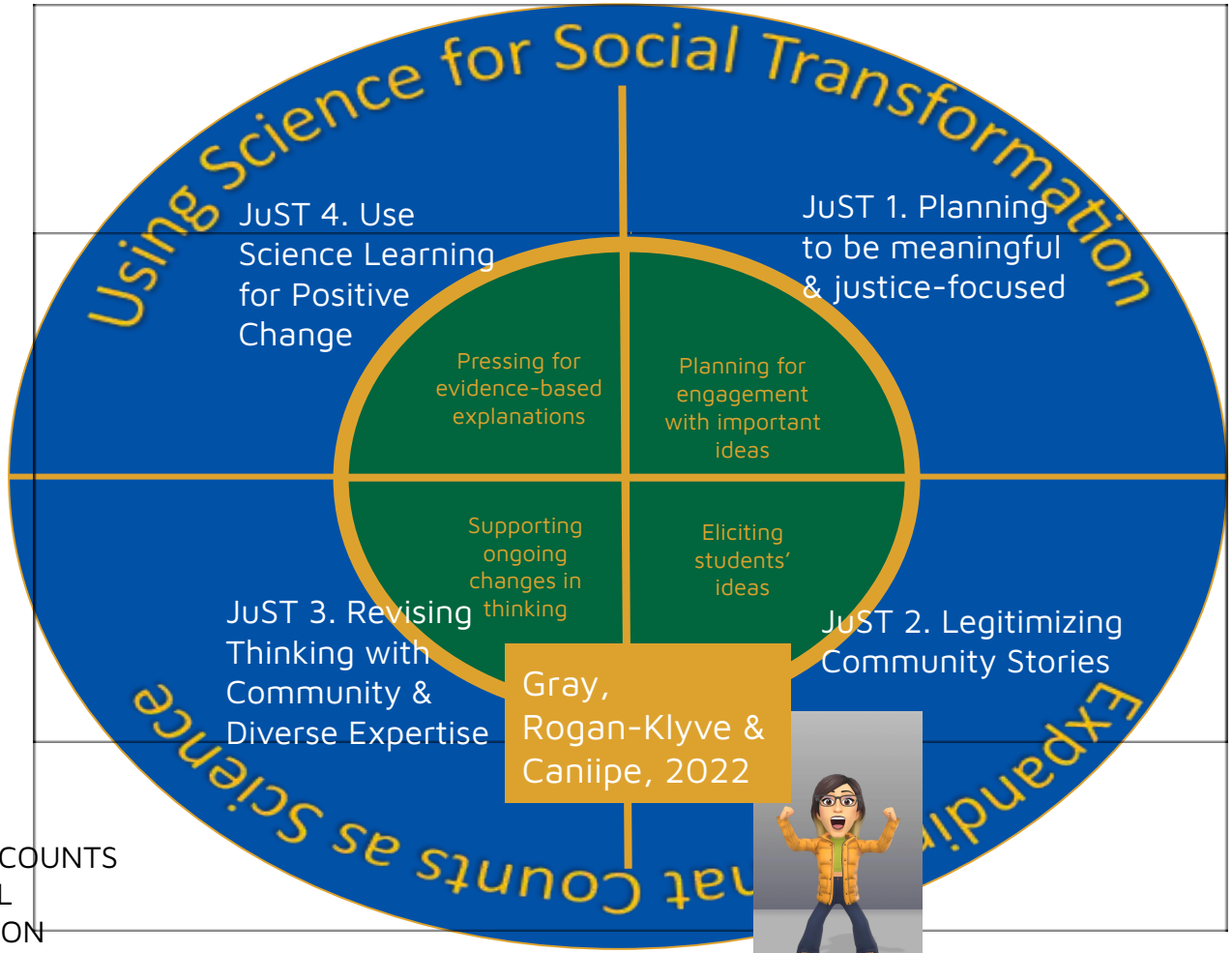
3. EXPAND WHAT COUNTS
4. USE FOR SOCIAL TRANSFORMATION

Philip & Azevedo, 2017

**Practice Brief 57: How place-based science education strategies can support equity for students, teachers and communities**

"One insight relevant to teaching is that instruction should be organized to invite diversity in pathways of participation in learning activities and bring multiple knowledges to bear on learning academic content. ***If we know that learning, at best, engages a multiplicity of cultural repertoires of practice (Guitiérrez & Rogoff, 2003) and involves multiple representations and ways of knowing,*** then it is **imperative that teaching start from a place of respecting the range of knowledge and epistemologies learners bring to the learning setting and have the capacity to connect learning and provide a range of entryways** into core academic content."

**—NASIR, LEE, PEA & MCKINNEY DE ROYSTON, 2021**




EQUITY DISCOURSES

1. RIGOR
2. IDENTITY

---

3. EXPAND WHAT COUNTS
4. USE FOR SOCIAL TRANSFORMATION

Philip & Azevedo, 2017

Critical Consciousness

Using Science for Social Transformation

JuST 4. Use Science Learning for Positive Change

JuST 1. Planning to be meaningful & justice-focused

Pressing for evidence-based explanations

Planning for engagement with important ideas

Supporting ongoing changes in thinking

Eliciting students' ideas

JuST 3. Revising Thinking with Community & Diverse Expertise

JuST 2. Legitimizing Community Stories

Explanding What Counts as Science

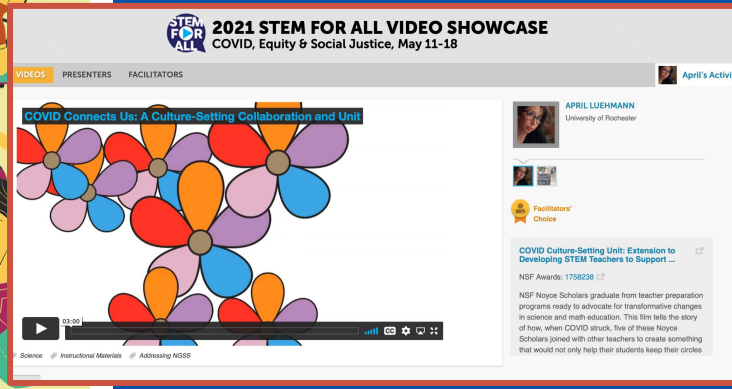
Challenged & changed science

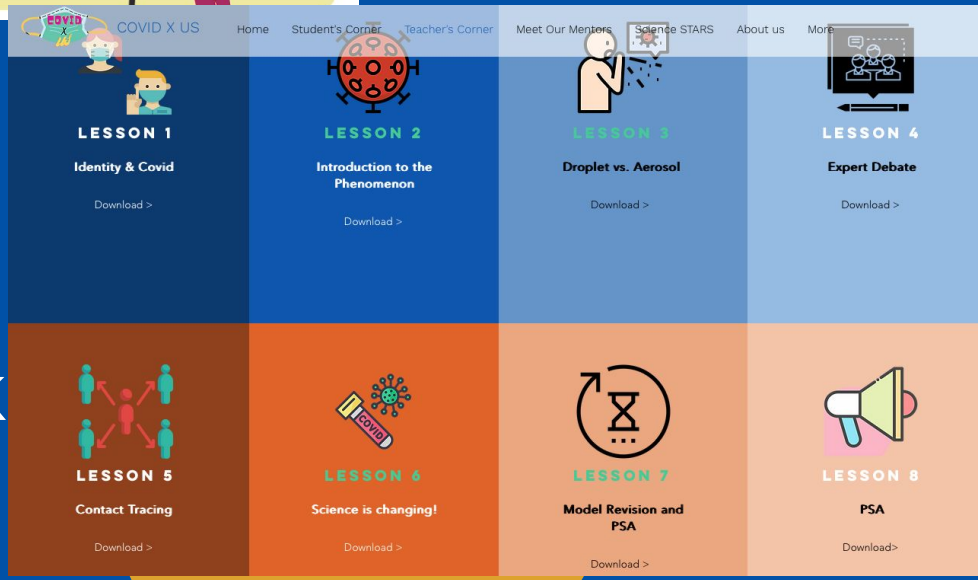
JUST 0. Nurturing a critical, welcoming & joy-filled community

Luehmann, A., Zhang, Y., Boyle, H., Tulbert, E., Marliss, G., Sullivan, K., [2023]. *Shaping Ambitious Science Teaching to be Culturally Sustaining and Productive in a Rural Context: Toward Justice-Centered Teaching Frame*
Journal of Resea
Science Teachin

The Justice-centered Ambitious Science Teaching (JuST) Framework.

# 03


# The PROJECT,
## The Team, The Work

Funded in part by NSF Award #210217

# 2021 STEM FOR ALL VIDEO SHOWCASE

COVID, Equity & Social Justice, May 11-18

VIDEOS | PRESENTERS | FACILITATORS

April's Activity


Science | Instructional Materials | Addressing NGSS

APRIL LUEHMANN

University of Rochester


Facilitators' Choice

**COVID Culture-Setting Unit: Extension to Developing STEM Teachers to Support ...**

NSF Awards: 1758238

NSF Noyce Scholars graduate from teacher preparation programs ready to advocate for transformative changes in science and math education. This film tells the story of how, when COVID struck, five of these Noyce Scholars joined with other teachers to create something that would not only help their students keep their circles

GET REAL!

# A Culture-Setting Unit

What is it conceptually?

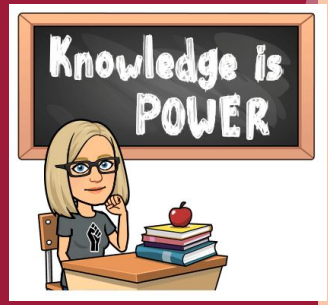
- First unit of the year
- Model for kinds of engagement
- Adapted to local contexts
- Pre-assessment
- The power of the preview… “Remember when we…”
- Groundwork for critical, caring & joy-filled community

# A Culture-Setting Unit

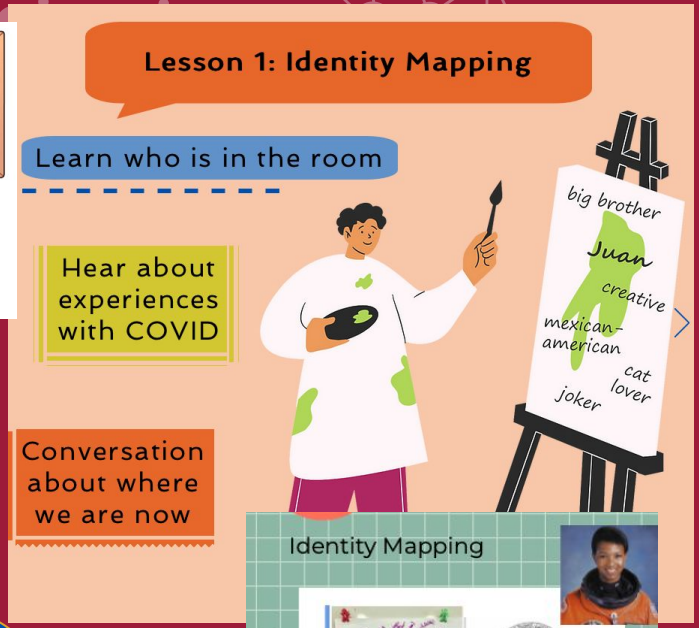
What is it practically?

| COVID Connects Us<br>A Culture Setting Unit | | |
|---|---|---|
| | Class Activity | Purpose |
| 1 | **Identity mapping** | Build a welcoming community |
| 2 | **Local zip code data analysis**; Initial modeling of local phenomenon | **Why are People of Color disproportionately impacted?** *Anchoring Phenomenon Routine* |
| 3 | Mask investigations | Design an original investigation |
| 4 | Debate: Is a mask necessary when 6-ft distance is maintained? | Construct an argument |
| 5 | Medical mentor interviews | Connect with local physicians |
| 6 | Contact tracing | Analyze personal and local data |
| 7 | Model revisions | Draw evidence-based explanations |
| 8 | **Myth busters for families** | Communicate science to help keep circles safe |

# Identity Mapping




Ellie Faugh,
Warner ‘19
Rochester, NY

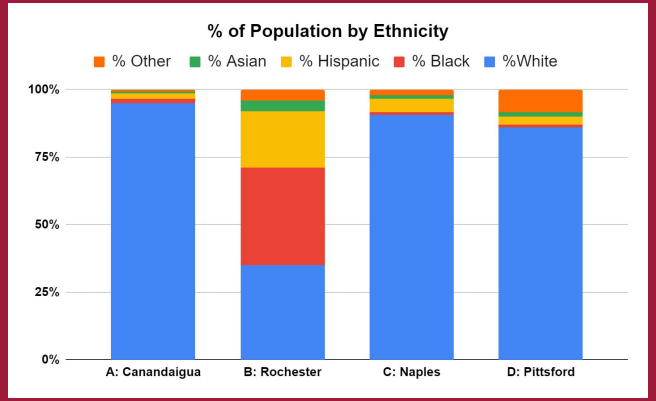


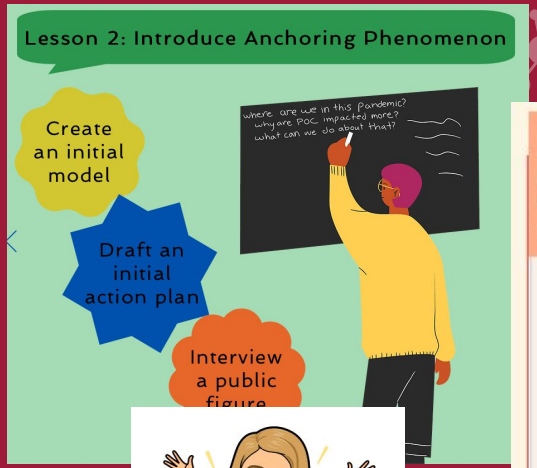

Who are you?
*Identity, priorities, culture*

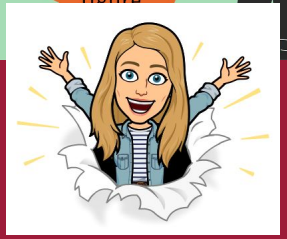
Who are we?
*Developing classroom identity*

*How does who we are impact how we do science?*

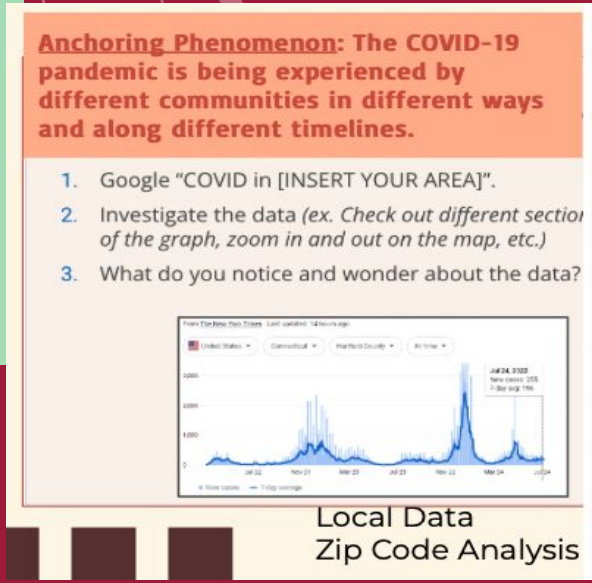
# Localized & Justice-Centered Anchoring Phenomenon



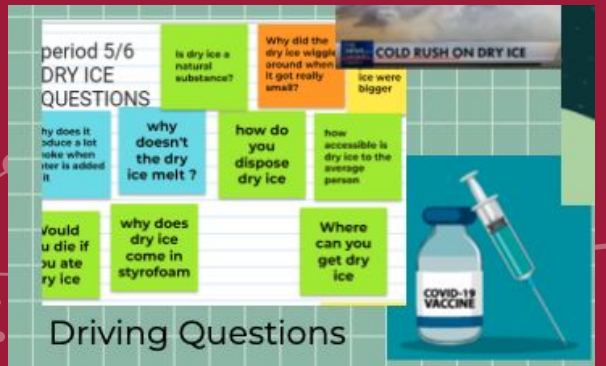



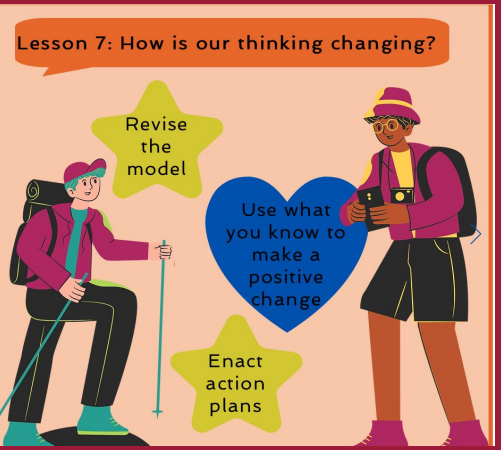



Ellen Ellison,
Warner '19
Naples NY




| | Population (counted in 2010 Census) | % of population with COVID cases | Number of COVID-related deaths |
|---|---|---|---|
| **Community A** | 20,565 | 0.48% | 35 (county) |
| **Community B** | 210,452 | 1.04% | 295 (county) |
| **Community C** | 2,502 | 0.20% | 35 (county) |
| **Community D** | 31,426 | 0.30% | 295 (county) |

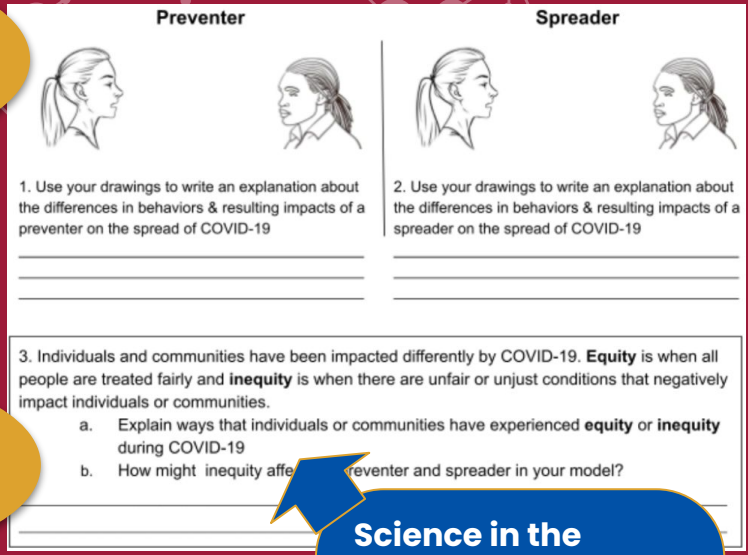





Engage in sensemaking activities

Reflect on what we figured out

Add revised thinking to your model




**Science in the context of equity:** Explain ways that individuals or communities have experienced equity or inequity during COVID-19.

How might inequity affect the preventer and spreader in your model?

# Modeling Phenomena in context

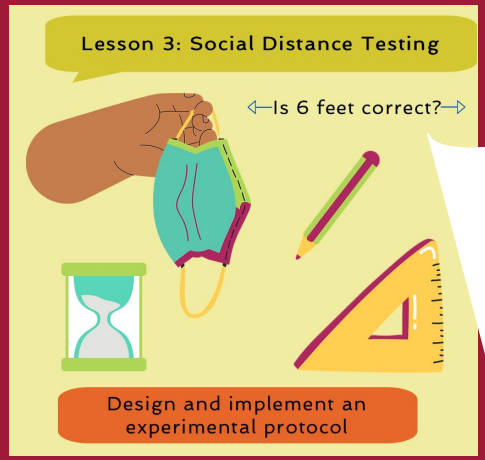
Bre Uckermark,
Warner ‘14
Rochester, NY

**Gotta Have Checklist**

- particles…
- arrows…
- energy…

# Student-led Experiment Design

Katrina Robinson
Warner ‘20
Penfield, NY




How does Covid spread? Do masks work?

**Looking at your notes above, create 3 testable questions about dry ice:**

(Testable questions: build on what you already know and can be answered through measurement or experimentation)

1._____

2._____

3._____

**Experience**

↓

**Question**

↓

**Design**

↓

**Experiment**

↓

**Share!**

# Community Connections:

## Positioning Students as Agents of Change

James Kostka,
Warner ‘18
South Bronx, NY


## Evaluating Sources with CRAA

**C** Currency - the timeliness of information
When was the information published or posted? Has the information been revised or update
Is the information current or out of date? Are the links functional?

**R** Relevance - the importance of the information for your needs
Does the information relate to your topic or answer your question? Who is the intended aud
Is the information at an appropriate level? Have you looked at a variety of sources?

**A** Authority - the source of the information
Who is the author/ publisher/ source/ sponsor? Are the author’s credentials or organisational affiliations given, and what are they? What are the author’s qualifications?

**A** Accuracy - the reliability, truthfulness, & correctness of the cor
ence? Has it been reviewed?
nguage seem unbiased?
S
rs make their intentions
ve, impartial & unbiased?

## Group 5

**Focus Question:** Is the covid vaccine safe? And Is it trustworthy?

**Myths and/or Misconceptions:**

- President Joe Biden announced his latest effort to stop the spread of COVID-19, he will be putting Americans who have chosen to not be vaccinated, into ‘quarantine camps’ where they will be detained indefinitely until they get their shots. - Osiris Foux, The Stock Market, 2021
- The New York Times will tell you that, as of Feb. 16, over 487,000 Americans have died from COVID-19, but I say it’s all hogwash. All these lizard-people will tell you that it’s all about the health of “The Public,” but I don’t know who that is, and I don’t care. No one I know personally has died from COVID-19, so it simply can’t be real! - Sophia Pan, Spoke News, 2021

**The Facts and Science:**

- **“The FDA’s approval of this vaccine is a milestone as we continue to battle the COVID-19 pandemic. While this and other vaccines have met the FDA’s rigorous, scientific standards for emergency use authorization, as the first FDA-approved COVID-19 vaccine, the public can be very confident that this vaccine meets the high standards for safety, effectiveness, and manufacturing quality the FDA requires of an approved product,” - Acting FDA Commissioner Janet Woodcock, M.D.** This important because the FDA is the one in charge of the public health on ensuring the safety on food supply, cosmetic, and products that transmit radiation. https://www.fda.gov/news-events/press-announcements/fda-approves-first-covid-19-vaccine
- “To date, the systems in place to monitor the safety of these vaccines have found only two serious types of health problems after vaccination, both of which are rare. These are anaphylaxis and thrombosis with thrombocytopenia syndrome (TTS) after vaccination with J&J/Janssen COVID-19 Vaccine.” The pfizer and the moderna vaccine both have a 90% or more of effectiveness against covid, there would be side effects like, redness on the spot you were given the vaccine, tiredness and swelling which would be a normal reaction to the vaccine. CDC, 2021)

[redacted] Sep 24, 2021
So why exactly are these misconceptions dangerous?

[redacted] Sep 24, 2021
OK, so you explained why the vaccines are safe. But what exactly makes them trustworthy? Some people might not believe they are safe yet...

## FAQ: Mask For Covid-19

### Facts About Masks:

1. I believe the most effective way to end the global pandemic is wearing masks. In the article Face Mask Really Do Matter. The Scientific Evidence Is Growing, it says, “Face masks are emerging as one of the most powerful weapons to fight the new coronavirus, with growing evidence that facial coverings help prevent transmission—even if an infected wearer is in close contact with others.Face masks are emerging as one of the most powerful weapons to fight the new coronavirus, with growing evidence that facial coverings help prevent transmission—even if an infected wearer is in close contact with others. This evidence shows that face masks really are effective. It shows how wearing a mask can prevent the spread of the Covid-19 virus.

2. I believe the most effective way to end the global pandemic is by wearing mask. In the article Wear A Mask To Protect Yourself And Others, it states, “Masking is a critical public health tool and it is important to remember that any mask is better than no mask.”
This evidence proves that masks are a great safety source for protection against the Covid-19 virus.

3. I believe the most effective way to end the global pandemic is to wear mask. In the article Face Mask During The Covid-19 Pandemic, it says, “Wearing face masks is recommended as part of personal protective equipment and as a public health measure to prevent the spread of coronavirus disease 2019 (COVID-19) pandemic.”

**Common Misconceptions About Masks:**

**1) Shortness of breath and may lead to death**
**Response: This information is false. Masks are very breathable and are made up of breathable fibers. This is how it fails the CRAAP test.**

**2) A way to control people**
**Response: This information is false. Masks are a way to protect people and their own health. This is how it fails the CRAAP test.**

**Q1:** How can we evaluate information to determine its reliability?

**Q2:** How can we pull in expert opinions to inform our <u>local</u> perspective?

**Q3:** How can we provide space for collaborative conversations with <u>our</u> stakeholders?

**Q4:** How can I communicate <u>to</u> and <u>for</u> people I care about keeping safe?

# 04

# The NETWORK

Design-Based Research by Networked PLCs

Autonomy-supportive institutions support engagement and well-being during reform (Meristo, 2021)

Sarah & Leslie's *Justice League*

Islandwood Teams

Edith & Esther's *Environmental Allies*

Middle School Science Teachers

Jason's *Advocates*

Community Educators

Kathy's *Atoms Family*

Chemistry Teachers from many different districts

Gina's *Bio Bosses*

Sr and Jr Biology Teachers

Jill's *Lifers*

Biology Teachers

Brynne's *Chem Crew*

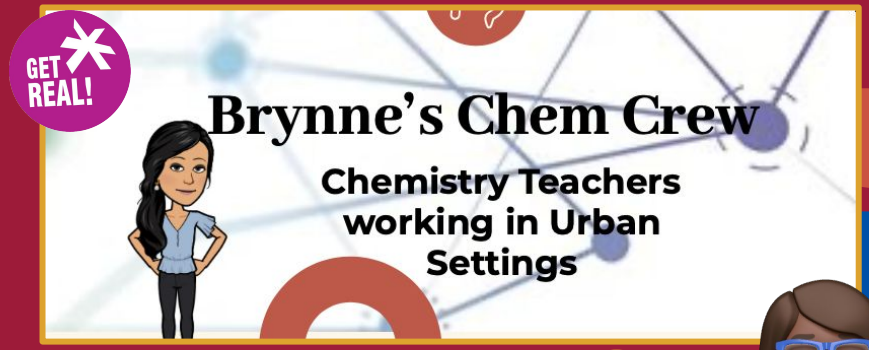
Chemistry Teachers working in Urban Settings

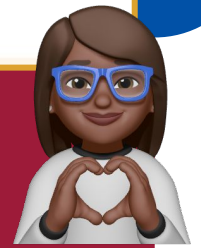
Paul's *Tigers*

Science teachers in the same school district, 7-12

Astor's *Alpacas*

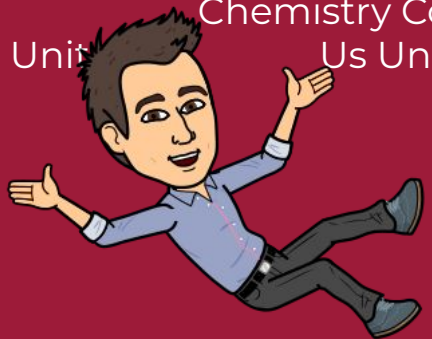
# The work of each PLC



## Summer PD

Justice-centered Ambitious pedagogy
Working as a PLC
COVID Culture Setting Unit



## Lesson Study

Implement, evaluate and revise Covid Chemistry Connects Us Unit

## JuST Practice

Identify valuable and effective justice-centered ambitious science teaching practices

Theory of Change

WARNER SCHOOL OF EDUCATION
UNIVERSITY of ROCHESTER

# DESIGN-BASED IMPLEMENTATION RESEARCH

PLC Name: Chem Crew Date: : Fall 2021

Name of Your DBIR Study: Conceptually-rich questioning

What is your persistent problem of practice? What struggle did you decide you all face that you want to collaboratively work on?

Students' contributions are not conceptually-rich

What strategy did you decide to try to address this Persistent Problem of Practice?

Teach, monitor & share data on higher-order questioning

Why do you think this strategy will be effective?

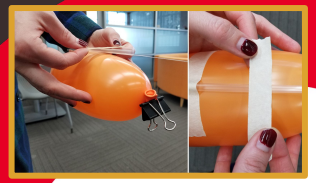
Students ownership in what counts and why
Recognition
See value as students build on each other's ideas

How will your PLC collaboratively measure and analyze the effectiveness of the strategy?

Data table: Level 1, 2, 3 questions by class & student over time
Student feedback on perceived value of the process

# JuST Practices by Teachers for Teachers

WHERE ELSE IN YOUR LIFE HAVE YOU SEEN THINGS ACT LIKE A ROCKET LAUNCHING?



## JuST Practice

Identify valuable and effective justice-centered ambitious science teaching practices

Routledge
Taylor & Francis Group

# THANKS!

## DO YOU HAVE ANY QUESTIONS?

april.luehmann@rochester.edu

COVID Connects Us

Get Real Science

WARNER SCHOOL OF EDUCATION
UNIVERSITY of ROCHESTER

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