Culturally Responsive Meaning-making and Recognizing Bias in the STEM Curriculum

Samsung Solve for Tomorrow - Teacher Workshop
Elissa Levy
April 2, 2019
Today’s Workshop

Culturally Responsive Meaning-making and Recognizing Bias in the STEM Curriculum

In this workshop, participants will explore the intersection between culture and meaning-making in the STEM classroom. Through hands-on experiences and teacher-led discussion, participants will analyze data to understand why certain groups are underrepresented in science, explore how culturally responsive teachers balance hands-on evidence with received authority, and grapple with the question: "Is scientific knowledge objective, and how does culture fit in?" The workshop leaders will also facilitate a discussion on how to recognize implicit bias and use it as a lens to frame STEM teaching practices. Together we’ll explore: how does our curriculum, grading and classroom culture cause racial inequality? We’ll also investigate ways to look critically at curriculum through this implicit bias lens, and to modify curriculum, grading, and classroom culture to avoid these biases.

This is a lot to cover in a mere three hours! Let’s turn it into an agenda...
Agenda for today

1. Norms & introductions
2. Explore: What is (and isn’t) culturally responsive teaching?
3. Analyze: Why are certain groups underrepresented in STEM?
4. Reflect: Where do we STEM teachers have implicit biases?
5. Engage: How can we integrate CRT into daily lesson planning? (Safir, Four R’s, CSQ+)
6. Extend: How can we create a safe space to discuss race and culture with our students? (Gorski, Courageous Conversations, physics example)
Discussion norms

1. Assume **good intentions**.
2. Speak **YOUR truth**.
3. **Share** the mic.
4. Treat everyone with the **patience** you have for your students.
5. Treat everyone with the **reverence** you have for your teachers.
6. **Reflect and contribute** to improve this workshop and future ones.
7. Expect and accept **lack of closure**.
Who are we?

Elissa D. Levy
Physics & AP Psychology Teacher
Life Sciences Secondary School
elissadunnlevy@gmail.com

- Education: BS in Physics (Yale), MST (Pace)
- First career: hedge fund analyst / manager
- Courses designed and taught: Physics First, Regents Physics, and AP Psychology
- Teaching philosophy: inquiry-driven (modeling inspired), hands-on, intensely metacognitive
- Ask me about: NYC Teaching Fellows, Girls Who Code, World Science Festival, CUWiP
- Personal life: I have a husband and 1-year-old son; I enjoy yoga, theater, and novels

STEMteachersNYC
CRT Committee
https://stemteachersnyc.org/culturally-responsive-stem/

STEMteachersNYC was founded in 2011 by Dr. Fernand Brunschwig. We now have more than 1,000 members. We have presented over 175 innovative workshops to over 3500 teachers.

In 2018, our teacher-members formed a Culturally Responsive STEM taskforce, focused on: (1) Culturally Responsive PD, (2) a CRT Resource Guide and (3) a Leadership Training Framework.

Thank you to my fellow CRT workshop leaders: Alisha Ragan & Paul Chin, Caroline Doherty & Jenny Shen, Tegan Morton
Who are you?

1. Your name
2. Your pronouns
3. Where you’re from
4. What you teach
5. What you’d like to get out of this workshop
6. Describe your classroom using one word
Today we’re exploring culturally responsive teaching (CRT). Everyone here has a different background, belief set, and way of thinking. There is no single right answer: we’re here to share ideas with each other and to grow as a group.

**With your table, create a whiteboard showing:**

1. What is culturally responsive teaching TO YOU?
2. What is an example of a culturally responsive lesson? Why?
3. What is a non-example of a culturally responsive lesson? Why?

You have 12 minutes. Be prepared to share out with the full group!
“Culturally Responsive Teaching can be defined as using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them. It teaches to and through the strengths of these students. Culturally responsive teaching is the behavioral expressions of knowledge, beliefs, and values that recognize the importance of racial and cultural diversity in learning.” (p. 31)

Turn and talk: What are the key similarities and differences between Gay’s definition and yours?
CRT: what educators should do

In summarizing and synthesizing this body of work, Aronson and Laugher stated that culturally relevant educators:

- use constructivist methods to develop bridges connecting students’ cultural references with academic skills and concepts.
- engage students in critical reflection about their own lives and societies.
- facilitate students’ cultural competence, which refers to “helping students to recognize and honor their own cultural beliefs and practices while acquiring access to the wider culture” and to STEM cultures (Ladson-Billings, 2006, p. 36).
- unmask and unmake oppressive systems through the critique of discourses of power.

Culturally sustaining pedagogy (Paris, 2012) shares commonalities with culturally responsive or relevant education with three differences (Paris & Alim, 2014):

- It foregrounds students’ cultural practices, and it seeks the maintenance of these cultural practices as a primary goal, rather than using them solely as bridges to academic practices or hybrid practices.
- It seeks to “honor, explore and extend” heritage practices and evolving contemporary practices (e.g., Hip Hop), rather than focusing exclusively on heritage practices (Paris & Alim, 2014, p. 87).
- It encourages students to reflectively critique both dominant and non-dominant cultural practices (e.g., those related to homophobia, racism, xenophobia, and misogyny), rather than focusing exclusively on the critique of dominant cultural practices.

In all cases, culturally responsive/relevant/sustaining education is based on the idea that underrepresented students’ cultural and linguistic practices are assets rather than deficits or barriers to the learning process.

This is from an NSF Roundtable in June 2016.

Questions

What might be challenging about “developing bridges connecting students’ cultural references with academic skills and concepts”?

Do you agree that teachers are responsible for “helping students to recognize and honor their own cultural beliefs and practices while acquiring access to the wider culture’ and to STEM cultures”?

In the phrase “culturally responsive / relevant / sustaining education,” which word stands out to you the most and why?
Underrepresentation in STEM

We’ll return to the definition of CRT in a bit. For now, let’s analyze some data regarding underrepresented groups in STEM.

Women, minorities (NB: this utilizes phrasing from the National Science Foundation though we acknowledge the more accepted phrasing is “people of color”), and persons with disabilities are underrepresented in STEM majors and occupations. For example, though women are approximately 50% of the population, less than half of all degrees awarded in the physical sciences are awarded to women: “In 2016, women’s share of bachelor’s, master’s, and doctorate degrees was 39%, 36%, and 31%, respectively” (NSF 2019). Similar issues of underrepresentation apply to people of color and persons with disabilities. What accounts for this underrepresentation?

Your task: with your group, answer the question in your packet. Prepare a whiteboard showing your claim, evidence, and reasoning. Be thorough: we will share our work via a gallery walk.

You have 18 minutes to complete this task.
As you walk around, leave post-its on each board:

- What surprises you?
- What confirms what you already thought?
- What do you want to know more about?
- What is unique compared with other boards?
- What is common among the boards?

You have 10 minutes to complete the gallery walk.
Debriefing the exercise

If you haven’t yet noticed, there are two versions of the packet. They each had a different question, and slightly different data sources.

Question 1: **What is structurally problematic about STEM education and STEM careers which excludes women, minorities, and disabled persons?**

Question 2: **What makes women, minorities, and disabled persons not persist in STEM?**

**Turn and talk:** how did each of the following affect your answer (or did it)?

- The framing of the question
- The sources of evidence you were given
- The attitudes and beliefs of your fellow group members
- Your own background and biases
Knowledge and objectivity

As a table, explore:

- Can scientific truth and falsehood be definitively determined?
- What qualifies as a “good” answer to a scientific question?
- Is scientific knowledge objective? How do you know?

Be prepared to share your responses with the full group!
Science practices are culturally mediated

- Science has been described as being “heavily dependent on cultural contexts, power relationships, value systems, ideological dogma, and human emotional needs” (Harding, 1998).

- Sociocultural consciousness is “the awareness that one’s worldview is not universal but is profoundly shaped by one’s life experiences, as mediated by a variety of factors” (Villegas & Lucas, 2002, p.27)

- “Both meter stick and retinal imprints are elaborate constructs to which experience has direct access only when the scientist...arranges....The alternative is not some hypothetical ‘fixed’ vision, but vision through another paradigm” (Kuhn, 1970).

**Turn and talk:** what are some possible answers to the guiding questions?

- What is an example of “power relationships” in STEM careers?
- What “emotional needs” are fulfilled by doing science?
- What determines the experiments we choose to undertake?
- How do we decide whether our answer is “right”?
“Children and adults the world over explore their surroundings and converse about the seeming causes and consequences of the phenomena they observe, but they are raised in environments with varied exposures to activities (e.g., fishing, farming, computing) that relate to different science and engineering domains. **What counts as learning and what types of knowledge are seen as important are closely tied to a community’s values and what is useful in that community context.**...Science has been described as being ‘heavily dependent on cultural contexts, power relationships, value systems, ideological dogma, and human emotional needs.’ Although this view is a contested one, seeing science as ‘a culturally mediated way of thinking and knowing suggests that learning can be defined as engagement with scientific practices.’ When people enter into the practices of science or engineering, they do not leave their cultural worldviews at the door.” (National Research Council, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas)

“The paradox of education is precisely this - that as one begins to become conscious one begins to examine the society in which he is being educated.” (James Baldwin, 1963)
# Implicit Bias vs. Priming

## Implicit Bias

“...the attitudes or stereotypes that affect our understanding, actions, and decisions in an **unconscious** manner. These biases, which encompass both favorable and unfavorable assessments, are activated involuntarily and without an individual’s awareness or intentional control...cause us to have feelings and attitudes about other people based on characteristics such as race, ethnicity, age, and appearance. These associations develop over the course of a lifetime beginning at a very early age...

“Implicit biases are pervasive. **Everyone possesses them**....They do not necessarily align with our declared beliefs or even reflect stances we would explicitly endorse.” (Kirwan Institute)

## Priming

“Priming is a technique whereby exposure to one stimulus influences a response to a subsequent stimulus, **without conscious guidance or intention**. For example, the word NURSE is recognized more quickly following the word DOCTOR than following the word BREAD. Priming can be perceptual, semantic, or conceptual.” (Wikipedia)

As with implicit bias, people are unaware when they are being primed; however the effects are shorter term and less deeply ingrained than the effects of implicit bias.

---

**Turn and talk**: What role did each of these phenomena play in the previous exercise?
Use priming to your advantage

You can’t change your students’ ingrained worldviews, but you can prime them in a culturally positive way!

Your task:
1. Read through the sample lesson plan on the next page.
2. As a table, list the elements of this lesson that are problematic from the lens of culturally responsive teaching.
3. For each element that is problematic, design an alternative approach that will positively prime the students.

When doing the exercise, think about how YOUR students might perceive the lesson, given what you know about them.

Adapted from Alisha Ragan & Paul Chin’s workshop, Oct. 2019
Sample lesson plan for table exercise

Learning objective:
Students will develop basic engineering design concepts by building the tallest tower possible.

Introduction:
Teacher will show students images of the tallest buildings around the world. Teacher will explain that these buildings are the best structures because they are the tallest. Teacher will share brief biographies of the men who designed these buildings.

Before the activity:
Teacher will create groups of four, where each group has an obvious leader who will take charge and spearhead. Teacher will identify that leader in advance by placing a red sticker on their worksheet.

The activity:
Students are informed that the person with the red sticker is the team leader. That person is the only one who can speak. The rest of the group can use gestures but not their voices. All ideas and group decisions must be approved by the team leader. Students have 15 minutes to engineer a structure that is taller than the other groups’ structures. Students will use spaghetti noodles and marshmallows to complete this task. Students are reminded that there really is only one best solution. Teacher will inspire students by saying, “Let’s see if you can find the right way to do this!”

Adapted from Alisha Ragan & Paul Chin’s workshop, Oct. 2019
Share-out: We’ll go around the room. Each table will share an element of the lesson plan that they would change - and why.

Questions for discussion:

- Where does a teacher’s implicit bias show up in a lesson plan?
- What elements of the lesson plan needed to be changed?
- How would the original lesson be perceived by your students?
- How would the revised lesson be perceived by your students?
- Is it be important to revise this lesson even if all students in the class were white and male? Why?
Equality vs. Equity

**Equality** means giving everyone the **same resources**. **Equity** means giving each student access to the **resources they need** to learn and thrive.

To gauge how in-depth we go: Thumbs-up if you have seen this image (or a similar one) and these definitions before today’s workshop.
Safir’s Six Steps Towards Equity

1. **Know every child:** First and foremost, get to know each student as a unique and layered individual. Embrace storiorientation to learn where they’re from, what they love to do outside of school, what their family is like. Don’t subscribe to a single story about any child. The more you know, the more you can build trust and differentiate instruction.

2. **Become a warm demander:** Author Lisa Delpit describes warm demanders as teachers who “expect a great deal of their students, convince them of their own brilliance, and help them to reach their potential in a disciplined and structured environment.” An equity stance pushes us to couple high expectations with a commitment to every child’s success.

3. **Practice lean-in assessment:** As you gather a student’s human story, start to piece together his or her learning story. How does she approach tasks? What are his strengths as a learner what does she struggle with? No standardized test will provide you with quality data on these questions. Use proximity and lean-in assessment to diagnose students’ learning needs. Carry a clipboard with you while students are working, and take careful notes on what you observe.

4. **Flex your routines:** Remember that one-size lessons do not fit all. Jane had mastered the art of the mini-lesson, but she was losing learners in the process. Be willing to flex or set aside your well-laid plans to individualize instruction. If pulling a student out of an activity to support him or her makes you uncomfortable, notice your discomfort and try not to let it control your decisions.

5. **Make it safe to fail:** Teach students that failure is just another form of data. When a child feels shame about his learning gaps, he’ll hide behind quiet compliance or bravado and acting out. In an equitable classroom, there’s no need to hide because struggle and failure are neutralized, normalized, and even celebrated. Consider this: Once a week, have students meet in groups to share something they struggled with and what they learned in the process.

6. **View culture as a resource:** Finally, don’t be culture-blind. When we ignore students’ identities, we efface who they are in the world and lose a rich resource for learning. Understand this simple, powerful truth offered by my friend Zaretta Hammond in her recent book Culturally Responsive Teaching and the Brain: “Culture, it turns out, is the way every brain makes sense of the world.” Help students activate their cultural schema to access challenging content. Invite them to share where they come from, not just with you but also with each other. Value and affirm all forms of difference.

**Reflect:** Given the definition of “equity,” how does each of these steps increase equity?
The Four R’s of CRT

Reflect: How can we incorporate all four R’s in every lesson we plan?

Being real to who you are, giving kids credit for who they are and what they know. Also, leveling with kids when you make mistakes in judgment or with instruction.

Access to rigorous materials and content, providing scaffolding, working in a student's zone of proximal development, and considering interest/engagement. Determine students’ safety nets and access points for engaging in rigorous academic learning.

Understanding who your students are and ensuring that the content or your delivery of content connects to them and their experience. This includes the types of books in the classroom the students get to choose from and the topics about which they write.

Among students for instance, during turn and talk, it would be evident whether all students are connected -- are comfortable in conversations with their classmates; with the teacher: whether the student feels belonging and acceptance and safety.
STEM: Claim-Sources-Questions+ (CSQ+)

CER

(traditional Claim, Evidence, Reasoning)

Guiding question:

Claim:

Evidence:  Reasoning:

Answer (Claim):

Support:

What is the answer to my question?

What evidence can I use to support my claim?

What are some caveats, nuances, or counterclaims?

What evidence can I use to show the exception cases?

Future Investigation: Questions:

What else do I want to learn or test about this topic?

Future Investigation: Sources:

How might I get the information I need to test it?

Question

What question did I ask?

What kind of question is it (circle one)?

Where did I go to get my evidence?

Where is my evidence from (circle)?

Texts
Published data
My own observation

Sources

Support

Answer (Claim)

Claim, Sources-Questions+ meaning making
adapted from Making Thinking Visible and proposed by E. Levy & T. Morton, 2019
The CSQ+: discussion

**CSQ+**

*(Claim, Support, Questions + meaning making)*

adapted from *Making Thinking Visible* and proposed by E. Levy & T. Morton, 2019

<table>
<thead>
<tr>
<th>Question</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>What question did I ask?</td>
<td>Where did I go to get my evidence?</td>
</tr>
<tr>
<td>What kind of question is it (circle one)?</td>
<td>Where is my evidence from (circle)?</td>
</tr>
<tr>
<td>How it works</td>
<td>Texts</td>
</tr>
<tr>
<td>Why it works that way</td>
<td>Published data</td>
</tr>
<tr>
<td>How to use the knowledge</td>
<td>My own observation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Answer (Claim)</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the answer to my question?</td>
<td>What evidence can I use to support my claim?</td>
</tr>
<tr>
<td>What are some caveats, nuances, or counterclaims?</td>
<td>What evidence can I use to show the exception cases?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Future Investigation: Questions</th>
<th>Future Investigation: Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>What else do I want to learn or test about this topic?</td>
<td>How might I get the information I need to test it?</td>
</tr>
</tbody>
</table>

**Discussion questions**

- Would you use the CSQ+ (or parts of it) in your classroom? Why or why not?
- How do you think your students will respond to it?
- How can we inspire students to become aware of their own stake in their investigations?
- How can we further engender metacognition and the awareness of the subjectivity of scientific knowledge?
Why discuss inequity in the classroom?

Discussing women’s underrepresentation had a significant positive effect on the physical science career interests of female students.

(Note: I haven’t found similar research on people of color, but I’ve heard that there are similar results. Let me know if you’re aware of such research!)
Stage 5: Multicultural, Social Action, and Awareness

In addition to the changes made in the Structural Reform stage, important social issues, including racism, sexism, and economic injustice, are addressed explicitly as part of the curriculum. The voices, ideas, and perspectives of the students regarding these and all other topics are brought to the fore in the learning experience -- the students themselves becoming yet another multicultural classroom resource. The textbook is viewed as a single perspective among many, and the relevance of its limitations, along with those of other educational media, are explored and discussed.

Stage 4: Structural Reform

New materials, perspectives, and voices are woven seamlessly with current frameworks of knowledge to provide new levels of understanding from a more complete and accurate curriculum. The teacher dedicates her- or himself to continuously expanding her or his knowledge base through the exploration of various sources from various perspectives, and sharing that knowledge with her or his students. Students learn to view events, concepts, and facts through various lenses. "American History" includes African American History, Women's History, Asian American History, Latino American History, and all other previously differentiated fields of knowledge.

Stage 3: Integration

[Teachers add] substantial materials and knowledge about non-dominant groups to the curriculum...it transcends special celebrations to deal with real issues and concepts and that it more closely ties diverse material into the rest of the curriculum. But many weaknesses remain: New materials and units become secondary resources and knowledge as textbooks and the meat of the curriculum remain based on a Eurocentric, male-centric orientation (Banks, 1993). New information is still delivered from a Eurocentric, male-centric perspective. For example, the story of Manifest Destiny is still told only from a European point of view.

Stage 2: Heroes and Holidays

Teachers at this stage "celebrate" difference by integrating information or resources about famous people and the cultural artifacts of various groups into the mainstream curriculum. Bulletin boards might contain pictures of Martin Luther King, Jr., or Rosa Parks, and teachers might plan special celebrations for Black History Month or Women's History Month. Student learning about "other cultures" focuses on costumes, foods, music, and other tangible cultural items. By focusing celebratory attention on non-dominant groups outside the context of the rest of the curriculum, the teacher is further defining these groups as "the other." Curricula at this stage fail to address the real experiences of non-dominant groups, instead focusing on the accomplishments of a few heroic characters.

Stage 1: Curriculum of the Mainstream

The curriculum of the mainstream is Eurocentric and male-centric. It ignores fully the experiences, voices, contributions, and perspectives of non-dominant individuals and groups in all subject areas. At this stage, all educational materials, including textbooks, films, and other teaching and learning tools, present information in a Eurocentric, male-centric way. This stage is harmful both for students who identify with dominant culture and those from non-dominant groups. It has negative consequences for the former because, according to Banks (1993), it reinforces their false sense of superiority, gives them a misleading conception of their relationship with other racial and ethnic groups, and denies them the opportunity to benefit from the knowledge, perspectives, and frames of reference that can be gained from studying and experiencing other cultures and groups (p. 195). The curriculum of the mainstream has negative consequences for students from non-dominant groups, as well, failing to validate their identities, experiences, and perspectives. According to Banks (1993), it further alienates students who already struggle to survive in a school culture that differs so greatly from their home cultures.
Physics: one possible “Stage 5” lesson

Stage 5: Multicultural, Social Action, and Awareness
In Stage 5, the teacher invites students to explore important social issues, such as racism or sexism. Students see their perspectives as yet another multicultural classroom resource.

Learning objective:
Students will synthesize a historical definition of “physicist,” and will reflect on how to ensure all voices are heard in the field of physics going forward.

Research activity:
Each group researches one of the famous physicists whose work we study throughout the year. (Note: the famous physicists list comes from the mainstream curriculum: they are the ones who are generally credited for discovering particles or deriving equations - or they have physical quantities or units named after them. With the exception of Marie Curie, they are all men. And all of them are white.) Each group prepares a presentation board about their physicist.

Gallery walk:
As students circulate, they (a) collect statistics on how many physicists were white vs. non-white (100% white) and male vs. female (90% male), and (b) record the types of struggles and accomplishments that they see across the physicists.

Reflection questions:
- Are the voices of all races and cultures equally represented in the history of physics? Why do you think certain voices are represented more than others?
- When not all voices are represented, what is the effect on how much science humanity can discover?
- What makes a person a physicist?
- What are some ways to ensure all voices are represented in physics in the future?

This is a lesson I do with my students. It is not meant to be authoritative, and I’d love to hear your feedback!
Reflect

Has your definition of culturally responsive teaching changed today? If so, how?

What is one action you will do going forward to acknowledge and address your implicit bias as a STEM teacher?

What is one action you will do going forward to connect with and to better understand your students?

What takeaways from this workshop will you share with your colleagues when you return to school?
Thank you! And next steps

Thank you to...

You
My students
My mentors and teachers
Fernand, Chris, and the STEMteachersNYC CRT Committee

Next steps for you

Now: Complete the survey

Every day: When lesson planning, use the frameworks you saw today

Some day: Try out the CSQ+ or another culturally responsive tool in your classroom!
### Books

- Coates, T. *Between the World and Me*
- Cohen, E. & Lotan, R. *Designing Groupwork: Strategies for the Heterogeneous Classroom*
- Hammond, Z. *Culturally Responsive Teaching and the Brain*
- O'Neil, C. *Weapons of Math Destruction*
- Popham, J. *The Truth About Testing: An Educator’s Call to Action*
- Steinberg, R. *An Inquiry into Science Education, Where Rubber Meets the Road*

### Websites

- [http://stepup4women.org](http://stepup4women.org)
- [https://www.facinghistory.org](https://www.facinghistory.org)
- [https://www.npr.org/podcasts/510312/codeswitch](https://www.npr.org/podcasts/510312/codeswitch)
- [https://www.tolerance.org/learning-plan/addressing-implicit-bias](https://www.tolerance.org/learning-plan/addressing-implicit-bias)
- [https://www.cultofpedagogy.com/culturally-responsive-misconceptions/](https://www.cultofpedagogy.com/culturally-responsive-misconceptions/)
- [https://implicit.harvard.edu/implicit/](https://implicit.harvard.edu/implicit/)
- [https://courageousconversation.com/about/](https://courageousconversation.com/about/)

Would you add any resources to this list?
Appendix

(Unused slides)
## Introduction to this matrix

<table>
<thead>
<tr>
<th>Questions: What kind of question do you ask?</th>
<th>My interpretation of authoritative sources</th>
<th>My analysis of published data</th>
<th>My personal, direct observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>How it works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Why it works that way</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How to use the knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: What type of evidence do you use?

Evidence-Authority Matrix, T. Morton & E. Levy, 2019, to be published
## Put your lessons on this matrix

### Evidence-Authority Matrix, T. Morton & E. Levy, 2019, to be published

<table>
<thead>
<tr>
<th>Questions: What kind of question do you ask?</th>
<th>Sources: What type of evidence do you use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How it works</td>
<td>My interpretation of authoritative sources</td>
</tr>
<tr>
<td>Why it works that way</td>
<td>Activity: Relative mass and the mole</td>
</tr>
<tr>
<td>How to use the knowledge</td>
<td>Reading and bar charts: Thermal and phase energy</td>
</tr>
<tr>
<td></td>
<td>Project: Design an electromagnet</td>
</tr>
</tbody>
</table>

### What to do now:

1. Decide where your 3 lessons fit in the matrix
2. Create the matrix on your whiteboard; fill in everyone’s lessons
3. Start to think about whether your lessons are clustered or spread out, and what kinds of meaning-making you’re having your students engage in
### Chalk talk

**What to do now:** provide your answers (or ask related questions) to the prompt on the chart paper.

<table>
<thead>
<tr>
<th>Do your lessons <strong>cluster</strong> in one area of the map? Why?</th>
<th>Where on the map are <strong>you</strong> the most comfortable teaching? Why?</th>
<th>Where on the map are <strong>your students</strong> the most comfortable learning? Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who <strong>generates the questions</strong> your students explore? Why?</td>
<td>Who <strong>generates the sources</strong> your students utilize? Why?</td>
<td>Is one part of the matrix “<strong>better</strong>” or “<strong>worse</strong>” than another? If so, how?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Full-group reflection

For discussion:

A. How does our bias affect the questions and sources we provide our students?

B. Is our personal preference on the matrix driven at all by our culture?

C. Are our students more comfortable in some parts of the matrix than others? Why?

D. How do power dynamics in the classroom or in society map onto these questions and sources?