

Five Phases for Engaging Secondary Teachers in Expansive and Connective Sensemaking

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ABSTRACT

Visions of equitable science teaching emphasize the need to engage with heterogeneity in scientific sensemaking, valuing diverse ways of knowing and resources for understanding the natural world. However, most secondary science teachers have not had opportunities to experience science in these ways, making it challenging to implement in their classrooms. Therefore, we have been designing and facilitating activities for teachers to engage in expansive and connective sensemaking to invite *their* diverse resources for understanding phenomena and to connect to *their* identities, histories, and futures. In this paper, we share our instructional framework for these activities and how this framework supports heterogeneity in scientific sensemaking. This framework consists of five phases of our design and facilitation: (1) motivating our inquiry, (2) posing a broad launching question, (3) surfacing heterogeneity, (4) supporting material engagement, and (5) deepening connections to contexts. We offer concrete examples of this framework across two contexts: a preservice teacher education content course and an in-service teacher professional learning community. These examples illustrate the possibilities of creating space for current and future educators to imagine more expansive and connective forms of science.

Keywords: scientific sensemaking, heterogeneity, teacher learning communities, teacher identity, teacher preparation

Introduction

The National Academies consensus study report, *Equity in K-12 STEM Education: Framing Decisions for the Future*, emphasized “embracing heterogeneity” as a key frame for fostering equitable and inclusive science learning (NASEM, 2025). Embracing heterogeneity means expanding beyond narrow, singular ways of being and knowing in science learning (Bang et al., 2012). This call for heterogeneity encourages science teachers to make space for different ways of knowing and relating to phenomena and to engage with learners’ identities and lived experiences, particularly those from marginalized communities (Rosebery et al., 2010; Tzou et al., 2019). However, it is a challenge for teachers to address this call when they typically have never experienced science in this way themselves. Therefore, for the past five years, we have been designing and facilitating activities for teachers to re-experience science in ways that invite *their* diverse resources for sensemaking and connect to *their* identities, histories, and futures. For instance, in our programs pre-service and in-service teachers have made sense of the colors of the rainbow not just by thinking about wavelengths and using prisms, but by drawing on their lived experiences using paints, coding website colors, blending make-up, and recalling their family’s stories working in a garment factory, as well as by reflecting on cultural perspectives on color, racialized histories of color photography, and sociohistorical contexts of pigment production.

In this paper, we share our instructional framework for engaging teachers in scientific activities that embrace heterogeneity. This framework consists of five phases of our design and facilitation: (1) motivating our inquiry, (2) posing a broad launching question, (3) surfacing heterogeneity, (4) supporting material engagement, and (5) deepening connections to contexts. We first unpack expansive and connective science sensemaking as a central goal of our activities and discuss how these activities support teacher learning. We then delve into each phase, providing facilitation details and concrete examples of implementation.

Expansive and Connective Science Sensemaking

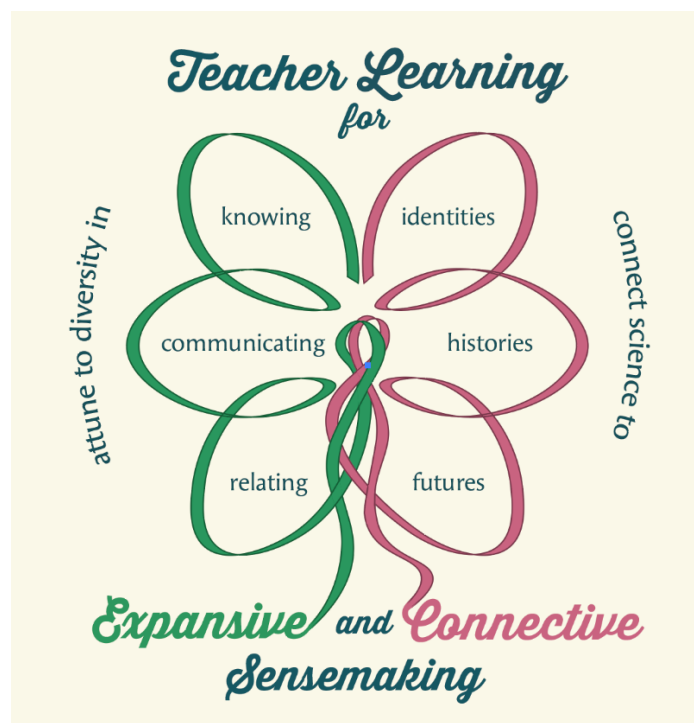
In our scientific activities with teachers, we engage them in expansive and connective sensemaking (Watkins et al., 2024), which incorporates heterogeneity, power, and historicity in pursuits of coherent and explanatory accounts of the natural world (Figure 1; Warren et al., 2020). Expansive and connective sensemaking builds on prior frameworks for designing and studying how to engage with epistemic diversity, historicity, and identity within disciplinary activities (Agarwal & Sengupta-Irving, 2020). In our work, we focus on sensemaking as a key disciplinary activity, defining it as a generative process of building and refining explanations about the natural world to “figure something out” (p. 192, Odden & Russ, 2019). Incorporating heterogeneity recognizes that scientific sensemaking benefits from bringing together diverse ways of knowing, communicating, and relating to each other and the natural world. Incorporating power recognizes that while we all bring diverse resources for science, ways of understanding and engaging with the natural world associated with dominant communities have been privileged, while those from nondominant communities have been marginalized (Warren & Rosebery, 2011). These sociohistorical patterns not only impact who gets to be a

scientist and what science gets recognized, but also the outcomes and goals of scientific inquiry.

In our vision, expansive sensemaking incorporates *multiple ways of knowing* in explanations of phenomena by incorporating canonical science knowledge alongside resources and perspectives from learners' families, communities, and out-of-school experiences. Expansive sensemaking also affords opportunities for *diverse ways of communicating*, particularly to make space for expressions that show how one's positionality informs their understanding of the world. Lastly, we consider sensemaking as a path to *different ways of relating* to the natural world, which challenges dominant relations of scientists as omniscient and distant individual observers, instead highlighting the ways we are connected to phenomena and each other.

Figure 1

Framework for Teacher Learning for Expansive and Connective Sensemaking



We also consider how our scientific sensemaking can connect to our identities, histories, and futures. Connective sensemaking provides opportunities for learners to *author and enact their identities* as part of their pursuits of explanatory accounts of the natural world to bridge scientific inquiry with who they are being and becoming. Connective sensemaking also makes space to *consider how sociohistorical narratives and structures* shape our understanding of the natural world and our place in it. Lastly, it helps learners *engage in future-making* to imagine how their sensemaking can shape their lives, their communities, and the broader world.

Supporting Teacher Learning

Our central aim in engaging teachers in expansive and connective sensemaking is to encourage secondary science teachers to imagine how science teaching and learning can incorporate heterogeneity, but in ways that meet the needs and histories of their specific teaching contexts. While other models that engage teachers in scientific activities either have them go through the curriculum they will teach or are aimed at specific content and pedagogical content knowledge (e.g., Reiser et al., 2017), our goals are for teachers to learn to appreciate heterogeneity in science, practice integrating diverse perspectives in science, and critically reflect on their pedagogy towards creating more equitable, engaging, and joyful science learning environments in their classrooms.

By participating in science environments that invite them to draw on what they learned in prior science courses together with ideas from everyday experiences, ways of reasoning and communicating from other settings, and aspects of their identities, teachers experience how to incorporate these resources and, importantly, what it feels like to bring diverse parts of oneself to science learning. Furthermore, a common pattern is that teachers can elicit students' diverse ideas, but struggle to build on them. By participating in expansive and connective sensemaking, teachers respond to each other's diverse sensemaking resources, providing opportunities to practice integrating them to broaden and deepen their accounts of phenomena. Lastly, these experiences provide a backdrop for critically reflecting on their pedagogy. For in-service teachers, there are immediate opportunities to adapt curricula and pedagogy in ways that fit their specific teaching contexts and make science more expansive and connective. For pre-service teachers, these experiences serve as a touchstone for their later methods course, wherein they develop pedagogical tools to enact their emerging visions for their science teaching.

Our Contexts

We have explored how to engage pre-service and in-service teachers in expansive and connective sensemaking across two contexts: a pre-service teacher education course and an in-service teacher professional learning community. Modeling in Secondary Science is an undergraduate and graduate-level course that meets for 3 hours for 14 weeks. It primarily serves preservice secondary teachers across science subdisciplines, but also other students interested in science education; course enrollment ranges from 8 to 15 students. During the course, students engage in two extended science investigations, while also reading about modeling as a scientific practice and expansive and connective forms of science inquiry (Watkins et al., 2024). Students keep online journals documenting their scientific sensemaking, engage with each other and materials to deepen their understandings of phenomena, and develop shared representations of their models. This course is part of an extended teacher education sequence that includes other courses on science literacies, teaching methods, and social and philosophical foundations of education.

Science Teacher Circles is a professional learning community of secondary science teachers and university teacher educators that meets monthly during the school year to engage

in joyful and expansive science exploration together (Watkins et al., 2025). In each meeting, we connect over food, then engage in scientific sensemaking together. We describe STCs as like a book club for science teachers, but instead of discussing a novel, we investigate natural phenomena; each investigation spans ~3 meetings. At the end of each meeting, we debrief and discuss pedagogical implications. We started co-designing STCs with 3 university educators and 6 science teachers; our community has grown to 4 university educators and 15 science teachers.

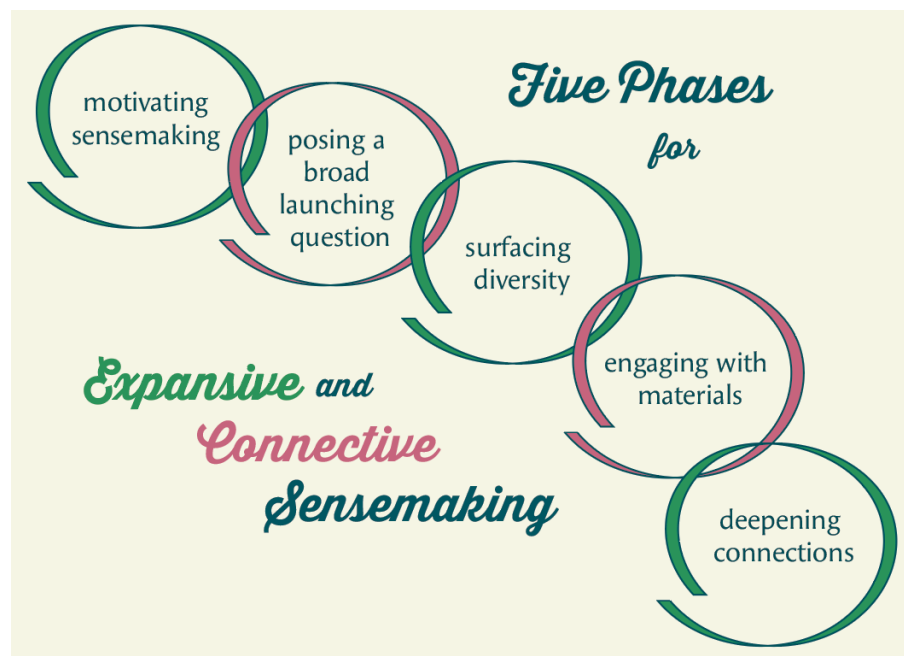
While these two contexts address different populations with different needs, they were both designed to help future and current science teachers imagine new possibilities for learning. For each investigation, we start with a broad launching question that will spark our sensemaking; in Table 1, we list the questions we have piloted in different contexts. Then, based on how teachers make sense of this question, the community explores different avenues of experimentation with materials. For instance, after our first meeting with the taste question, the STC teachers pursued two different lines of inquiry—one on how our geographic origins might shape our taste preferences with salts from similar or different origins, and another on how the ordering of different flavors might affect taste buds. With the rainbow question, Modeling students have coalesced around 2-3 avenues: understanding color mixing, modeling how the eye perceives color, and exploring how prisms work. Within each avenue, teachers interact with materials, share their observations, develop emerging models, make predictions and test them, and refine their understandings of phenomena. These explorations are extended over time; in STCs, teachers engage with a launching question for three monthly sessions; in Modeling, students persist in their exploration over several weeks (see Watkins et al., 2024 for more details on the course).

Across these two contexts, we have developed a framework for how to plan, launch, and facilitate expansive and connective sensemaking with secondary science teachers. We drew on our experiences teaching, our reflections and planning notes, interviews with Modeling students, and feedback from STC teachers to identify five key phases for embracing heterogeneity with secondary science teachers (Figure 2).

Table 1

Sample Launching Questions We Have Used in the Modeling Course and STCs.

Sample launching questions
Are all the colors in a rainbow?
What makes water clean? How do we know?
Why are some plant stems and leaves purple?
Why does salt, fat, acid, and heat make food taste better?
What determines how large a tree can be?
Why are some sounds pleasant and others grating to our ears?

Figure 2*Five Phases for Expansive and Connective Sensemaking***Phase 1: Motivating Our Own Scientific Inquiry**

This phase sets the tone for our scientific inquiry by addressing the needs and goals of engaging in sensemaking together. This motivation is critical at the start of a new course or a new STC year, but it is also important to revisit periodically during our time together.

Introducing the importance of speculative spaces. In Modeling and STCs, we motivate our sensemaking together by positioning these activities as experimenting with what is possible in science teaching and learning. We explicitly state that we are not engaging in the same lessons they will later teach, but rather creating a space to imagine together the kinds of experiences we want to cultivate for our students. For PSTs, we emphasize that the Modeling course serves as a foundation for their methods courses; they will have opportunities in later courses to learn about and implement pedagogical tools. Instead, we expect this course to help them develop their pedagogical vision, that is, toward what ends they want to draw on those tools. Similarly, in STCs, we emphasize the importance of continuing to re-envision what our classrooms could be. The multidisciplinary composition of our group helps frame our activities as speculative because there is no common standard to address; instead, teachers expect to have to adapt what we do together to their contexts.

Some PSTs in the Modeling course have expressed concerns that our sensemaking together does not adhere to the typical constraints of public schooling. We respond by acknowledging this concern: some aspects of our sensemaking activities may not be possible in their classroom due to testing, overcrowding, lack of resources, etc. However, we also share the

accompanying concern that if we always restrict ourselves to these constraints, we might not know what to do when there are opportunities to break free.

Crafting an affective appeal. We also work to set up conditions for teachers to *feel* why it is important to engage in expansive and connective sensemaking together. These affective appeals remind teachers what learning science typically feels like and then invite us to cultivate different kinds of feelings for our community and in their classrooms (Vea, 2020).

In the Modeling course, PSTs typically read and comment on Eleanor Duckworth's (1972) essay *The Having of Wonderful Ideas* before the first day of class. We ask them to add stickies to online slides to share a recent "wonderful idea" they had (not limited to ideas in science or school) and reflect on what supported them in having this idea. We use the essay to affectively frame the course as an opportunity to have our own and support each other's wonderful ideas; we set up course norms based on the reflections on their slides. For STCs, we have made an affective appeal by sharing a quote from Robin Wall Kimmerer's *Braiding Sweetgrass* (2013) in which the author shares how her desire to understand the beauty of asters and goldenrods was dismissed as "not science" by her undergraduate advisor. We use this story as motivation to consider how we can create community through STCs that re-imagine science beyond the typical narrow portrayals.

Responding to teachers' needs and concerns. Motivation is not just about convincing teachers about our objectives, but listening and responding to their goals, needs, and interests. Particularly in this era of teacher deprofessionalization, we want to honor teachers' expertise and partner with them in learning together. In Modeling, one way we are responsive is by adapting the syllabus to incorporate different readings that connect to PSTs' interests or concerns. For instance, in one semester, PSTs were skeptical that any form of sensemaking was possible to achieve in secondary classrooms, so we added readings with rich examples from public schools (e.g., Hammer, 1997; Warren & Rosebery, 2011). In STCs, teachers are co-designing our community together, and therefore, their needs and concerns are continually integrated in how to develop and enact our vision and activities.

Phase 2: Posing a Broad Launching Question

Anchoring our expansive and connective sensemaking is a broad launching question that can invite teachers to draw on different kinds of resources and perspectives. Launching questions are different from driving questions in that there is not a pre-planned outcome or trajectory. Instead, these questions can lead to multiple lines of inquiry (Hammer, 1997). Developing a good launching question involves anticipating how it might foster heterogeneity in our sensemaking. In Table 1, we share some of the questions we have used.

Considering multiple disciplinary lenses. In our communities, the Modeling students and STC teachers typically have majored in or teach different sciences; posing questions that can incorporate different subdisciplines can therefore foster interdependence for collaborative sensemaking. For example, with the taste question, we used chemistry, anatomy, botany, and geology to model different aspects of the phenomenon. We also consider how questions might

create opportunities to navigate different ways of knowing: exploring taste as involving biochemical processes, cultural practices, and sociopolitical dynamics. Similarly, with the clean water question, we reflected on multiple ways of relating to water in our lives (Davis & Schaeffer, 2019).

Inviting experiences beyond school. We also anticipate how launching questions can tap into experiences and resources beyond the typical science disciplines. With the rainbow question, for instance, we drew on our experiences with seeing rainbows, painting, photography, or even memes (the infamous gold- or black- striped dress) to make sense of the phenomenon. For the clean water question, we drew on our experiences hiking, using home water filters, observing the creek in our yard, and tasting different waters to expand the range of resources for our sensemaking.

Leaving aspects open for interpretation. Our analyses of how teachers responded to different questions point to the importance of ambiguity. When teachers needed to interpret what a question was asking or what a word might mean, it led them to think about multiple possible meanings. For instance, in the question “What makes water clean?” we considered what “clean” might mean, which led to reflections like: Clean for whom? How might we consider what is clean for different people, other organisms, or broader ecosystems? How is this word “clean” politically charged?

Creating opportunities for material engagement. We also found that a critical aspect of a launching question was anticipating how teachers might interact with materials to further their sensemaking about phenomena. We mapped out different possibilities for how teachers might learn from or with materials. Some questions invite direct manipulation of the materials; for instance, we provided multiple materials to make different colors for the rainbow question. For other questions, teachers made observations without manipulation, for instance by taking field walks to observe different tree sizes in relation to their environments.

Phase 3: Surfacing Heterogeneity

After posing a launching question, we typically prompt either individual reflections or small group talk. This allows for brainstorming before sharing with a larger group. While there are descriptions of general facilitator moves to support sensemaking (Benedict-Chambers et al., 2017), we offer ways to foster norms for engaging with diverse ways of knowing, communicating, and relating to phenomena. We seek to support—without putting pressure on—teachers to share how launching questions relate to their cultures, identities, and histories.

Sharing our own personal experiences. If we are going to ask teachers to be vulnerable to share parts of themselves with the class or group, then we as facilitators also should be willing to share our personal or cultural histories. For instance, in STCs, Jess (first author) volunteered her experiences with the sulfur smell in the well water on her family’s rural farm to reflect on water “cleanliness,” while Yeung (second author) reflected on cultural differences between Hong Kong and the United States in what is taught as colors in the rainbow. Sharing

these aspects of ourselves as facilitators helps to frame the activity as a place to bring in different aspects of our identities into science.

Validating by weaving teachers' cultural resources within sensemaking. Sharing aspects of one's identities and cultural perspectives in science is risky, especially for those from non-dominant communities. There is a strong risk of these resources being tokenized, essentialized, and/or dismissed (Sengupta-Irving et al., 2021). Therefore, we show care in our facilitation when teachers share cultural resources to both honor their histories and to leverage them as meaningful parts of our sensemaking. For instance, in the Modeling course, when a Chinese international student introduced how farmers created patterns in apples' pigmentation by placing stickers on them before they ripen (Figure 3), we made space to learn about the cultural context of this practice and wove these observations within our sensemaking about how light impacts anthocyanin production in our inquiries about purple in plant stems and leaves.

Figure 3

An International Student's Modeling Course Journal Entry



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Hypothesis 2:
More exposure to sunlight, more purple:

Is anthocyanin just like red on apples? For examples, farmers cover apples with black paper, and the part that is covered will be white (no red is generated)



- *Evidence from observation: The top part of the plant is covered by other plants until I pulled it out, it was so green so that I doubted that no light no purple.*
- *However, from our plants in box, the green plants have bigger leaves which mean it will easier get light, it might go against the hypothesis.*
- *Also, the stem/ bottom of most plants are purple rather than the top, dose it go against again?*

Note. This journal entry draws on this Chinese international student's knowledge of covering apples with black stickers to create patterns with the sunlight, which are special gifts during Chinese New Year and Christmas.

Modeling deep engagement with others' ideas. Deeply engaging with others' ideas is foundational for incorporating heterogeneity. Therefore, in both Modeling and STCs, we model this way of engagement with others' thinking. At the start of Modeling classes, the instructor presents examples of students' journals from the prior week to raise new questions, highlight new ideas, make connections across students, and/or prompt new avenues for exploration

(Figure 4). In STCs, we develop concept maps that synthesize the ideas introduced in our previous meetings and propose possible avenues for exploration (Figure 5). These practices signify that the teachers' thinking forms the basis of our work together. Indeed, our analyses from the Modeling class show the development of a "collective responsibility" norm—students came to expect to work to deeply understand others' ideas, build on each other's models, notice differences or gaps, and refine these models through suggestions and feedback (Tang & Watkins, under review).

Phase 4: Supporting Material Engagement

We design launching questions to create opportunities for material engagement to help teachers develop, refine, and extend their ideas. Engaging with materials to develop understandings of the natural world is a hallmark of scientific inquiry, yet school science often either positions material investigations as fun extras or as tightly scripted procedures. We consider how engaging with materials can foster heterogeneity in our sensemaking, inviting multiple ways of knowing, communicating, and relating to the natural world.

Figure 4

A Sample Page from a Modeling Student Journal Shared at the Start of Class

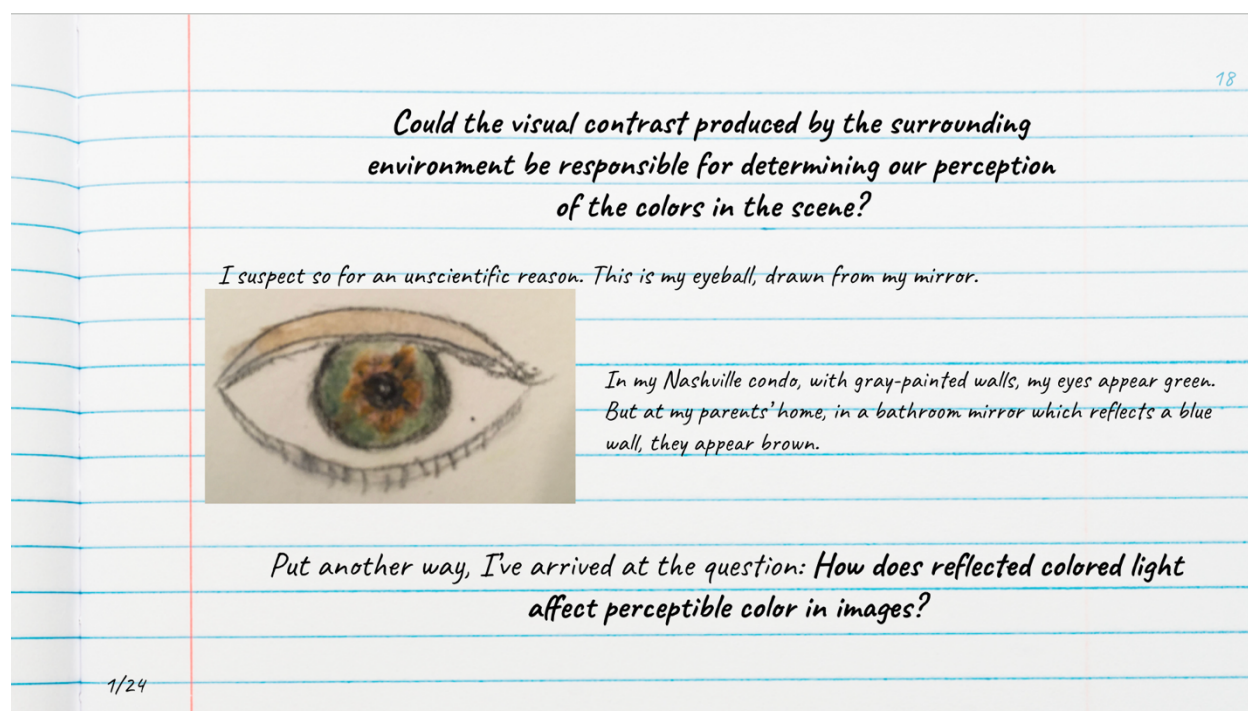
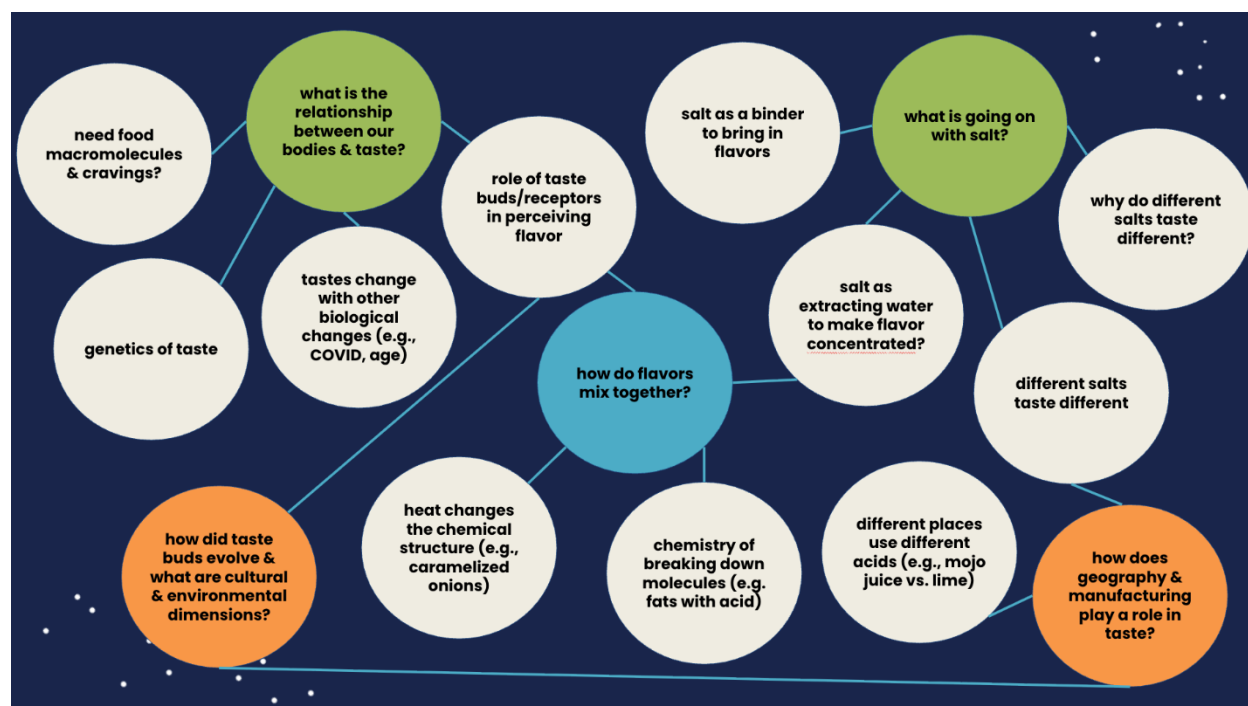


Figure 5

Concept Map of STC Brainstorming Around the Taste Question



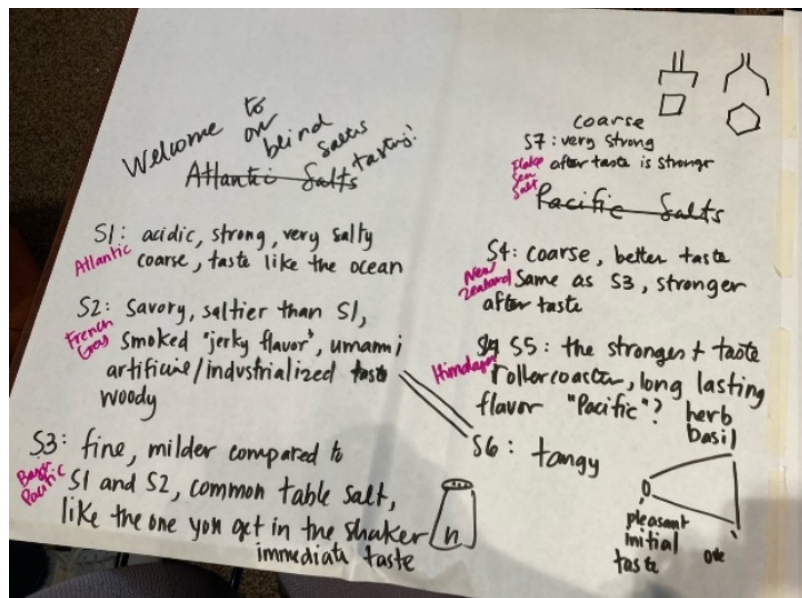
Making diverse materials available. As teachers pursue different lines of inquiry, we make sure to provide materials that you would not typically find in a school science lab, alongside more traditional materials. We have found that selecting diverse materials can help frame our activities as those that can draw on heterogeneous resources for sensemaking. For instance, with the rainbow question, we provide prisms, flashlights, and color filters, alongside watercolor and acrylic paints and suncatchers. We have also brought artifacts and materials from prior Modeling classes in which teachers made filters from nail polish and eyeshadow to examine color combinations and light filtering. We also listen to what teachers introduce in their initial conversations around a launching question for material ideas. For instance, after hearing about STC teachers' cultural experiences with different ingredients, we bought mojo juice as an example of acid and different regionally popular seasoning salts (Lawry's, Old Bay) to be part of our material investigations.

Leaving open different pathways of engagement. Often, school science labs use materials in predetermined ways, to be manipulated by students to arrive at already-established outcomes. We have found that making space for uncertainty in how to work with materials not only supports meaningful sensemaking (Manz, 2025) but also can create opportunities for heterogeneity in empirical investigations. Secondary science teachers are already quite familiar with typical tools and scripts for science experiments; our teachers did not need explicit protocols. Instead, we found that leaving open how to engage with materials gave them space to adapt or remix typical tools for more heterogeneous investigations. STC teachers, for instance, conducted a blinded taste test to assess whether our geographical

origins shape whether we prefer salts from similar regions. Figure 6 shows how, within this seemingly sterile scientific procedure, teachers tapped into personal memories, like accidentally swallowing ocean water or using salt shakers, to document their findings (Goodwin & Watkins, 2026). Similarly, in Modeling, students have combined developing quantitative tables of plant data with embodied dances to depict plant growth and needs (Rae, 2024).

Figure 6

Data Table Made by STC Teachers during Blind Taste Test of Different Salts



This openness also allowed participants to question the utility of typical scientific tools and technologies in their sensemaking. For example, in Modeling, when students had to determine what counted as evidence of color change in plant stems, they argued about whether to defer to technology (e.g., paint eyedropper) and statistics or to value their own senses (e.g., whether their eyes detected differences). This argument prompted students' reflections on resisting default stances on technological tools as objective and neutral.

Acknowledging material histories. A central commitment to both communities is to recognize and value our own identities and histories. However, we also began to realize that the materials we were working with in our scientific investigations brought their own histories that were important to acknowledge. When tasting bitter melon juice or testing water samples, for example, understanding where these materials come from and what role they play in communities impacted our sensemaking. This approach challenges typical ways of relating to materials as simply objects to manipulate for our own ends and instead recognizes that they bring their own cultural and ecological contexts to bear on our sensemaking. Hearing about bitter melon juice use in Asian herbal remedies helped us make sense of the strong taste, and learning about the ecologies of local creeks informed how we made sense of the water tests.

This realization has shaped how we set up our materials for investigation. In our first STC material explorations for the taste question, we had taken most of the ingredients out of their containers to put in sterile, standardized bottles. However, as teachers began to observe and taste these materials, they wanted to know more about where they came from and how they were used, leading us to go back and look at the packaging. Learning from this moment, we now share what we know about materials' histories and why we chose these materials to study. We see this practice as opening new ways of relating to materials and the natural world.

Phase 5. Deepening Connections to Contexts

While we consider the sociopolitical contexts of scientific phenomena and science teaching throughout our sensemaking, this last phase highlights how we have learned to set up explicit structures for deepening these connections.

Orienting to place. One way we connect to contexts is by calling attention to the ways that place shapes our understandings of phenomena as it emerges within our inquiry. For instance, in Modeling, when we explore purple in plants in springtime, we have compared our experiences during changing seasons where we grew up: does spring in University City look, sound, and feel like how we remembered it? Similarly, in STCs during our taste investigations, when some teachers found different flavors “taste like home,” we led a discussion about how our homeplaces shape our senses and sensemaking, even beyond the sensations of taste.

We also provide opportunities to ground our inquiry in shared places. In Modeling, students conduct fieldwork around campus or in local parks to observe the color purple in plants in their environment, which helps them brainstorm possible evolutionary advantages for purple in plant stems and leaves, and see their local environments in new ways. Afterward, we read frameworks from Learning in Places (2021) and tie our fieldwork to socioethical decision-making, asking: Should we landscape our campus with flowers each season?

Relating to broader sociohistorical contexts. We ground our orientations to place within broader sociohistorical contexts. For instance, before walking around our campus for fieldwork, we presented on the institutional history of the land, chronicling from the 1800s, when it used to be the campus for (Given name) University, a leading Black university in the South, to the “suspicious fires” in the early 1900s that led the university to move and eventually sell the land to (Historical Teacher College), to the later merger with (University).¹ PSTs reflected on this history as they considered the should-we question around landscaping, integrating history, science, and politics in their ethical considerations.

We also share resources that shed light on the ways that broader sociohistorical contexts shape how we examine and understand the natural world. For instance, in both Modeling and STCs, we present videos during our sensemaking about the rainbow question that detail how our understandings of color are shaped by cultural and political histories. We

¹ Redacted

reflect on how the chemistry of color photography was informed by racialized standards² and how the material production of color reflects our sociopolitical relationships to land and labor³⁴.

Reflecting on pedagogical implications. While the focus of our activities is on our own scientific sensemaking, we also make space for connecting with pedagogy, particularly by considering the specific sociopolitical contexts of our teaching and/or learning. In Modeling, given that most students are not yet student teachers, these reflections often focus on their science learning in gateway undergraduate STEM courses to consider how dominant pedagogical practices shape what parts of ourselves we can bring to science and what we hide away. In STCs, we spend some time each meeting to reflect on our teaching in relation to our scientific sensemaking. The topics of these conversations emerge organically from participants. For instance, teachers have questioned how to assess students' sensemaking in relation to assessment expectations at their school; we later read and discussed a research article that considered more expansive and equitable assessments (Kang et al., 2023). In another instance, STC teachers helped us reflect on when and how to incorporate the history videos in relation to light and color inquiries in the Modeling class to support preservice teachers' learning.

Conclusion

These five phases represent what we have learned about the kind of facilitation work that is needed for fostering expansive and connective sensemaking with secondary science teachers. This framework adds to the literature exploring how to design and study for disciplinary learning environments that engage with heterogeneity (Agarwal & Sengupta-Irving, 2020); here, we focus on expansive and connective scientific sensemaking with teachers as a critical professional learning experience. Engaging teachers in this kind of multidisciplinary work is not meant to be a roadmap for how they should facilitate scientific sensemaking in their classrooms. Instead, we position the Modeling class and STC meetings as speculative spaces to reflect on what is possible in science teaching and learning. Indeed, the STC teachers we shared this framework with saw meaningful connections to how they facilitate scientific sensemaking in their classrooms. By creating more opportunities for science teachers to imagine, play, and reflect together, we hope to empower them to enact more expansive and connective pedagogies for their students.

² <https://www.youtube.com/watch?v=d16LNHIEJzs>

³ <https://www.youtube.com/watch?v=7OiG-WjbCQA>

⁴ <https://www.youtube.com/watch?v=sDQ6p9M9gdU>

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EXPANSIVE AND CONNECTIVE SENSEMAKING

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