Community Ethnography

BY KATHLEEN SCHENKEL, SELENA BLIESENER, ANGELA CALABRESE BARTON, AND EDNA TAN

Community ethnography uses research methods such as observations, interviews, and surveys to learn more about one's community members, their wants, and their needs (Adler and Adler 1998). Students can use community ethnography to deeply engage in the engineering practices of asking questions and defining problems outlined in the *Next Generation Science Standards*, and constructing explanations and designing solutions, thus optimizing their solutions when responding to community wants and needs. Just as important, students can use community ethnography to leverage the various forms of expertise held by people in their community as they draw on engineering practices to help make their communities a more just place to be.

Integrating community ethnography supports more equity-oriented science teaching by supporting students in learning with and for their community. To effectively engage in these practices, students ask questions, gather and analyze information to determine specific challenges to address and define the dimensions of a problem. An example of this is when students made observations of a local corner store; interviewed family members about their favorite dishes; and designed nutritionally-sound, appetizing, and economical meals in their sixth-grade classroom. Throughout this process, students were able to develop and use new expertise about nutrition, metabolic

TABLE 1: Examples of community ethnography stances, pedagogical moves and tools

Stance	Pedagogical Moves	Tools
• Community knowledge matters in defining problems and designing solutions • Multiple community members' input supports defining problems and designing solutions • Students are experts about their communities and should shape how they engage in community ethnography	• Asking students to share the evidence they used in defining problems and designing solutions • Emphasizing the importance of understanding/addressing both the technical and social dimensions of community problems and solutions • Supporting students in analyzing their generated data • Encouraging students to seek more community feedback as needed	• Participant observations • Surveys • Interviews

processes and their community's cooking histories (Calabrese Barton and Tan 2009).

Community Ethnography as Pedagogy involves:

1. **A stance** that community knowledge is a valuable part of disciplinary knowing and necessary for effectively engaging in the practices of defining problems and designing solutions. This is the starting motivation for supporting students using community ethnography.
2. **Pedagogical moves** that support multiple forms of, and purposes for, interactions and interactional spaces for students, teachers, and community members and that help teachers notice, value, and respond to students' cultural knowledge/practice as important forms of epistemic authority.
3. **Tools** that position students and teachers as co-learners of community concerns and their intersections with disciplinary knowing and classroom activity. The main tools we have used in our classroom have been making participant observations, administering surveys, and conducting interviews. These tools support students in defining problems by soliciting information from their community and designing and optimizing their designs by gathering more community feedback. Teachers and students can collaboratively decide which aspects of their communities are most salient to their investigation and focus on using their ethnographic tools with those community members who are experts about those areas (see Table 1).

How to get started

Teachers can plan to use community ethnography in multiple forms throughout a unit. Students can use community ethnography tools in formal ways by designing/administering surveys or interviewing others during a formal feedback cycle. Students can also engage in community ethnography in more informal ways by using ethnographic tools as needed throughout the engineering design cycle. We recommend that teachers plan for both *informal* and *formal* community ethnography opportunities. These approaches help students make decisions in a systematic way throughout the engineering design cycle. The 5E lesson example highlights how community ethnography was incorporated to support creating a solution to a problem.

When introducing community ethnography, ask students to explore why including other people's perspectives matters in engineering. Teachers can do this by talking about engineering projects in their community and why community voices have mattered to the projects. Additionally, ask students to brainstorm which community

CONTENT AREA

Engineering across science content areas

GRADE LEVEL

6–8

BIG IDEA/UNIT

Crosscutting

ESSENTIAL PRE-EXISTING KNOWLEDGE

Some data analysis skills will help, but community ethnography can support students in analyzing quantitative and evaluating qualitative data.

TIME REQUIRED

Ongoing throughout units

COST

N/A

SAFETY

Students should ask for permission first if they are taking participant observation photos that will include people. If students are conducting surveys outside of the school setting for homework, they should have adult supervision and use a buddy system.

stakeholders should be included in the engineering process. Incorporating multiple community stakeholders supports students in balancing trade-offs and designing engineering solutions that are not detrimental to the broader community (Gunckel and Tolbert 2018). It is also important because it teaches students that engineering design should center the needs of the people for whom designs are intended.

A first step to plan for community ethnography in a unit is for teachers to ask, "How does this unit connect to my students and their community's lives?" and

5E lesson example

Ms. B. taught a unit focused on designing ways to investigate and eradicate invasive plant species, focused on the driving question, "How can we help our community stop the spread of invasive plant species, and why should we care?" Throughout the unit, students cycled through three iterations of the 5E model. Below we focus on the second 5E cycle where students designed and conducted an investigation into the biodiversity of their local neighborhood ecosystem and garlic mustard's—the invasive plant under study—impact on it.

Prior to the multiday lesson described below, students were introduced to the unit goal of helping their community stop the spread of invasive garlic mustard. Additionally, they observed the structure and function of garlic mustard to build explanations for how plants reproduce and spread.

The challenge in this lesson was to develop an approach to safely harvesting garlic mustard, which meant reviewing how to identify garlic mustard based on structures, setting criteria for successful harvesting (e.g., get all of the roots, not dropping seeds), developing an approach for harvesting (by practicing harvesting dandelions in their schoolyard without leaving roots and seeds), and creating identification and harvesting guides to use around the school neighborhood using a "biocube" approach (Smithsonian National Museum of History, n.d.). Having students explore the biodiversity of their schoolyard is a powerful way for them to design ways to learn about ecosystems (Harris et al. 2013). Students were supported in developing explanations of the impact of garlic mustard on biodiversity and approaches to supporting biodiversity. Throughout this lesson, the students used the community ethnography tools of participant observations and interviews with members of their classroom and local communities to meet the lesson goal.

Engage

To open the lesson, Mrs. B had students make **participant observations** about the different places they saw invasive plants at school and at a local park. Then she had the students observe the areas around their homes and to talk with family members about if, and how, they dealt with garlic mustard. Participant observations included observations of the plants and people in their neighborhood. Ms. B. used these observations to support students in posing questions about where garlic mustard collection guides might be used, and by whom.

Explore

Ms. B reviewed the results of the previous lesson's plant dissections with students and what they had learned about how plants reproduce and spread. She asked them to consider how this, along with their participant observations, might inform the design of a garlic mustard harvesting guide. The students initially brainstormed criteria for a guide based on the structure and function of the garlic mustard and experiences harvesting dandelion plants. They then used these criteria, in groups, to design a potential collector, including a set of guidelines for how to use the garlic mustard harvesting guide.

In this part of the lesson, the students conducted **interviews.** For example, groups shared their designs with knowledgeable others, including student peers, facilities staff members (who care for the school property), and

"In what ways might students use their new science knowledge and practices with other forms of expertise, with their community during this unit?" Generate a list of answers to these ideas. Then, teachers can look across the lessons in the unit and incorporate formal opportunities for community ethnography. We also recommend asking students for ideas because they are experts about their own lives.

Additionally, plan and develop procedures in the class community to support students in engaging in informal community ethnography when they decide they need

5E lesson example (continued)

parents. Interview questions focused on eliciting insight into the experiences and challenges in dealing with invasive plants, and the functionalities and user-friendly dimensions of their garlic mustard harvesting systems.

Explain

The teacher engaged her students in three related activities. First, her students tested their systems using fair tests based on their criteria, and then developed explanations for how their systems worked, including ideas for improvements. For example, students in Ms. B's class came up with a three criteria:

- Able to harvest all of the plants
- Did not spread seeds
- Will not let a plant grow out of the roots

Second, students developed and agreed upon additional criteria for analyzing the impact of garlic mustard on their school neighborhood ecosystem using the biocube approach. These criteria include documenting:

- Harvest location
- Number of garlic mustard plants present
- Number of different organisms present

Third, the teacher supported students in developing initial explanations for how and why garlic mustard may impact their school neighborhood biodiversity.

Elaborate

The teacher engaged her whole class in devising a plan to use their garlic mustard harvesting guide in their schoolyard. First, they developed a plan for safely harvesting garlic mustard. Second, in teams, they harvested the garlic mustard and generated data on biodiversity in the process.

Evaluate

A whole-class discussion was held to develop an explanation for school leadership about the impact of garlic mustard on the school neighborhood. Additionally, the class devised a take-home garlic mustard kit (a garlic mustard harvesting guide and a trash bag for safe disposal). The teacher prompted students to explain their choices based on evidence from their participant observations, interviews, and garlic mustard harvesting data.

Key *NGSS* Performance Expectations Addressed:

MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics

Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

to leverage it as a tool. For example, consistently ask students to share participant observations when they brainstorm ideas, or if students request feedback on their design solutions, ask: "Who else could you talk to for more ideas?" Teachers can display anchor charts with these and other prompting questions to support themselves and their students when engaging in community ethnography to better define problems and design solutions.

In the following sections, we outline how to use the three community ethnography tools. These tools have been used in in-school and out-of-school contexts across multiple units (Calabrese Barton and Tan 2010). These tools can be flexibly adapted in both engineering and science-based units. We share examples of how we used these tools in middle grades science classes during an energy engineering unit focused on making classrooms more sustainable.

Participant observations

Students can make participant observations to support their efforts throughout a science and engineering unit. Participant observations pay attention to the culture, norms/practices, and people and how they interact within a space. Teachers would support students in two steps: (1) making participant observations and (2) analyzing the observations to discern patterns, build evidence-based explanations, and make engineering decisions.

Making participant observations can be both a formal and informal process. As students are defining a problem or designing a solution, teachers could support students in deciding which communities matter in their investigation, and why. From these insights, teachers could then encourage students to consider what they would like to observe in their desired community, and how they might do so. For example, in investigating healthy eating, students could identify the school community as important to their investigation. Additionally, teachers can encourage students to draw on their past experiences and describe and use participant observations they have made in their daily lives. Teachers should elicit students' informal participant observations by asking questions like, "How do you know that xxx is a problem that you want to address?"

Students should be supported in analyzing their participant observations as a way to justify their design choices. This can occur in whole-group conversation and through group work. Teachers should have students consider how their participant observations inform their efforts to define problems or design solutions through group discussions and using graphic organizers (see Figure 1).

When Mrs. B, a sixth-grade teacher, initially supported her students in designing ways to make their classroom more sustainable, she asked students to stop and look around to systematically observe and document routines and the things they use as a class every day. The students took turns sharing ideas about what they used. Then, Mrs. B asked how they could improve those everyday classroom objects and/or routines to support their class in being happier and/or healthier. The students were told that they could use green energy sources, LED lights, copper tape, and ev-

FIGURE 1: Sample survey analysis graphic organizer and student work

What are the top 3 problems kids identified?	What percentage of kids cared about this problem?	Why do you think this is a problem?
needs to be more fun	68.9%	I think this is a problem because we only go outside for recess so I think it
more opportunities to celebrate accomplishments	34.5%	I think this is a problem because if people get good grades they don't get to celebrate
need to do more things as a class to make it different	31.7%	I think it is a problem because some classes get more privileges

eryday classroom materials. The students brainstormed initial design ideas. Mrs. B emphasized that student designs should address both the technical and social aspects of the challenges.

For example, the Knock No More group created a system that used a hand-crank generator, copper tape, and LED lights to design a green energy–powered system that would allow visitors to alert the class community of their arrival without making a loud noise. The Knock No More students made technical participant observations about how the direction that the classroom door opened would impact the location of their circuit, and social participant observations about how to teach visitors to turn the hand crank in a clockwise direction to illuminate lights in the classroom. Students shared these justifications in whole-group conversations, on planning activity sheets, and in design sketches. Mrs. B's pedagogical moves highlight a stance that science and community knowledge mattered in students' engineering efforts. She supported the students in making more participant observations when they needed them, systematically analyzing them for patterns and asking them to justify their decision making with evidence from their participant observations.

Surveys

Students can administer surveys as they are working to define problems that they want to solve with their community. Surveys need to be designed, administered and analyzed.

Teachers and students should collaboratively design the surveys. Teachers can ask students what type of questions they want to ask as they work to understand the technical and social aspects of a problem and solutions. This conversation can happen in whole class and small group conversations. Students can design, administer, and analyze surveys to gather community members' ideas of possible solutions for defined problems as well as highlight community assets that can be used when designing the solution. Surveys can include both free-response questions and multiple-choice questions, and can be designed using paper-and-pencil forms or electronic forms (e.g., Survey Monkey and Google Forms; see sample survey in Figure 2).

Students should be supported in thinking about who should be surveyed. Teachers can ask students: What communities are we most interested in and why? Which community members' ideas matter most to our investigation? Who is most affected by the problems and solutions being designed? Students should first practice administering the surveys to each other before reaching beyond their classroom community. Teachers can support students in making sure they understand and can explain the questions to

FIGURE 2: Sample survey—school/classroom sustainability

1. Which category best describes you?

❏ School Staff

❏ Student

❏ Parent or other adults in the community

2. What challenges related to a healthy and happy school/class community do you think are most important [select 2 or 3]

❏ Wasting natural resources

❏ Need more sense of community

❏ Need to do more things as a class to make a difference

❏ Need to feel safer

❏ More opportunities to celebrate accomplishments

❏ Needs to be more fun

❏ Needs to be more happy and positive

❏ Needs to be more fair

❏ Need more chances to do something important

3. What other challenges related to happy and healthy communities do you think are important?

younger responders when they administer the surveys. Teachers should invite students to explain the survey questions in their own words. This facilitates smoother survey analysis as well as supports the students in better understanding the problems they are defining. Teachers can organize survey sessions or have students make plans to administer the surveys outside of class time. Students should only administer the survey to people they know or under supervision by an adult. Additionally, teachers can share the survey through social media or email to gather additional responses.

After administering the surveys, students analyze their data. This is an important aspect of obtaining, evaluating, and communicating information practice. It is helpful to separate the responses from different community members (e.g., students, adults) to support students in understanding patterns in different groups' views. Students can use graphic organizers to analyze how many people chose each response and patterns in who selected/shared what. The organizers can support students in predicting the reasons for the responses and how to apply insights from the responses to their engineering work (see Online Supplemental Materials for a survey analysis graphic organizer).

For example, in the energy engineering unit, Mrs. B's class reviewed a survey they planned to administer to better understand the sustainability issues that mattered most to their community. They made participant observations before administering the survey and after analyzing it. Mrs. B purposefully had students contribute to the survey design because their expertise as community members mattered. The students added and deleted questions. Then as a class, they decided systematically who they should survey based on who would be affected most by their eventual design solutions and who had expertise that would support their efforts. After the sixth graders took the survey themselves, they chose to survey a fifth-grade class because they were impacted by similar classroom sustainability issues as the sixth graders. Sixth graders also administered the survey to other community members, including Mrs. B, the school custodian, the administrative assistant, and the student services officer. Mrs. B actively encouraged students to find more survey participants because she valued the students' expertise on whose input mattered.

Next, students analyzed what problems mattered most to different community member categories (students, teachers, staff). The students also analyzed the qualitative data by looking for patterns in proposed solutions to sustainability challenges impacting their school community. The students then decided on the problems they wanted to address with their energy engineering designs such as low morale, school bullying, lack of fun, and energy wasting.

Interviews

Teachers can have students use interviews to better understand the technical and social dimensions of the problems they are defining and addressing. Interviews can be used at any stage of a unit. Students need to design, conduct, and analyze their interviews.

First, teachers with students can determine a goal for the interview, such as defining a problem or optimizing a design solution. Then, students should write three to five questions, with a mixture of technical and social questions because engineering solutions that are responsive to community members require attending to both dimensions. Students should then identify who should be interviewed based on who is impacted by the issue they are studying. See Figure 3 for a handout example to support students in designing and conducting interviews.

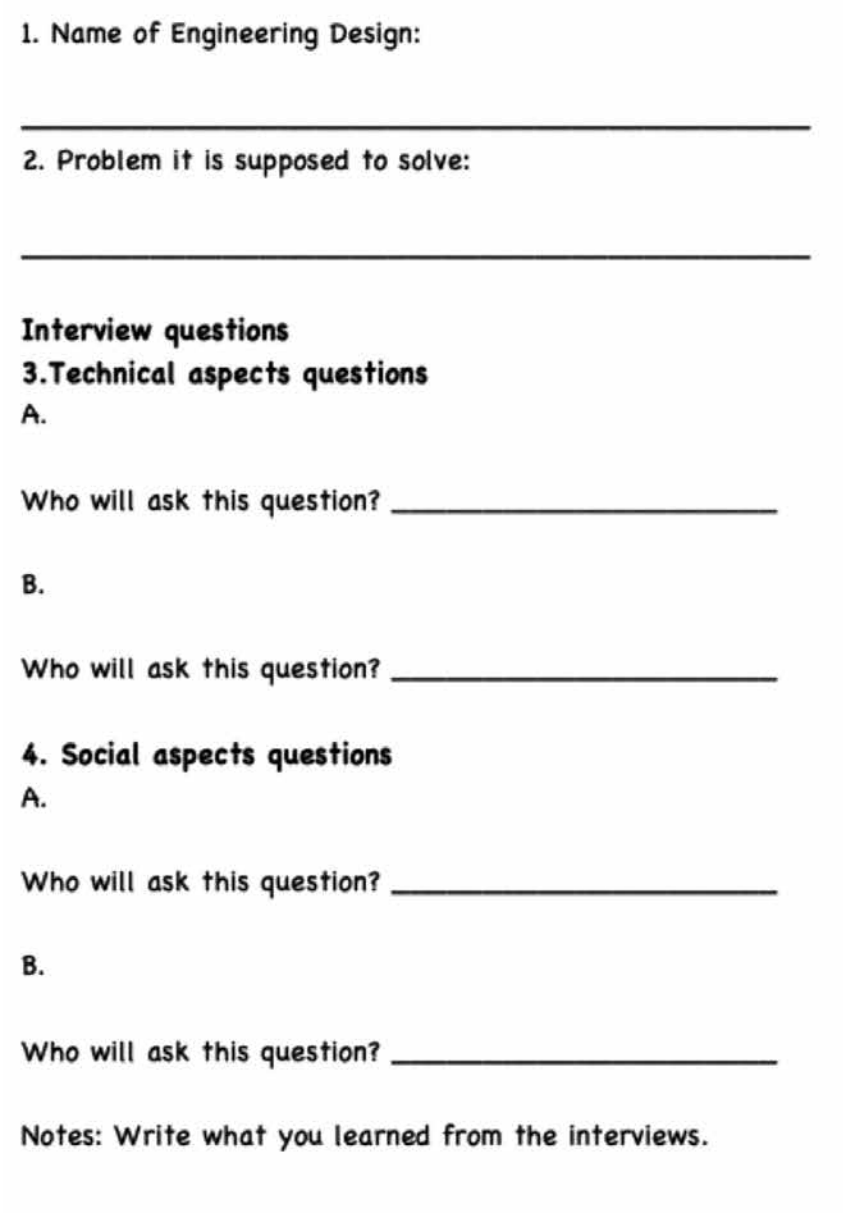
Students in their groups should take turns asking and recording the responses of interviewees. Have students take notes during the interview. Students can interview multiple people using the same interview protocol.

After interviews, students should systematically analyze the responses they received. Ask students to discuss and record: What did they learn? How will it impact their engineering plans? Mrs. B's class conducted interviews after they sketched up their initial design solutions to make their classroom community more sustainable. The students' sketch-

ups were designed to address the problems they defined based on their previous survey and participant observations. In the sketch-ups, each part of the engineering design was labeled with short descriptions of how the engineering design worked. Mrs. B had a conversation with students about how to design an interview that would elicit both technical and social feedback. The students wrote their questions in groups and took turns asking the questions and writing notes on their feedback. They also determined that they wanted to interview community experts and engineering experts because they wanted feedback on both the technical and social aspects of their design solutions. Each group interviewed a local engineer, a parent, and a science teacher. Mrs. B then supported them in reading through their feedback and revising their sketch-ups before they began building them. The students later engaged in another feedback cycle when they shared their built designs with the fifth-grade students that they previously surveyed.

Both rounds of interviewing and applying feedback helped students to optimize their design as well as provide formal assessment information for Mrs. B to be able to analyze how students leveraged the interview data. These interviews occurred during a planned feedback cycle event that allowed every group to get feedback from individuals from both within and beyond the school community.

FIGURE 3: Sample interview protocol design handout



1. Name of Engineering Design:

_____

2. Problem it is supposed to solve:

_____

Interview questions

3.Technical aspects questions

A.

Who will ask this question? _____

B.

Who will ask this question? _____

4. Social aspects questions

A.

Who will ask this question? _____

B.

Who will ask this question? _____

Notes: Write what you learned from the interviews.

Conclusion

Integrating community ethnography into science curricula can support students in balancing technical and social concerns as they work to use science and engineering practices in meaningful ways. The community ethnography tools of participant observations, surveys, and interviews can be used across different units, disciplines, and grades. Planning to use one of these tools in a lesson is a strong step to connecting

students' science learning to their community. ●

ACKNOWLEDGMENT

This study has been generously supported by the National Science Foundation, Grant #1502755.

REFERENCES

Adler, P. A., and P. Adler. 1998. Observational techniques. In *Collecting and interpreting qualitative materials*, ed. N.K. Denzin and Y.S. Lincoln, 377–392. Thousand Oaks, CA: Sage.

Calabrese Barton, A., and E. Tan. 2010. We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences* 19 (2): 187–229.

Calabrese Barton, A., and E. Tan. 2009. Funds of knowledge and discourses and hybrid space. *Journal of Research in Science Teaching* 46 (1): 50–73.

Gunckel, K. L., and S. Tolbert. 2018. The imperative to move toward a dimension of care in engineering education. *Journal of Research in Science Teaching* 55 (7): 938–961.

Harris, C., A. Berkowitz, J. Doherty, and L. Hartley. 2013. Exploring biodiversity's big ideas in your school yard. *Science Scope* 36 (8): 20–27.

Smithsonian National Museum of History. n.d. How to use biocubes. Retrieved from *https://qrius.si.edu/biocube/how-to.*

ONLINE SUPPLEMENTAL MATERIALS

Survey analysis graphic organizer—*www.nsta.org/middleschool/connections.aspx*

Kathleen Schenkel *(kaschenk@umich.edu)* is a postdoctoral research fellow and **Angela Calabrese Barton** is a professor, both in the School of Education at the University of Michigan in Ann Arbor. **Selena Bliesener** is a teacher in the Lansing School District in Lansing, Michigan. **Edna Tan** is a professor in the Teacher Education and Higher Education Department at the University of North Carolina at Greensboro.