Appendix A. Project Snapshots

Elementary School

Farmer Appreciation Project
Project Type: Design Challenge (event)
Driving Question: How can we honor local farmers?
Grade Level and Subject: Early elementary (K–1); literacy and social studies

Leah Obach is a 1st grade teacher at Hamiota Elementary School, which serves an agricultural community in rural Manitoba, Canada. By listening for cues from her 1st graders, Obach designed a project in which students honored the contributions of local farmers.

Obach, who has taught at both high school and elementary levels, says she was doing PBL "before I knew that's what you would call it. Projects have always been part of my teaching." She's also a veteran collaborator. Obach routinely partners on projects with kindergarten teacher Devon Caldwell, whose school is about 45 minutes away. The two met when Obach was a student teacher in Caldwell's classroom and have been collaborating ever since.

The teachers often have their classes "meet" via a Skype videoconference. The interaction gives their young learners a reason to put their speaking and listening skills to good use, while also generating project ideas. "We'll have kids talk about issues or problems that they identify. We want to know, what interests them?" Obach says.

For inspiration about PBL ideas early in the school year, the teachers invited some former students to be guest speakers on a conference call. The older students described memorable projects that had made a difference, such as adopting polar bears or campaigning for litterless lunches. Their conversation not only gave the older students a chance to reflect on their learning, but also provided an engaging entry event for Obach's and Caldwell's students to think about how they might make a difference.

The teachers noticed that their current students were keen on talking about the weather and the effect it was having on farmers. "Kids noticed that their families were feeling stressed about getting their crops harvested. We'd had a good growing season, but all that rain was interfering with the harvest. The kids could tell that farmers were having a hard time," Obach relates.

The teaching partners then prompted students to brainstorm how they might help. That activity led to a range of possible solutions. Some students suggested helping to bring in the crops themselves; others imagined holding a fund-raising event to help farm families. After voting on a variety of student-generated ideas, the classes settled on the idea of hosting a Farmer Appreciation Day.

"It's amazing how perceptive students can be when you give them the opportunity to think about things affecting their community," Obach says, "and then ask how they want to respond. This is what makes for good citizens."

Between September, when the project idea emerged, and November, when the special day took place, students engaged in a variety of learning activities. Obach had no trouble mapping learning goals to the project. "In social studies, there are a lot of curricular connections about understanding our community. For language arts, I knew we would be reading procedural texts (such as recipes) and writing invitations (to an authentic audience)." Math problem-solving strategies would prove useful in a variety of ways, as well. Says Obach, "I knew I could address these goals in a meaningful way that would give students a need to know."

Planning for Farmer Appreciation Day also offered an opportunity to emphasize teamwork. "Sometimes that takes direct modeling—here's how you sit beside someone and work on something together. This is what sharing a job looks like," Obach says. "We'll also talk about what's happening if things aren't going well. Even though students are young, they usually know if something wasn't a good teamwork move. They can

reflect on what they want to do differently next time. These collaboration and teamwork skills are just as important as the content knowledge that students are learning," she adds.

As she watched students work together to plan and prepare for Farmer Appreciation Day, Obach reflected on the difference between an authentic project such as this one and the thematic teaching that's common in the elementary grades. "With a project, the day-to-day learning activities tie together naturally. Students are directing a lot of their own learning. As the teacher, you're pulling in lessons and teaching skills in an authentic way." The teacher is actively teaching and assessing throughout a project, "but it's their work—they've taken ownership of it," Obach says. "It's not you saying, 'This month we're doing a farming theme,' and then trying to get them excited about it. That initial question—*How can we honor farmers?*—is coming from students themselves. That leads to more engagement. Your whole day just fits together so well."

As part of the *Farmer Appreciation Project*, for example, Obach assessed students' procedural writing individually. Each student chose a topic, used a graphic organizer to plan, wrote a rough draft, had an editing conference with the teacher, and then made improvements before producing a final version, which combined text and illustration.

When the big day finally arrived in November, students were ready to greet their honored guests. They had decorated their classroom with posters and artwork, prepared pumpkin cookies from scratch (starting with a giant pumpkin that was donated for the occasion), produced a video, and planned musical entertainment. Guests outnumbered their young hosts almost two to one.

"It was amazing how many farmers came," Obach says. "It was meaningful to them that our students took time to think about them and why their work is important to our community." Students were equally pleased by the adults' response, which reminded Obach why having an authentic audience is so essential to high-quality PBL. "It's powerful to know that someone is seeing the good work you're doing. You're not writing a story or an invitation because the teacher asked you to. You're doing it because you want someone else to enjoy what you're creating."

How to extend this project:

To expand literacy connections with older students, consider having them produce a book or video documentary to raise awareness about an issue of concern in their community. Look for opportunities to incorporate service learning, too, and have students reflect about what they learn by engaging with their community.

Powerful Communities

Project Type: Solving a Real-World Problem

Driving Question: How might we design a more peaceful community?

Grade Level and Subject: Primary/early elementary; literacy, social studies

When minor conflicts between students started to migrate from the playground into the classroom, a team of 1st grade teachers turned a problem into an opportunity for inquiry.

Teachers Beth Lopez, Glenda Forgie, and Freny Dastur are the 1st grade team at the American School of Bombay in Mumbai, India. They designed the *Powerful Communities* project to engage students' problem-solving skills and also address grade-level learning goals for social studies that focus on the role of communities.

To scaffold the inquiry experience for young learners, teachers introduced students to the process of design thinking. The design-thinking process, used in a variety of industries as well as in education, typically starts with an empathy phase: understanding a problem by studying and engaging with those most affected by it. During this phase, students made observations about conflicts they noticed in and around campus—a community in microcosm. They analyzed the data they gathered to detect patterns and pinpoint where conflicts were most likely to occur, and then shared their findings by creating graphs. Through their analysis, students were able to group problems into types, such as small problems (that students should be able to resolve themselves) and big problems (that might need help from an adult).

Literacy skills also came into play. During read-alouds, students discussed conflicts in children's literature and noted how different literary characters responded to tensions. Students put their listening and speaking skills to good use, too. For example, they interviewed their school principal and other experts about the importance of a peaceful environment for learning.

When students were ready to generate possible solutions, they used a graphic organizer to capture their thinking. Three prompts asked students to describe (in words or pictures, or both)

- Our problem is …
- Why is this a problem?
- Ideas for solving the problem

With their ideas in this shareable format, students were ready to select solutions they wanted to prototype. Among the community-improvement ideas they tested were posters to ensure a conflict-free boys' bathroom, signed community agreements for peaceful playground behavior, and solutions to issues such as teasing or not sharing. The solutions they deemed most effective were adopted across the grade level to encourage a more positive learning community.

In a final reflection about the project, teachers noted heightened engagement for both students *and* teachers (Lopez, Forgie, Dastur, & Hoffman, 2014). Benefits were long-lasting, with improved classroom culture continuing long after the project concluded. During conferences, many parents remarked that their children were even becoming better problem-solvers at home.

How to extend this project:

Use the design-thinking process to engage students in problem solving about an issue affecting their campus. For example, they might want to focus on strategies to reduce neighborhood traffic, expand school recycling efforts, increase parent involvement, or reduce the school's carbon footprint. Incorporate data gathering and statistical analysis to increase math content and build students' informational literacy during the research phase.

Home Sweet Home

Project Type: Design Challenge

Driving Question: How can we design a habitat for the Detroit Zoo?

Grade Level and Subject: Upper elementary (grade 4); ELA, science

When the Detroit Zoo announced plans to build a $21 million conservation center dedicated to penguins—complete with an indoor viewing area where visitors will be able to watch the aquatic birds explore underwater—teachers at Village Oaks Elementary and Deerfield Elementary in Novi, Michigan, saw an opportunity for their 4th graders to dive into their own investigation of habitats.

They designed the *Home Sweet Home* project to address specific learning goals for reading and writing, along with science. Teachers saw opportunities for technology integration, as well, by having students use iPads to research and document their investigations with photos and video.

To add authenticity to the project, teachers contacted an education expert at the Detroit Zoo. Adam Dewey wrote a detailed letter to students that became the entry document for their project. In it, he invited students to collaborate with the zoo on designing models for animal habitats. He emphasized specific design criteria, such as considerations for animal welfare, positive guest experiences, and zookeeper safety. Student teams had the opportunity to choose a species that interested them, and then design a model habitat that would meet all criteria.

Myla Lee, PBL coordinator for the Novi Community School District, was impressed by students' depth of inquiry and critical thinking in the project. "They took this to another level. They were not only thinking about predator/prey relationships, life cycles, and survival, but also about the architecture of zoo exhibits," she says. Students learned about the behind-the-scenes features of zoos that separate predators from prey and help zookeepers stay safe. "There are trenches and barriers that animals can't get over, but you can't see those as a zoo visitor."

As students developed their habitat plans, Lee could see their critical thinking and creativity getting a workout. "They started asking questions like, 'If an animal can hop this far, how high would the fence or barrier need to be?'" Some students designed exhibits with an emphasis on accessibility for visitors with disabilities. One girl added a waterfall feature to her exhibit. "She designed it to be a water-purification feature to benefit animals, but also to be aesthetically pleasing to visitors. She realized that people are attracted to exhibits that look cool," Lee says.

During the revision process, teachers and outside experts gave students critical feedback to help them improve their plans. One student's aunt, for instance, happened to have experience working at the zoo and agreed to offer constructive feedback. Teachers challenged students to be true to animals' habitat needs but also go for the "wow!" factor that would attract human attention to their exhibits. That got students thinking about the use of color, artwork, and other elements. "They started thinking like architects and interior designers," Lee says. Students wrote informational texts about their habitat designs, explaining the scientific basis for their designs and demonstrating their in-depth understanding of ecosystems.

At the culminating event, the zoo's education director came to listen to students' presentations. He asked detailed follow-up questions about the thinking behind their design decisions. Parents had a chance to watch, even if they couldn't attend in person. Teachers livestreamed the presentations via Adobe Connect. Some teams also presented their work to the school's Parent Teacher Organization. "Parents said they didn't realize how creative their own kids are," Lee says. "They could see this was out-of-the-box thinking." (You can read a case study about Novi Community School District's approach to building teacher leadership for PBL on page 150.)

How to extend this project:
With older students, expand career exploration opportunities by having students interview technical experts (such as architects or zoologists) about their professions. Expand math content by having students produce detailed budgets about their proposals. Integrate geography by having students analyze habitat loss in the regions where endangered zoo species are native.

Upper Elementary/Middle School

The One and Only Ivan Global Project
Project Type: Taking a Position on an Issue
Driving Question: Do we have the right to capture and cage animals?
Grade Level and Subject: Upper elementary/middle (5th grade); ELA, social studies

Fifth grade teacher Heidi Hutchison from Friends School of Baltimore was attending an education conference when she hit on the idea for a collaborative project. What would happen, she wondered, if students from different communities read the same novel and then, by sharing their responses, created a new book together? She imagined a digital writing project that would incorporate technology and build students' global competency while also meeting learning goals for language arts.

The provocative novel that Hutchison chose as an anchor text for the project is *The One and Only Ivan* by Katherine Applegate. It tells a fictionalized story about a captive gorilla. Inspired by a real-life story, *Ivan* provides an emotional hook for readers to think critically about complex animal rights issues. Hutchison set up a wiki describing the project. She posted her idea on a collaborative site called the Global Classroom Project and shared the link with her personal learning network. Before long, teachers from five locations had joined the project (and many more expressed an interest). Participants agreed to have their students respond to the same driving question: *Do we have the right to capture and cage animals?* They also agreed to have their students read the same novel, write research-based responses, and share their writing with a public audience. What's more, students would have the opportunity to help animal rights organizations by donating any proceeds from the sale of their collaboratively written digital book.

"I wanted to make the project grow-able," Hutchison says, "to see if other classes would be interested in answering the same driving question." She mapped out the project that reflected the Gold Standard project design framework. She also identified videos and readings that would be useful for building students' background knowledge, such as a video interview with author Katherine Applegate and *National Geographic*content about endangered wildlife. To model best practices, she documented and shared her own students' need-to-know questions as they embarked on the project.

Hutchison also drew on her prior experiences with PBL, including an earlier global project involving the rights of girls to receive an education. "I knew that a project like this [Ivan] would teach writing," she says, "but I also wanted to include digital citizenship, global citizenship, and empathy among people from different backgrounds." Students discovered there are no clear right-or-wrong answers to many of their questions about animal rights, causing them to dig deeper into research and think critically about everything from pet ownership to loss of habitat.

Within the context of the Ivan project, Hutchison found ample room to differentiate instruction based on students' needs. "Students who were only ready for simple research could write about one specific species. But those who were ready to go deeper could get into more complex issues. PBL offers a natural fit for differentiation. There's room for all students to experience success."

By spring, all participating classes had finished drafting and polishing their content—enough original material for a 250-page digital book. Hutchison's husband, an instructional technology specialist, provided technical assistance with iBooks Author.

Hutchison acknowledges that the collaborative writing process "was sometimes messy. Students were constantly revising." But students were motivated to do their best work, she adds, because they knew their digital book would reach a public audience. "Students realized that their book was going to help educate the public about an important issue. That was a huge motivator." When the book was ready to publish electronically (via the iTunes Store), students from participating classes held a Skype discussion about which organization should benefit from book proceeds. They chose the World Wildlife Fund. Teacher Robin Farnsworth, based in Utah, created a Facebook page to help publicize the collaborative effort. "Then her students decided to make up a song to promote the book. This project has taken on a life of its own," Hutchison says. "It becomes so rich when students take ownership."

How to extend this project:

Adapt the project for older students by choosing a different work of literature as a shared reading choice. To build global competency, consider having students from different geographic locations collaborate on the same project teams via Google Hangout, Skype, or another platform for connecting across distances.

The Cancer Project

Project Types: Conducting an Investigation; Design Challenge (event)

Driving Question: How can we support cancer research?

Grade Level and Subject: Upper elementary/middle (5th grade); science, ELA

The study of cells took a personal turn at Dupont Haley Middle School in Nashville, Tennessee, when a 5th grade student shared her story of being a cancer survivor. CiCi Collins was first diagnosed with a form of brain cancer at age 3. By the time she entered middle school, she had endured surgery, six rounds of chemotherapy, 12 weeks of radiation treatments, and was cancer-free.

CiCi's courageous story made the study of human biology and medical research both relevant and compelling for her classmates. Teacher Pamela Newman leveraged student interest to design a project that aligned with academic standards in science, English, and technology. Through the project, Newman wanted students to research a real problem, identify possible solutions, and share their findings with an audience of parents and other community members. CiCi and her family agreed to share their story as part of the project.

Students took on the challenge, and then some. Along with educating others, they brought visibility and financial support to those on the front lines of cancer treatment.

As the project unfolded, students conducted in-depth research into plant and animal cells. To learn more about cancer cells and how they differ from normal cells, they connected with scientists through a program at Vanderbilt University. Experts from the Vanderbilt Center for Science Outreach provided students with access to equipment such as compound light microscopes.

For the culmination of the project, the entire 5th grade teamed up to plan a fund-raiser to benefit Monroe Carell Jr. Children's Hospital in Nashville. Using math, literacy, and collaboration for a genuine purpose, students calculated necessary ingredients for a massive spaghetti dinner and invited the school community. Guests learned about cancer research and treatments by exploring the exhibits and presentations that students created, based on their research. CiCi also shared her own story.

Results: $1,300 to benefit the children's hospital, plus enduring understandings of science and compassion for students and guests alike.

How to extend this project:

Look for opportunities for students to educate the public about the wide range of health issues that may be affecting members of the school community. For example, students might apply their research by hosting health fairs, promoting fitness events, producing public service announcements, or offering nutritional counseling in collaboration with healthcare providers.

Champions of Change

Project Types: Solving a Real-World Problem; Design Challenge

Driving Question: How can we, as filmmakers, encourage our community to recycle?

Grade Level and Subject: Upper elementary/middle (grades 5/6); ELA, science

Residents of Elk Grove, California, are doing a better job of recycling and reusing household materials, thanks in large part to students from Foulks Ranch Elementary School. Through a series of video projects, students have educated their community about the ins and outs of recycling.

Teacher Jim Bentley, who "loops" with the same students from 5th to 6th grades, has discovered that video projects offer a powerful way for students to develop academic understanding while also taking an active role as citizens. He began introducing filmmaking several years ago as part of social studies projects focusing on government and citizenship. He found that making movies offers students an engaging way to develop their skills as writers and critical thinkers. Students also have reason to dive deeply into content to inform their productions. Such explorations can involve traditional research—including sometimes challenging nonfiction reading—and interviews with experts.

One such expert wound up inviting Bentley's students to produce an educational video for the city's integrated waste management department. At the time, Elk Grove was preparing to open a multimillion-dollar recycling facility and needed to teach the public how to safely dispose of hazardous household materials. The program manager had been talking with students about a different project idea they had investigated, which would have involved school-based recycling centers for batteries. She couldn't give the go-ahead for that proposal because of safety concerns. Instead, she invited students to produce an educational film with the city as their client.

That invitation turned into a long-term project. Students went through rounds of script revisions and hours of filming to meet exacting city requirements for the five-minute final cut. "Sixth-graders can sometimes move faster than government," Bentley says. The project was not completed during the school year, which meant that exiting 6th graders had to hand off their project to incoming 5th graders.

"They passed the torch," Bentley says. "I started the new school year with an entry event where I shared with the class, 'Last year's students got this far [with the film]. They need you to finish it.' " The project became a legacy, he says, "something handed on from kids to kids."

The success of that project has generated more requests from the city—and more film ideas from students themselves. Bentley's students continue to produce how-to videos on recycling that are published on the city website. They have more ideas in the works for public service announcements.

Bentley continues to incorporate film projects across the curriculum. Language arts are emphasized in each production. Students often need to read and analyze complex texts for projects that involve environmental science and behavior change. Critical thinking is important when students are assessing sources for reliability and accuracy. Writing comes into play during script writing and storyboarding. "It's hard to imagine teaching reading or writing in isolation," he says. Depending on the film topic, projects may also address science, math, or social studies standards.

Teaching in a self-contained classroom, Bentley is able to structure the day with large blocks of time that are well suited to integrated projects. Working on in-depth projects "is different from trying to cover a lot of content," he says. "I find that students do more deep thinking. They're more willing to question why, to have deep wonderings. They're not like stones skipping off the surface of a lake."

That's not to say that projects always proceed smoothly. "We've had some epic fails," the teacher admits. "I tell students early in the year that this is going to be hard. We talk about grit. I tell them that some of the project ideas they will come up with might involve reading complicated stuff—content written for adults, not for 6th graders. Yet even my most struggling students tell me they prefer learning this way to reading textbooks and doing worksheets. They're willing to be frustrated," he adds, "if they get a chance to do real things. And they love that adults take them seriously."

Meanwhile, students who want to go even deeper into the technical aspects of filmmaking can continue working on projects beyond the regular school day. Bentley and his students have formed the Foulks Ranch Film Academy, which meets after school. This gives interested students time to learn about editing and special effects, leaving the regular school day for the academic side of film projects. Students publish their videos on a YouTube channel, Curiosity Films, which provides yet another audience for their work.

How to extend this project:

If you teach in a single content area, look for grade-level collaborators who are willing to team up on cross-curricular projects like this one. Help high school students see how doing projects for authentic clients can help them meet service-learning requirements.

Systems Thinkers

Project Type: Solving a Real-World Problem

Driving Question: What is our school's waste management system, and how can we improve it?

Grade Level and Subject: Upper elementary/middle; environmental science

Nathan Mulhearn, a year 5 teacher at St. Francis College in Crestmead, Australia, wants his 10-year-old students to realize that they have the potential to be tomorrow's change agents. To put their innovation strategies to work on a real-life challenge, he designed a project to upgrade the school's outdated waste management system.

As an entry event, students took a walk around their campus and made observations. Some students noticed litter, which prompted a discussion about the location of trash bins. When Mulhearn introduced the phrase "waste management system," students wondered what that meant. And so their investigation began. Students took on the driving question, *What is our school's waste management system, and how can we improve it?* For Mulhearn, this question met several requirements: it addressed content standards in science and geography; it integrated 21st century competencies, including innovation and creativity; and it involved an authentic purpose and audience because the school was committed to upgrading its waste management system.

Working in teams, students began researching the current state of waste on their campus. They collected data about the amount of trash sent to the landfill daily and also investigated global waste issues. Then they expanded their research to learn about sustainability strategies that could reduce solid waste. A Skype call connected them with a sustainability expert from the United States.

Ready to apply their understanding, student teams moved into the idea-generation stage. Mulhearn and his teaching partner, Belinda Ciuffetelli, encouraged students to think critically and creatively about potential solutions. To encourage iterative rounds of testing and improving on ideas, teachers reminded students that

commercially successful products such as the iPhone have gone through multiple versions. "They didn't get it perfect the first time," Mulhearn says.

With 56 students in their two classes, the teachers found tools like Google Docs helpful to keep the project organized and also to capture students' reflections throughout the project. When students were actively working on the project, the teachers opened a moveable wall between their classrooms to encourage real-time collaboration.

Students presented their proposed solutions to two rounds of audiences: first, to peers and teachers; next, to parents and school administrators at a celebration of learning. Students fielded a range of questions. They explained how they had arrived at their ideas, how specific ideas could be implemented, and how much their proposed solutions might cost to implement.

Mulhearn says the project was meaningful to students and fulfilled an educational purpose. At the end, there was no doubt in students' minds that they were tackling an authentic issue. The parent committee agreed to fund a new waste management system for the school.

How to extend this project:

Be on the alert for initiatives that have to do with the physical plant of your school and leverage the learning potential of future construction projects. For example, if your school is updating its heating system, have students investigate the potential for solar panels or other alternative energy sources. Worthy project ideas don't have to involve major expenditures. A geometry class, for example, might suggest how to restripe the parking lot to minimize the potential for fender benders. Elementary students might use words and pictures to document change over time of a construction project.

House Hunters

Project Type: Design Challenge

Driving Question: How can we, as mathematicians, calculate the materials needed for renovating a house?

Grade Level and Subject: Middle school (grade 7); geometry, pre-algebra

Rosine Borello and Jennifer Lee team-teach 7th grade math at Bulldog Tech Middle School in San Jose, California. Their content is defined by the Common Core State Standards (indeed, their class was recently renamed Common Core Math 7). Yet these teachers find plenty of flexibility by designing projects with authentic problem solving in mind.

Their students have come to expect math class to relate to their lives, whether that means modifying a recipe or balancing a budget. Says Borello, "We never have students asking us, 'Why do we need to learn this?' We link everything we do to careers, to life skills, and to problems that they will have to solve in their lives. We hear them discussing math as if they are mini-architects, engineers, or chefs. It's exhilarating." Renovating a home is one such problem their students have tackled through the lens of mathematics.

Inspired by a friend who was featured on the television series *House Hunters*, they designed a project to calculate household renovations on a budget. Their friend, who happens to work at Google, provided an authentic public audience for students' final presentations (and also shared career insights from the tech sector).

For the project, student teams were tasked with preparing a blueprint and performing a series of calculations. Students took on different responsibilities, as if they were subcontractors bidding on a job. For instance, students assigned to install baseboards throughout the home had to calculate the perimeter of all rooms in linear feet. Those in charge of kitchen remodeling had to figure out the volume of cabinets that they planned to install. The painters had to accurately calculate the area of exterior and interior walls, allowing for window openings. "We taught everything—perimeter, area, volume—through the design of a home," Lee says. Each subcontractor prepared a separate bid and then collaborated with team members to write an overall project budget that had to stay within specific constraints.

The *House Hunters* project lasted several weeks and included a culminating presentation to a panel. The teachers alternate full-blown PBL with shorter-term problems, which may last for just a few days and usually

don't involve an audience. For example, problems have focused on comparing the fuel efficiency of teachers' cars or modifying a favorite recipe to feed a crowd.

Regardless of scope, the day-to-day learning experience feels consistent. "We use problems to drive our curriculum," Borello explains. In longer projects, those problems all relate to the same driving question. "Longer projects are made up of a series of smaller, related problems."

The math teachers collaborate to design projects, following popular bloggers like Dan Meyer and Geoff Krallfor inspiration. They also work closely with the language arts team at their school. "We look to language arts teachers to help us scaffold the writing tasks in math," Lee says. "By working together, and also bringing in outside experts when we can, we try to make projects as rich as possible." Reimagining math with a PBL focus takes time, "but when you see students excited to be learning math, it's worth every bit of effort," says Borello.

How to extend this project:

Adapt the *House Hunters* idea for high school students by incorporating an analysis of housing prices in specific neighborhoods and recommending which remodeling "fixes" would add the most value to a home. Or consider adding energy efficiency requirements to the remodeling task and having students calculate how long investments would take to pay off. Integrate technology by asking students to develop 3-D models of their design proposals, or challenge them to think bigger and redesign an entire neighborhood around specific constraints.

Civil War Technologies

Project Type: Conducting an Investigation

Driving Question: How did your technology change the Civil War?

Grade Level and Subject: Middle (grade 8); U.S. history

History teachers Jody Passanisi and Shara Peters want their 8th graders to remember more than the key battles of the Civil War. "To me, what's important about the Civil War is how it has shaped the American psyche and culture. That might be a little much for 8th graders," says Passanisi, "but they can see how things that happened during the Civil War still matter today."

That's why these teaching and writing partners (known on social media as @21centuryteachr and on MiddleWeb as Jody&Shara) designed a project in which students trace the lasting effect of Civil War technologies. "Technology is tangible. Students can see the reverberations through time," says Passanisi. What's more, adds Peters, "Our kids are living in an age when things are invented every day. They appreciate how a technology can impact life. That's not a foreign concept to them."

To launch the Civil War project, which they have taught multiple times, the teachers have students make connections between today's technologies and inventions of the past. "We might have them brainstorm technologies that are used for war and defense today. They do a quick-write about the role of technology in war," explains Peters. Teachers also share a video clip from the History Channel's *Modern Marvels*, showing examples of diverse technologies that debuted during the Civil War. "They start to see that there are many ways of looking at war through the technology theme," Passanisi says.

The entry event sets the stage for teachers to introduce this driving question: *How did your technology change the Civil War?* As they begin the inquiry process, students form project teams based on shared interests, such as technologies relating to medicine, communication, transportation, or even food. "We added food as a category this year [spring 2014]," Passanisi says, "and that was very popular." Students were surprised to learn that tin cans—the precursor to today's meals ready to eat, or MREs—were among the innovations that kept soldiers nourished during the Civil War.

Students are expected to research their topic and reference both primary and secondary sources. As a culminating product, each team produces an artifact that represents its chosen technology. Teams present their work to an audience of peers, teaching each other jigsaw-style about the various influences of Civil War technologies. Students have wide latitude to determine their final product, but all teams are assessed by the same rubric. "They might choose to make a model of a ship or write a song or build a working telegraph,"

says Peters, "but whatever form their product takes, it needs to be beautiful, thoughtful, shareable, and relate to enduring understanding."

Advances in contemporary technologies have affected how students interpret the past. As students have gained access to tools such as Tinkercad and MakerBot, they've used 3-D printing to build minireplicas of Civil War weaponry and warships. One team constructed its own working telegraph, capable of transmitting messages from classroom to classroom. That team impressed Passinisi with its grit—its capacity to overcome obstacles en route to success. Their experience is a good reminder that allowing time for iterative rounds of feedback and revision, learning through trial and error, is important in project design that emphasizes creativity and innovation.

Passanisi and Peters credit two educators for shaping their approach to PBL. Ron Berger, author of *An Ethic of Excellence* (2003), has been a key influence by encouraging projects that result in "beautiful work." Gary Stager, author and education consultant, helped to deepen their understanding of PBL during a workshop he led several years ago.

For Passanisi, a decade into her teaching career, the gradual shift to PBL has been a natural evolution. "When I began teaching, my main focus was constructivism. Back then, 'projects' weren't taken seriously. As I've learned more about PBL, I've found that it's very different from an activity. PBL provides a way to actualize constructivism. It provides a focus for student-driven learning," she says. "We're not telling students, "Here are the important things that happened during the Civil War. 'Instead, we're allowing for student discovery [of key knowledge and understanding]."

It's no accident that Peters shares a similar outlook. She did her student teaching in Passanisi's classroom. The two educators have been collaborating and stretching each other's thinking ever since. (Until recently, both taught at the same independent school in Southern California. Peters recently moved to a new job, but they plan to continue teaming up on projects.) Since her teacher-prep days, Peters says she has been drawn to many of the hallmarks of Gold Standard PBL, such as authenticity, critique and revision, and student-driven inquiry. "For me, those tenets were there from the beginning of forming my teacher identity."

The teaching team has used the same Civil War project idea multiple times, revising and updating it each year. "It gets better each time we do it," says Peters. The last time they did the project, several students used Twitter to connect with Civil War experts. The teachers hope to expand on the use of social media in the future and also are thinking about connecting their students with a wider audience through online publishing.

One recent modification has been adding more scaffolding to help students manage their learning. Passanisi has devised a simple checklist, for instance, to remind students of the process steps, from research and source evaluation to product development to crafting a presentation. She acknowledges a tension between "giving students parameters and guidelines, but not thwarting their creativity. I'm always trying to manage that tension between how slack, how taut in terms of autonomy." Simple project tools, such as due dates for milestone assignments, help students manage their own learning. "It's awesome to see them take charge of their own time. With the right scaffolding, they know they're in charge, but they also know what they need to do."

Passanisi is intentional about providing students with a wide range of learning experiences, not all of which are PBL. The unit before the technology project is a more traditional study of the causes of the Civil War. That builds students' background knowledge. By the time they move into the technology unit, she says, "they have some historical context. They're ready for this, and confident."

How to extend this project:

Connect the theme of technology's changing role to a wide range of other content areas, such as human geography, science, literature, or media literacy.

High School

Freedom Fighters Project

Project Types: Exploring an Abstract Question; Design Challenge

Driving Question: How can we honor community members who stand up for justice?

Grade Level and Subject: High school; humanities (interdisciplinary, ELA and history)

A student named Julio from Roosevelt High in Portland, Oregon, started his freshman year doing a project "as a class requirement I wasn't so excited about. By the end, it changed my life and opened my world" (Boss, 2014a).

Julio was describing the *Freedom Fighters Project*, which has become a tradition at his diverse urban school. An interdisciplinary humanities project, it challenges students to uncover stories of individuals in their community who have taken a stand for social justice. Students interview these unsung heroes, write essays about them, and compile their best work into a book. In the process, they hone their writing skills and learn about the history of the civil rights movement. Then they create museum-quality exhibits that they take into the community, sparking conversations about sometimes difficult topics and putting their communication skills to effective use.

The *Freedom Fighters Project* began as a summer writing experience to amplify student voice in the community. Two 9th grade teachers—history teacher George Bishop and English teacher Shawn Swanson—have taken up the *Freedom Fighters Project* in the humanities class that they teach together. They started with 90 students in 2012 and had 120 freshmen participate in the project a year later.

"I found a home for this project within the Common Core State Standards," Swanson explains. Students gain experience gathering information as they prepare to conduct interviews and put informational writing skills to use as they craft and revise essays.

The project doesn't stop there. "Students were inspired by the stories they heard, but inspiration isn't enough," Swanson explains. "I told them, 'You guys need to be the next Freedom Fighters.' " As the final phase of the project, he has students "pick an issue close to your hearts and write a speech about it." In the process, they learn to make compelling arguments and back up their words with evidence.

Julio, for example, wrote a powerful speech about immigration and race, which he has delivered to large community audiences. He was inspired by the Freedom Fighter he profiled, a local nonprofit leader who promotes intercultural communication and helps immigrant families understand their rights.

Julio not only found his confidence as a public speaker but also gained insights that will last long beyond his freshman year. Issues about immigration, race, and the achievement gap are complicated, he admits, "but it got simpler for me. I have a clearer view now. I have a better understanding of why things happen—cause and effect. I can see others' points of view. I understand what I'm doing, where I'm going."

Projects that emphasize service learning naturally encourage reflection. A student named Leticia, for instance, reflected on her own young life when she interviewed a community leader. The woman told Leticia that she was homeless during much of her childhood but managed to find her purpose in helping others. That resonated with Leticia, who has six younger siblings. "I try to guide them, to inspire them. I want the best for them," she says. Because students wanted to do justice to the stories they hear, they invested "so much time and effort," adds a student named Hannah. "This isn't like reading a textbook and taking notes. It's real life."

Having an authentic audience for their work has been key to the success of the *Freedom Fighters Project*. Since the project began, more than 3,000 people have seen the Freedom Fighter exhibits at settings ranging from the state historical society to churches to college campuses. That exposure gives the project visibility and helps to sustain it. Community members who have been recognized as Freedom Fighters have become supporters of the project, nominating others whose stories are worth telling and building stronger connections between school and community.

How to extend this project:

Look for opportunities to connect speaking and writing skills across the curriculum. For example, have your students present their scientific research to a public audience or produce a museum-style exhibit to educate

community members about an issue they've investigated. Adapt the project for younger students or English learners by scaffolding the research process with suggested question starters or interviewing guidelines.

Up to Par

Project Type: Design Challenge

Driving Question: How can we use geometry to design a challenging miniature golf course?

Grade Level and Subject: High school; geometry, technology integration

At an indoor miniature golf course not far from Tech Valley High School in Rensselaer, New York, freshmen and sophomores walked the artificial greens with tape measures and protractors in hand. As they attempted various shots to maneuver golf balls over bridges and around obstacles, they paid attention to what was happening—mathematically speaking—when they attempted bank shots or double-bank shots. This was their entry event for a project in which they were asked to apply their understanding of geometry to design a challenging miniature golf course.

Math teacher Jason Irwin, a career-changer from engineering, regularly designs projects that help students make connections between math concepts and real-world applications. Those connections were hard to miss when students were asked to come up with their own miniature golf designs. To add authenticity to the challenge, the golf course owner took on the role of client. "He told them he's had the same basic golf course for 25 years. He wants some new designs to attract business," Irwin says. At the end of the project, students would be pitching their designs to him.

Back in class, Irwin and his students discussed the project in more detail and together developed a problem statement. In student language, the problem statement defines the role that students are taking on (in this case, mini–golf course designer) and the purpose for the assignment ("to help our client, the golf course owner, create great experiences for customers"). "It defines the what and the why of the project," Irwin explains. The teacher also shared his own driving question for the project, which focused clearly on math content goals: *How can we design a miniature golf course that incorporates the properties of triangles and transformations?*

Next, Irwin invited students to suggest possible golf course themes and then grouped them in teams based on common interests. As part of his team management, Irwin has students draw up team contracts that spell out norms and expectations. He also asks them to identify who will take on specific roles related to collaboration. For example, he typically asks one student to be the accountability manager, tracking process and time line, and another to manage documents and team organization. "These collaboration roles help ensure that team members are following the process and staying organized," he says.

Working through the design process, students started generating and sketching rough ideas. They critiqued each other's concepts and made several rounds of improvements. Because Irwin wanted to emphasize specific math concepts, he required students to make their first designs by hand. "Using graph paper leads to content in geometry that I need them to acquire," he explains.

Technology tools enabled them to move into 3-D design. Some students used SketchUp, while those with more technical fluency used computer-assisted design (CAD) software.

The project allowed ample room for creativity, along with specific math content. Students incorporated special effects to make their designs more appealing to specific audiences. One team, for instance, went with a Candyland theme, appealing to younger mini-golfers, while others pursued more futuristic or jungle-themed designs to attract different demographics. At the end of the project, students e-mailed their final designs in presentation format, along with a persuasive pitch letter, to the golf course owner.

The miniature golf design project is one that Irwin has used multiple times, but each year with a different community partner. Some golf course owners come to Tech Valley to hear pitches, and others prefer to review proposals in writing. "Every year is different," Irwin says, "with new ideas from students' creativity."

How to extend this project:

Incorporate additional math content by having students calculate proposed costs of implementing their designs, projecting how much business would have to increase to pay for the remodel, or calculating

different options for financing the improvements. If you have access to a makerspace or work area for making prototypes, have students produce 3-D models to scale.

Global Happiness, Local Action

Project Types: Exploring an Abstract Question; Conducting an Investigation; Design Challenge

Driving Question: How can we use data, creativity, and community to make the world a happier place?

Grade Level and Subject: High school; English, digital media, social studies

English teacher Valerie Hoover was looking for a way to connect her students' reading of the classic American play *Our Town* with community service in their own hometown of Rochester, Indiana. Then she heard about the *Global Happiness Project*, an exploration of happiness that incorporates statistics, global awareness, and creative problem solving. "This became our springboard," she says, for a project that integrated literature study, digital media, and community service.

Hoover planned the project in collaboration with Rachel Haselby, who teaches digital media. They team up to teach a course called Digital Communication (better known as DigiCom) at Rochester High.

The *Global Happiness Project*, designed by the New Tech Network, took place during the 2013–14 school year. It engaged more than 200 classrooms from around the globe in answering this driving question: *How can we use data, creativity, and community to make the world a happier place?* The loosely structured project provides a framework of questions about happiness, along with resources to support students' investigations. It's left to each teacher, however, to determine how the project will meet specific learning goals and connect with students' interests.

Hoover set the stage for the project by having her students take a survey about happiness that was designed specifically for the *Global Happiness Project*. "Our kids took that survey right before spring break. When we all came back, we used the statistics [from the global survey results] to start our project." Results from around the world were compiled using an online platform for data analysis called Tuva Labs, which enabled Hoover's students to examine statistics by geographies, age levels, and other factors. They also were able to look at results for only their community. "We had class discussions and did some journaling about the differences in how people responded [to questions about happiness]. That brought the topic of happiness home," Hoover says.

Hoover organized the project in three phases: Defining Happiness, Connecting to the Community, and Giving Back.

Defining Happiness. The survey provided a natural entry point for having students define happiness. They also watched a documentary called *Happy*, exploring the science of happiness. Then, in readers' theater style, students read *Our Town* and analyzed playwright Thornton Wilder's take on happiness.

As a result of their research and literature study, Hoover says, students decided to focus their next steps on three factors that relate to happiness: to live in the moment, to give back, and to connect to your community. Their driving question for the project was a direct quote from the *Our Town* character named Emily. In the third act, she asks, "Do any human beings ever realize life while they live it?—every, every minute?"

Connecting to the Community. Rochester, like fictional Grover's Corners where *Our Town* is set, is a small town. "Students realized that if they were going to connect to their community, they needed to learn more about it," Hoover says. "Many students have lived here their whole lives but don't really know the history of the place. And it's a cool little town."

Students chose a place, a person, or an episode in history that interested them and then wrote short nonfiction narratives. Students went through the writer's workshop process, improving their essays. "They wanted their writing to be perfect," Hoover says, because the essays were intended for a public audience. Students posted their polished essays to their class website, along with photos, and then created QR codes that linked to each entry. Students then wrote a letter to each location they had written about, explaining the project and asking recipients to display the QR codes. "When people go around town, they can scan these codes and learn more about this place and what it used to be like," Hoover explains. Students produced

about 60 essays, focusing on everything from the historic courthouse with lions carved from stone to forgotten graveyards to sites where the circus used to come to town.

Giving Back. Hoover says she stretched her own goals with PBL by asking students to choose a local community action for the final phase of the project. "I've never done anything quite so open-ended," she says. "There were no parameters of what they could do. I even left the group size up to them. Once they chose a community action, they would need to figure out how many people it would take to complete."

Student response exceeded the teacher's expectations. "They came up with the best ideas ever!" Six boys who were involved in 4-H activities decided to paint the horse barn at the county fairgrounds. Two students teamed up to clean up a local park. Others made presentations at the local elementary school on topics such as how to prevent bullying. One team, inspired by a TED talk, made a "[Before I Die](#)" board. It's a place where community members can post their wishes for the city. It's posted at the school football field, a popular gathering spot. To encourage reflection about their service efforts, Hoover had students create photo journals to document their local action.

Although the project was ambitious, it took only about three weeks of actual class time, Hoover estimates. Community service was done during out-of-class time.

Now several years into teaching with PBL, Hoover says she has gotten more comfortable with meeting learning goals through engaging projects. "That was the hardest thing for me, as an English teacher, when I started doing PBL," she admits. "I realized that you don't have to change everything you did before." When students were reading *Our Town*, for example, she had them answer reading comprehension questions and gave a test at the end. "You can still incorporate a lot of traditional elements in PBL."

The benefit of teaching English via projects, she says, is that students "gain a deeper understanding of literature than they would just by answering my questions. I get more participation in the literature than I used to, because students can see that it's connected to the project."

In this project, students also got to participate in a global exploration of an interesting subject. Students from around the world who took part in the *Global Happiness Project* all tweeted out their reflections and insights on the same day.

How to extend this project:

Connect with a math teacher to expand on the opportunities for data gathering and statistical analysis in this project. For younger students, choose an appropriate literature selection that explores themes of happiness.

An American Student in France (Un Lycéen Américain en France)

Project Type: Design Challenge

Driving Question: How can Nicolas and his friends help an American exchange student to their school integrate into their community and to French culture in general?

Grade Level and Subject: High school; French language and culture, filmmaking

In his World Languages classes at Vintage High School in Napa, California, teacher Don Doehla looks for opportunities to create rich project experiences for language learners of all levels. When students are in the early years of language acquisition, projects are relatively brief by design. Nonetheless, Doehla wants even short-term projects to involve inquiry and reach an authentic audience. Novice speakers, for instance, might create a story in words and photographs that teaches others about life in a French-speaking country. They might design a menu for a restaurant that preserves the culinary heritage of a Francophone country of their choice and then share their work on a public website.

By the time students are in Year 3, they're ready for more extended inquiry experiences that require them to communicate almost exclusively in the target language. One example is a filmmaking project called *Un Lycéen Américain en France* (*An American Student in France*).

Doehla launches the project by presenting students with a request to produce a film about a popular French literary character, *Le Petit Nicolas*. In the *Nicolas* stories, the title character is a young boy. The challenge (purportedly from the book publisher) is to imagine him as a teenager. Students are asked to create a script and a film that portray Nicolas and his friends in high school.

Students start the inquiry process by considering their need to know questions in response to this driving question: *How can Nicolas and his friends help an American exchange student to their lycée (equivalent to an American high school) integrate into their community and to French culture in general?* The question is carefully worded, prompting students to think critically as they compare and contrast French and American teen cultures.

Working in teams of four, students take on the role of movie producers. They consult the *Nicolas* stories as source material, then put their own creativity to work developing characters and plot twists. Drawing on the rich tradition of French filmmaking, they make choices about shot selections and how to balance narration with dialogue. Research comes into play when they choose a specific French city as the setting and produce a storyboard that sets their idea against authentic landmarks. Through the critique-and-revision process, students improve their scripts and prepare for filming.

The project culminates with a public screening, to which students' families and members of the local French-speaking community are invited. There's also an online audience for the short films, which typically run about 8 to 10 minutes. Doehla has connected with French-speaking partner schools in Martinique, Marseille, and Paris, France, and students in those locations have the opportunity to view and critique the productions online.

Throughout the project, students collaborate and communicate nearly exclusively in the target language. They use Google Docs for collaborative writing and editing, and use French for nearly all team discussions. Doehla says students have enough technology fluency from previous projects so that very little class time is spent teaching the technical aspects of filmmaking. "Some students use their phones to shoot. Others have iMovie experience. Figuring out how to make the movie is part of their inquiry experience," the teacher explains. If students need specific instruction on video production, Doehla provides them with minilessons.

Doehla takes a multifaceted approach to assessment to ensure that he's tracking students' growth as speakers and writers of the French language. For example, along with the team assessment of the final film, students take part in an individual performance assessment that mimics a talk show. Students play the role of one of the characters in their film as they engage in an unscripted conversation. In another individual assessment, students respond to a prompt and write a letter or an e-mail response from one character to another.

Students are involved in their own assessment through peer and self-assessments. Doehla takes a creative approach to assessing the key success skill of critical thinking. As he explains, "I don't necessarily assess all criteria on the critical-thinking rubric. I give my students the complete rubric so they can see what critical thinking entails, and as we progress, we make a decision together about which two of the six criteria are of most interest to them, and those become the ones I assess with their help."

How to extend this project:

For similar projects in other languages, choose an appropriate literature selection that reflects the target language and culture. If students are not familiar with making videos, consider alternative ways for them to demonstrate understanding and use dialogue for a purpose, such as producing comic books.

Sweet Solutions

Project Types: Conducting an Investigation; Design Challenge

Driving Question: How can I use my understanding of chemistry to make hard tack candy?

Grade Level and Subject: High school; chemistry

A team of teachers from Newberg High School in Newberg, Oregon, formed a professional learning community to support each other's explorations of project based learning during the 2013–14 school year. For veteran chemistry teacher Luann Lee, this was the opportunity she had been looking for to extend science inquiry labs into "a more open-ended adventure for students."

As her first project, she revised a traditionally popular lab activity—making hard tack candy—into a project. "This seemed like a good opportunity for students to see the real-world application of chemistry concepts,"

she says. She also hoped that, by taking something familiar and allowing themselves a little creativity, "students would have more confidence when we tackled more challenging work."

When she had done candy-making labs in the past, the learning experience was limited. "We used to simply hand students a recipe and let them bring sugar and flavoring to make candy. It was fun, but we would observe phenomena during the process of making the candy and generate questions that never quite got answered." Reconsidered as a project, candy making became a way for students to investigate the science of solutions as well as careers in chemistry.

Lee's overarching question for the project was broad: How can I use my experience in chemistry to learn to think and communicate clearly, logically, and critically in preparation for college and a career? More narrowly, she also wanted students to be able to demonstrate: *How can I use my understanding of chemistry to make hard tack candy?*

To encourage students to reflect on their learning throughout the project, Lee had them write a series of blog posts. Blogging was new for most students, although some had experience creating photo blogs for a photography class. "They quickly became our resident experts," she says. Specific assignments for blogs focused on students' preliminary research about solutions and solubility, candy making as data collection, and application of the science of solutions to other authentic situations. To encourage student voice in the project, Lee had students decide on the criteria for evaluating their posts.

To build student understanding of chemistry, Lee planned a series of learning activities related to solutions and solubility. For example, students modeled the solution process, graphed solubility of different ionic and molecular compounds at different temperatures, and used diagrams and modeling to explain unsaturated, saturated, and supersaturated solutions.

These activities led up to the day when students actually made hard tack candy, using Bunsen burners and other lab equipment. Instead of simply following a recipe, as they had done in the past, this time students approached the activity as food scientists would, making observations, gathering data, and justifying their results. "Safety issues are huge," Lee adds, and students also knew that they had to gear up with chemical splash goggles and lab aprons.

Because the project finale happened just before the winter break, students had the chance to take their product home as a holiday gift and share their candy-making experience with an authentic audience.

If Lee repeats the project in the future, she can imagine adding an entrepreneurship angle and having students market their wares for a holiday fair. Already, she's sold on the benefits of "showing students how chemistry relates to real life. We've done candy making for years," she adds, "but never with such a deliberate focus on connecting it to the science of solutions."

How to extend this project:

Follow Lee's suggestion and add an entrepreneurship angle. Have students develop business plans for marketing their hard tack candy at a holiday fair. Have students interview a professional candy maker or other food scientists about the role of chemistry in their work.

Reimagine South Central

Project Types: Solving a Real-World Problem; Design Challenge

Driving Question: How can we work together to reimagine our South Central (Los Angeles) neighborhood?

Grade Level and Subject: High school; geography, digital gaming

What should the future look like for South Central Los Angeles, a 50-square-mile swath of Southern California? High school students from the Critical Design and Gaming School, part of Augustus Hawkins High School, are helping to answer this question through a project called *Reimagine South Central*.

During spring of the 2013–14 school year, 9th grade geography students used a digital gaming and strategic-planning platform called Community PlanIt to spark conversations, invite diverse perspectives, and start stakeholder dialogues about everything from land use to health care access to socially responsible enterprises.

For teacher Mark Gomez, the game-based project offered an opportunity for his students "to get a new understanding of what geography is. It's not just memorizing state capitals. Many students came away from this project with a deeper sense of the importance of geographic inquiry." They made and analyzed maps, for example, as part of their data analysis. They discovered that their community has no single identity. Some residents described their urban neighborhood as active, energetic, creative, and educational; others said they consider it dangerous, densely populated, and challenging.

Students also gained an introduction to the field of "serious games," in which game strategies focus on real-world issues and problem solving. "We're a game-design school, so it makes sense for our students to be designing their own games [as part of learning]," Gomez says. "Through the lens of serious games, they saw the uses that gaming can serve besides entertainment. They also understood that even a serious game has to have elements of fun." That meant thinking critically about what makes for a quality gaming experience.

For this project, students collaborated with game designers from the Engagement Lab at Emerson College in Boston, Massachusetts. These experts use games to design and research playful approaches to civic engagement. Gomez's students worked with them to customize Community PlanIt to invite residents of South Central LA into a conversation about their future.

Students were responsible for much of the content that players would see. "They came up with the challenge questions, themes, and media for the online game," Gomez explains. Students' contributions focused squarely on the driving question: *How can we work together to reimagine our South Central (Los Angeles) neighborhood?* As students investigated that question, they had a number of related need-to-know questions; for example, What is a healthy community? What's in the way of making South Central healthier? What's helping?

Meanwhile, game experts in Boston worked on the back end of the technology, programming the online platform where players could respond to challenge questions. Students and their Boston counterparts used collaborative tools such as Google Docs to communicate throughout the game-design process. That connection to experts added to the relevance of the project. "Students knew that their work mattered beyond getting a grade," Gomez says.

Once the game was ready to launch, students were charged with recruiting diverse stakeholders to play. "It fell on them to promote the game beyond the walls of the classroom," Gomez says. Students produced flyers and extended personal invitations to church groups, clubs, friends from their previous schools, and other networks in the community.

For the three weeks that the game was live, students also took part as players. They responded creatively to game prompts (or "missions," in game lingo), such as, What's good about your 'hood? How does where you live affect how you live? How can we reclaim the corner stores? How do you cope? Where do you go for help?

"Once they started playing the game, students got a sense of what we had created," Gomez says. The game also afforded a novel way to gather survey data. "This was more engaging for them than writing survey questions in a Word doc. It was all done through the lens of the game."

Students will get a chance to return to the game when they take 10th grade World History, which Gomez also teaches. "We'll have a public event where we'll honor the players. Then we'll analyze the data and use it for action-based community projects," Gomez says. Games that quickly generate quantities of data have great potential for learning, he adds. "It can be hard to get kids out of hasty generalizations. They need to learn how to analyze data and make decisions based on that analysis. But that can take time," especially the data-gathering part. Using games to gather data "means we can spend more time on the analysis and action piece" and leverage their talents to make their community into the place they imagine.

How to extend this project:

With younger students, consider reframing the project as the design of a board game about communities. Incorporate literacy with age-appropriate reading selections that tell the stories of specific neighborhoods or communities.

The Home Ownership Project

Project Type: Conducting an Investigation

Driving Question: What is the process of owning a home, and what are the economic and social barriers that prevent many from pursuing home ownership?

Grade Level and Subject: High school (grade 12); economics, personal finance

For many families living in the neighborhood near Maplewood High School in Nashville, Tennessee, home ownership feels like an impossible dream. Teacher Danette McMillian wants to change that perception. "I have a personal interest in building wealth through home ownership," says McMillian, who teaches in the school's Academy of Business and Consumer Services. "Many people who live in this area don't know there is a correlation between the cycle of poverty and renting your home. They aren't aware what home ownership can do for your life."

That's why she designed *The Home Ownership Project* for her 12th grade economics students.

The project started to take shape during a weeklong externship that McMillian spent at Fifth Street Bank. Teacher externships are among the strategies that Metropolitan Nashville Public Schools uses to build partnerships between school and community. (You can read a case study about the district's PBL leadership on pages 155–157.) "My big idea was to help people see that home ownership is actually possible," McMillian says. "And I thought, why not have a group of students find out what you need to do to get a house?"

As an entry event, students pitched in on the construction site of a Habitat for Humanity home being built for a recent graduate of their high school. The occupant would be the first in her family to own a home. Her success story grabbed students' interest. The young woman agreed to come back to the high school to share her story and insights about personal finance.

After the entry event, McMillian introduced her driving question for the project: *What is the process of owning a home, and what are the economic and social barriers that prevent many from pursuing home ownership?* That got students asking more need-to-know questions, such as, "What can we do to spread awareness and encourage home ownership in our neighborhood?"

Their questions set the stage for research and analysis of economic trends related to housing and interest rates. Students also surveyed classmates to gather data about home ownership versus rental rates in their local community. For some, the topic got personal. "Some students went home and asked their families hard questions. They wanted to know, 'Why don't we own our home?'" the teacher said. When students realized that families may struggle with poor credit scores because of a lack of information, they were motivated to share what they were learning. "I realized, I'm teaching the kids, and the kids are teaching the parents!" McMillian says.

As the next phase of the project, students organized community education events. Staff from Fifth Street Bank agreed to take part in an open-house event for the community, and the Habitat for Humanity client shared her insights about home ownership.

To apply what they were learning, students also went through a simulation of buying a home. McMillian had them fill out loan applications, based on the projected income they would earn in the careers they planned to pursue. Students met with loan officers at Fifth Street Bank and went through the entire approval process. Once students had loans pre-approved, "we were ready to go house shopping," McMillian says. She enlisted a real estate agent to work with students on selecting homes within their budgets. Students went through the entire sales process, learning about additional factors such as closing costs, amortization, and insurance. McMillian was able to connect the project with what students were learning in math. "There were good cross-curricular connections between math and economics." Students also produced a video to document the learning that happened throughout the three-week project.

"I like projects that have the potential to change students' lives," McMillian says. "It's real-world. When they graduate, they can look back and say, 'Now I understand how to do certain things because of a project I did in high school.'" Especially for students growing up in high-poverty neighborhoods, she adds, PBL experiences can connect them with experts and learning experiences they might otherwise miss. "I like the idea of PBL changing lives."

McMillian started teaching in 2004, then took two years away from the classroom to consult on a service-learning initiative. When she returned to teaching in 2008, she was quick to embrace PBL. Two of the elements that she considers key for deep learning are reflection and having a public audience for student work. "Those pieces are often missing from 'projects,'" she says, "but they're essential for PBL."

How to extend this project:

Look for opportunities for students to provide relevant community education in other applications of economics and personal finance, such as navigating college loans, selecting health insurance, or avoiding credit card debt. With younger students, look for opportunities to connect math content with everyday life. Borrow McMillian's strategy of connecting with experts to reinforce the real-world applications of the content that students are learning.