

# Appendix A

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## Project Library

### PROJECT SKETCHES

Many projects are described in *Thinking Through Project-Based Learning*. Here they are again in an easy-to-scan digest, interspersed with additional project sketches that will get your imagination flowing.

Projects are loosely organized by grade band under the subject matter headings of Social Studies, Science, Math, and Language Arts. Because good projects extend into the “real” world, and because real life seldom happens in content-specific silos, most sketches describe interdisciplinary projects.

*We encourage you to read with an open mind. If you see a project that strikes your fancy but is a grade band below or above what you teach, ask yourself, “How could I scale this up? Down?” If a project has an emphasis in a subject you do not teach, consider doing it anyway. Ask yourself, “How could I adjust this project so it’s sure to address significant instructional aims for my subject? Who from other disciplines might want to collaborate?”*

*If you are reading this book as a staff activity, gather in groups of five or six and divide up the projects for close reading. In your groups, have each person share two or three projects that he or she thinks deserve the group’s attention. Discuss. Together, ask yourselves, which projects resonate the most? Why? How might we adopt or adapt these projects for our classes?*

### SOCIAL STUDIES

#### 1. Come Fly With Us: p. 59 (Grades K–2)

Driving Question: How do people work together to get a big job done?

After a commercial pilot visits school, a second-grade class designs its own airport. Their challenge is to get all the parts working together so

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*Note:* To read more about projects that are described in more detail elsewhere in the book, see corresponding page numbers.

“passengers” make their way through ticketing, security, and boarding and get to their seats in time for a scheduled “flight.” Along the way, they come to understand how different jobs and different functions of an airport all work together to create a system that puts people on the move.

## 2. Let’s Be Fair (Grades K–2)

Driving Question: How can we share and be fair?

When faced with an issue of scarcity, first graders learn firsthand how rules and laws help people get along. Their teacher sets up a situation in which students are faced with a problem of scarcity—six handheld game consoles are distributed randomly among 25 eager students. After a period of chaos, students feel compelled to construct rules that govern individuals’ actions for the good of the group. Their teacher draws on this experience later as students study how communities function. Credit: Kathy Cassidy, Moose Jaw, Alberta, Canada.

## 3. What’s in a Name? (Grades K–5)

Driving Question: Does our school’s name say who we are?

In this schoolwide and cross-school project, students plan a celebration of the source of their schools’ names. (Note: They could investigate their city’s namesake or the name given to a significant natural feature as well.) In the process, they answer: How does our name reflect who we once were and who we are today? How does our identity compare to that of other schools? Each grade takes on different aspects of the celebration, from doing research and producing multimedia at Grade 5 to writing songs and painting murals in Grade 1. Each school’s celebration is filmed and shared with participating schools and their larger communities.

## 4. A Week in the Life: p. 168 (Grades 3–5)

Driving Question: How do our lives compare?

What can we learn from one another that we couldn’t learn alone? A Week in the Life is a project for third through fifth grades. Over 6 weeks, kids from around the world build cultural understanding and awareness as they study how people in different places live and communicate. Credit: Flat Classroom Project. Join A Week in the Life at the Flat Classroom website: <http://www.flatclassroomproject.org>.

## 5. California, Here We Come! p. 133 (Grades 3–5)

Driving Question: How can we provide service that meets others’ needs?

Fifth-grade “travel agents” plan a customer’s air travel, taking into account time zones, distance, in-air and layover times, amenities, fares, taxes, baggage fees, and more. They present their customer with a proposal that includes a scale map and cost comparison table the client can use to make an informed decision. Credit: Lisa Moody, Point Pleasant, West Virginia.

## **6. Families Around the World: p. 132 (Grades 3–5)**

Driving Question: How do the lives of families compare?

Students study a *Time* magazine photographic essay that shows families from around the world surrounded by the food they eat in a week and come up with these questions to investigate: What proportion of their income do these families spend on food? What is the caloric and nutritional value of each family's food? Who's healthiest? How can we help those with the most meager diet? See the "What the World Eats" photogallery here: <http://www.time.com/time/photogallery/0,29307,1626519,00.html>.

## **7. Plotting History (Grades 3–5)**

Driving Question: How does the past share its stories?

Although they never leave the school grounds, students' "field trips" kick off significant history investigations. Before students study a pivotal historic period or event, teachers superimpose scale maps of the region of study over the school grounds, stash "artifacts" in locations relative to real historical sites, and retag each cache. For example, for the study of Lewis and Clark Corps of Discovery, Fort Mandan, the headwaters of the Great Falls in the Rockies, and Fort Clatsop are geotagged with a bit of history hidden in each place. An arrowhead, bullet casing, or a candle mold finds its way into caches, as well as raw materials such as deer hide and antler. Equipped with historical maps, geographic coordinates, and GPS devices, students set to work, puzzling out each item's significance to the era or events they are studying. History experts are on call to discuss students' theories and guide their investigations. As their studies conclude, students plan historical reenactments to share during a community celebration. In short dramas, each student stars as a historical figure and relates a true tale from the past. In preparing their dramas, with the help of experts, students transform cache materials into their own props, and in the process learn about tanning hides, flint napping, taxidermy, and dugout canoes.

## **8. Arkansas: Shape of Things to Come? (Grades 3–5)**

Driving Question: Is our presence here inevitable?

Students learn about their state's geography, people, and pivotal turns in history up to statehood through two related projects. The first has them working from a landforms map and examining political maps from different periods prior to statehood to document the role of geography on human settlement and to show change over time. They tag major developments in cultural geography and history on a timeline and make judgments about which developments have had the greatest influence on society as we know it today. They look at factors that led to key events along with the impact of those events and write scripts for historic reenactments that are vetted by historians and history enthusiasts. Their reenactments demonstrate understanding of the causal nature and dynamism of history.

### 9. Let's Remember (Grades 3–5)

Driving Question: It was important then; is it important still?

A teacher brings a neglected local monument to students' attention and gets them thinking, *How has our community commemorated what it cares about over time?* A search of newspaper and historical society archives reveals a trove of documentary evidence of ribbon cuttings, statue unveilings, and more. Some memorials no longer exist and others are in poor repair. Some students create a virtual tour using Google maps for a kiosk at the local visitors' center. Others research the stories that have gone untold and recommend ways to commemorate people and events deserving recognition. Still others campaign for a day of recognition for unsung heroes who walk among us.

### 10. Bike Theft: p. 133 (Grades 3–5, 6–8)

Driving Question: How can we make our community safe?

The local newspaper reports that bike thefts are on the rise. Should everyone worry? Students address this question by examining local police records for monthly bicycle thefts, plotting the data on maps, and creating public service announcements and posters to inform the community about the best and most risky places to keep a bike.

### 11. Make Me Care: p. 58 (Grades 6–8)

Driving Question: Where should we focus our efforts to do the most good?

Student advisors help community members select local charities to support. They identify problems in their community and do a gap analysis to determine the nature and severity of the problems in relation to efforts to resolve them. They plan a night of persuasive "lightning" talks to garner support for charitable causes. They advertise the event using Twitter and Facebook, set up FirstGiving accounts ([www.firstgiving.com](http://www.firstgiving.com)) to collect donations, and, on show night, watch as donations roll in.

### 12. State of the City (Grades 6–8)

Driving Question: How does a town operate?

After initial local government studies, student teams create an organizational chart of their town, showing how the city functions and how decisions are made. Teams analyze each other's charts and ultimately settle on one collective chart. Next, they identify people holding key roles in different sectors of civic life. They ask the city manager to examine the chart and recommend adjustments. Now pairs of students select a job role, research it thoroughly, write a short paper, and prepare to interview the person who fills that role. Student interviews lead them to understand general civics and challenges unique to their city, as well as problems facing cities nationwide (such as an aging workforce and lack of career pipeline leading to city hall). They investigate ways to improve their city and decide which executive, legislative, or community actions

are in order. Students present their “mayor” with critical issues and viable solutions to include in an upcoming State of the City speech.

### **13. Café Coffee Day: p. 97 (Grades 6–8)**

Driving Question: How do our neighboring countries compare?

A middle-school teacher in India wants her students to learn about neighboring countries in South Asia. She has students pretend they are business owners who want to expand their companies to nearby countries. (She’s setting up a task in which students compare and contrast to make an informed judgment as they learn about South Asia. She also could have asked them to act as philanthropists wanting to support charitable causes, or as professional sports executives wanting to expand cricket to more cities.) They use Wolfram Alpha and other sources to study socioeconomic data and draw conclusions about life and economy in other countries.

### **14. Sim City: p. 21 (Grades 6–8)**

Driving Question: How do we make a place livable?

Using the simulation game *Sim City*, students build a virtual city in order to investigate urban design principles and growth patterns. Game-generated graphs and moment-in-time screenshots at various decision points serve as the basis for assessing their decisions around urban planning. This foray into systems thinking helps students as they go on to examine the built environment around them. As they consider their own city, they ask, Why were bridges built where they were? Why are high-rises luxury housing in some cities but low-income housing in others? Experts in land use and city planning help them understand how decisions were made in the past and how present thinking shapes decisions around livability. Credit: Julie Robison, Portland, Oregon.

### **15. Cigar Box Project: p. 87 (Grades 6–8)**

Driving Question: How does the imagery we choose reflect who we are?

Students operate as historians do to understand Canada’s colorful history by studying the commercial art on cigar boxes. They research the people and events portrayed and seek to interpret the stories the panels illustrate. They meet with a museum curator and historian to share their interpretations and ask questions and then go deeper, designing cigar boxes of their own drawn from the memories and perspectives of those whose stories are infrequently told. Credit: Neil Stephenson, Calgary, Alberta, Canada.

### **16. Granny Em on the Move (Grades 6–8)**

Driving Question: How can we all get where we need to go?

Recently, a student’s grandmother fell on a broken sidewalk and fractured her hip. Kids expressed concern about mobility and safety in the community. Groups craft “need-to-know” questions and investigate the

needs of different citizen constituencies (elderly, disabled, bike commuters, parents with strollers, joggers, young pedestrians, etc.). They develop reasoned solutions to mobility concerns for those groups, develop an action plan, and campaign for change.

### **17. Look Into the Past: p. 96 (Grades 6–8, 9–12)**

Driving Question: To what degree can we see the past in the present?

As students prepare for a history tour of Washington, D.C., their teacher presents them with a challenge: Each team is to find an illustration or photograph of a pivotal period or event in D.C. history, visit the site where the event took place, shoot a picture (or even a picture-in-a-picture), and write a photo essay describing the significance of the event in its time and its relevance today. When complete, students compile photo essays into a book published for inclusion in the school library (to inform future tour groups) and for submission to the D.C. Historical Society.

### **18. Mingling at the Renaissance Ball (Grades 6–8, 9–12)**

Driving Question: Does “greatness” endure?

After a brief study of the Renaissance Period, students form affinity groups based on their interest in different fields that advanced during the period (medicine, architecture, science, arts, literature, etc.). Each group determines who the greats were in their area and then each student in the group studies one. Next, they pool their understanding and the team writes an operational definition of “greatness.” They write a justification for their definition and present it to an expert for vetting or improvement. Once the definition is solid, each student makes a case for why his or her notable figure best exemplifies the definition. Ultimately they rank the figures, design an award that signifies the qualities of the field, and present it in character at their Renaissance Ball.

### **19. Civil War Then and Now: p. 60 (Grades 6–8, 9–12)**

Driving Questions: Is war inevitable? Do civil wars share common roots?

History students examine events and conditions that contributed to the Civil War in the United States and compare these to factors influencing contemporary civil wars. Along the way they meet a newly minted citizen of South Sudan over Skype.

### **20. Deserts in Rainy Seattle? p. 9 (Grades 6–8, 9–12)**

Driving Question: Is healthy food a right or a privilege?

In this project, students ponder issues of access to healthy food. After examining USDA nutrition guidelines, they discuss how easy or hard it is to meet them. They decide to investigate one barrier to good nutrition: access to healthy foods. Using government data (<http://www.ers.usda.gov/data/fooddesert>), teams identify local “food deserts” (defined as

neighborhoods in which fresh and affordable food is lacking) and attempt to “shop” for a week’s menu using the USDA thrifty food budget (<http://www.cnpp.usda.gov/usdafoodcost-home.htm>). Using Google maps, spreadsheets, phone calls, grocery store advertisements, and actual visits to “desert” neighborhoods, students analyze food availability and affordability, interview residents, draw conclusions about issues of food access, and recommend ways to solve them.

### **21. Digiteens: p. 179 (Grades 6–9)**

Driving Question: What does citizenship mean in the digital age?

In the Digiteens project, eighth- and ninth-grade students explore their rights and responsibilities as digital citizens. Teams from across the globe partner to study and then teach others about topics as wide ranging as cyberbullying, Internet fair use, and balancing security and personal freedom. Credit: Flat Classroom Project. Join this year’s project on the Flat Classroom website: <http://www.flatclassroomproject.org>.

### **22. Eracism: p. 179 (Grades 6–9)**

Driving Question: How can our diversity be our strength?

Eracism is a global student debate that joins diverse cultures with the intention of building global competence and international-mindedness. Schools selected for the project enter a four-person team to debate other teams, and the remaining students in each class act as researchers around the topics of debate. The topic statement debated in 2012 was “Government regulation requiring immigrants to adopt the beliefs, habits, and language of the dominant culture does more harm than good.” Credit: Flat Classroom Project. Join this year’s project on the Flat Classroom website: <http://www.flatclassroomproject.org>.

### **23. Slavery in the Third Millennium: p. 79 (Grades 6–8, 9–12)**

Driving Question: What can we do to address modern-day slavery around the world?

After reading a novel about a girl who was trafficked, students launch a social media campaign to speak out against modern-day slavery. They incorporate research on human rights to add authority to what could otherwise have been a strictly emotional appeal. Credit: Shelley Wright, Moose Jaw, Saskatchewan, Canada.

### **24. It’s All About the Benjamins (Grades 9–12)**

Driving Question: Does money really make the world go ‘round?

Starting with the story of Argentina’s currency collapse in 2002, students explore the role of money, currencies, commodities, and trade. After “news” of the collapse of the U.S. dollar, students invent alternative methods

of trade (these may include bartering, gift economics, time banks) and test them through commerce for feasibility and fairness. Next, students study the history of money, work in groups to design their own national currencies, and then establish an exchange rate with other countries' currencies by calibrating against the value of a common basic good such as a loaf of bread. Tariffs, embargoes, and other mitigating factors are introduced during a final trade simulation designed by students.

### **25. Government for and of the People? p. 3 (Grades 9–12)**

Driving Questions: How do everyday people engage with the government? Could government serve its people better?

High school students interact with federal functions as anyone might who navigates a bureaucratic process. Students explore government functions by “applying” for federal student aid or a green card, making a request permitted by the Freedom of Information Act, or submitting a complaint to the Better Business Bureau. Along the way, they analyze each process, present it in a diagram, and recommend ways the process might be improved. As students share their investigations, the class comes to understand the myriad ways in which citizens interact with government. Credit: Diana Laufenberg, Philadelphia, Pennsylvania.

### **26. Work the System, Change the World (Grades 9–12)**

Driving Question: In what ways can citizens make a difference?

Using the Civic Action Project framework from the Constitutional Rights Foundation (<http://www.crfcap.org>), teams address an issue that concerns them and take civic action. In the process, they explore the relationships between the issue, their proposed actions, and the public policy they need to work within or attempt to change to make civic action possible. Students develop a cogent argument for their position, study opposing views, defend their solution, and rally others to their cause. Civic concerns students addressed in the past include: high school start times, coyotes in the park, euthanasia, increased funding for cancer research, sin tax on junk food, elder abuse, advocacy for “real size” models in fashion, crime against immigrants, and texting while driving.

### **27. Roll the Presses (Grades 9–12)**

Driving Question: In what ways is information power?

Students investigate all aspects of the written word that affect the exchange of ideas, from innovations such as Johannes Gutenberg's 15th-century invention of the printing press to societal rules governing that exchange, such as legal protections and censorship. Students also examine the American constitutional guarantee of freedom of speech and consider ways it has been protected or compromised over time. Credit: Intel Education.

## SCIENCE

### **28. Blue Fender Defender: p. 79 (Grades K–5, 6–8)**

Driving Question: Can we make a difference?

Students learn that a butterfly species relies on a prairie habitat that is rapidly diminishing. Their research leads to a letter-writing and leafleting campaign that gets the community's attention, and part of a local park is returned to prairie.

### **29. The Square of Life: p. 8 (Grades K–2)**

Driving Question: Why do some creatures live in one place but not another?

Primary classrooms studying life science team up over Skype to explore diversity, habitat, and niche. They are registered in the Square of Life, an Internet-based collaborative project in which students investigate their local environment and share information with students from around the world (<http://ciese.org/curriculum/squareproj/>). Student teams select a square meter of local ground to examine. They organize what they find into categories based on shared characteristics and learn to discriminate between living and nonliving, plants and animals, insects and isopods, and more. They theorize about and investigate the role of habitat and niche in the distribution of organisms. They share their findings through Skype with Australian students and report their conclusions about *Why here and not there? Why there and not here?*

### **30. Don't Be S-s-scared: The Truth About Snakes! p. 103 (Grades K–2)**

Driving Question: Where would we be without snakes?

In this project, second-grade students root out truths about snakes' place in the world and speak up for these often-maligned reptiles. One of their products is a music video they write and star in, set to the tune of Lady Gaga's hit, "Born This Way." The clever lyrics include scientific facts students discovered during their in-depth investigation. Students also produce a richly illustrated book, *What Snake Am I? A Clue Book of Snakes From Around the World*, and donate copies to the Harvard Museum of Natural History and a local wildlife sanctuary for use in educational programs. Credit: Jenna Gampel, Brighton, Massachusetts.

### **31. Be Prepared (Grades 3–5)**

Driving Question: How can we prepare for a natural disaster in our area?

Student groups study the instances of natural disaster in their region over time and identify the best ways to avoid, prepare for, and react to different disasters. They seek advice from first responders, city management personnel, and others as they create brochures and public service

announcements for the community. This scenario could be expanded to imagine living in other places in the world where a different assortment of natural disasters occur.

### **32. World Tree Watch: p. 112 (Grades 3–5)**

Driving Question: What conditions influence where and how trees grow?

Students in Grades 4 and 5 in the United States and Japan observe the role of trees in their communities. They do tree surveys to identify the numbers and kinds of native and cultivated trees. They meet with city arborists to learn about the growing conditions necessary for healthy trees in their location and compare these criteria. Students exchange photos, artistic renderings, haiku poetry, and descriptions that help them compare trees, geography, and climate in the two countries. They each find a tree that can be grown in the other school's environment and send these to the partner school as part of Planting Day ceremonies.

### **33. The Landmark Game (Grades 3–5, 6–8)**

Driving Question: How do landmarks tell the story of who we are?

In this global game, classes choose landmarks anywhere in the world and become experts on them. They compile nine interesting clues and dole out three at a time as other classes try to guess the landmark by asking questions for which a simple “yes” or “no” must suffice. Along the way, students refine their writing, problem solving, critical thinking, map reading, and organizational skills. At the end of 3 weeks, the team guessing the most landmarks is declared the winner. The Landmark Game project runs each year in February. Join at <http://www.kidlink.org/project/landmark>. Credit: Terry Smith, Macomb, Illinois.

### **34. The Garden Project: p. 132 (Grades 3–5, 6–8)**

Driving Question: How does a garden grow?

Students break into research groups to study different considerations for growing a garden. One subset of questions students investigate relates to determining when to plant: *If tender plants require a steady ground temperature of 55°, when should we start recording daily soil temperatures? What instruments or materials will we need? What patterns might historical temperature records reveal? Is there a way to speed up the process?* Other research teams look at selecting crops suited for the local climate, calculating the expense of gardening relative to yields, and lining up experts such as the county extension agent, farmers, and gardening grandparents.

### **35. The Great Carbon Race: p. 112 (Grades 6–8)**

Driving Question: How can I change my carbon footprint and tread more lightly on the world?

After completing a project called The Problem with Oil, eighth-grade students focus on greenhouse gases, an issue related to the combustion of

oil but related to other emissions, too. In *The Great Carbon Race*, students are challenged with the question: Who can save the most carbon from entering the atmosphere? They have to defend their results using clear, credible evidence for the class courtroom. Students are graded by the quality of their evidence, and the biggest footprint reducers are crowned Carbon King and Carbon Queen. Credit: Sue Boudreau, Orinda, California. See more Take Action Projects at <http://takeactionscience.wordpress.com>.

### **36. Water, Water, Everywhere? (Grades 6–8)**

Driving Question: What problems does the world face with its water supply?

In this collaborative project, students research the world's water problems, particularly relating to fresh water, and focus on how their personal water use affects aquatic ecosystems in their communities. Students participate in email exchanges as they explore the global importance of water. See ePals [http://www.epals.com/projects/info.aspx?DivID=Water\\_overview](http://www.epals.com/projects/info.aspx?DivID=Water_overview). Credit: ePals.

### **37. Energy Diet: p. 63 (Grades 6–8)**

Driving Question: Can we spend money to save money?

Student consultants advise their city council, director of a retirement home, business owner, and other ratepayers on ways to invest in improvements (i.e., solar panels, insulation, regulation sensors) that will save them energy and money. On the way to proposing a plan of action, each team conducts an energy audit, evaluates options for saving energy, and calculates investment costs, loans, and payback based on their client's budget. They seek advice from a nonprofit that helps utility customers save energy and run their proposals by experts here before sharing them with clients.

### **38. Low Energy at the Fitness Center: p. 113 (Grades 6–8)**

Driving Question: How can we conserve energy?

A nearby fitness center wants to conserve energy so it can keep club prices low. The director appeals to students to analyze the center's energy usage and propose recommendations. Students study the center's energy bill, investigate alternative energy sources, complete cost/benefit analyses for competing innovative ideas, examine government weatherization incentives plans, and create graphs to substantiate their recommendations.

### **39. Life in the Balance (Grades 6–8, 9–12)**

Driving Question: What causes an ecosystem to hang together or fall apart?

An ecology class considers factors of regulation and equilibrium by modeling population dynamics in a desert ecosystem. Students plot data

and look for relationships among populations (example: coyote and desert hare) over time as they investigate the question “What causes an ecosystem to hang together or fall apart?”

#### **40. Los Rayos X: p. 61 (Grades 9–12)**

Driving Question: How can we put energy from the electromagnetic spectrum to work safely?

Physical science students investigate electromagnetic waves and differences and similarities between kinds of waves as a means of transmitting energy by examining consumer products that put electromagnetic waves to work. They write consumer manuals that explain how products function and advise on their safe use and disposal. Some of the products and devices include X-rays, MRIs and other imaging technologies; compact fluorescent, incandescent, and LED bulbs; ultraviolet light-protecting products like house paints and sunscreen; laser beams; digital, plasma, and LCD televisions; wifi, radios, microwaves, satellites dishes, repeaters, and antennas for telecommunications; surgical gamma ray knives and Geiger counters; infrared and radio-frequency remote controllers such as automobile key fobs, garage door openers, TV remotes, and Bluetooth devices; and bombs that create an electromagnetic pulse.

#### **41. Checks and Balances: p. 112 (Grades 9–12)**

Driving Question: What systems do pros use to ensure quality work?

In a physics and engineering project, high school seniors use engineering methods to study technical failures that lead to real-world disasters. Before diving into a final performance task, an investigation of the 2003 Space Shuttle *Columbia* accident, students apply real checks and balances that govern practices of engineering. They learn to pick apart a problem using root cause analysis and probe issues of workplace culture that interfere with the discovery of engineering problems using Harvard University’s corrective and preventive action method. Credit: Technology High School, Sonoma, California.

#### **42. Phys Newtons: p. 70 (Grades 9–12)**

Driving Question: How can we best represent Newtonian physics?

An art and physics project has students researching one of Newton’s Laws (motion, gravity, energy, circular motion, or projectiles) and then painting images to illustrate the law. They design a page for a book called *Phys Newton*, using a combination of images and text. A page explaining Newton’s Second Law, for instance, features a series of images showing a baseball player going through the motions of pitching. Accompanying text explains the relationship between force and acceleration. In an authentic performance assessment, students use their book to teach their peers about Newton’s laws. Credit: Andrew Gloag and Jeff Robin, San Diego, California.

### **43. Microbes Ate My Driveway (Grades 9–12)**

Driving Question: How does bioremediation work to keep the environment safe?

Equipped with a basic understanding of the hazards of motor oil to the environment, ecology students study microbes, bioswales, and other bioremediation methods and plan investigations that ultimately lead to recommendations for ridding the pavement of the school parking lot of motor oil before it runs off into the water system.

### **44. Kinetic Conundrum (Grades 9–12)**

Driving Question: How does art move us?

After investigating and documenting public art in their community, students set out to create their own kinetic sculptures. Working in teams, they design and build prototypes for sculptures that move or change in response to the environment. Developing their plans involves researching art and engineering, making mathematical calculations, learning about the history of public art projects, and using language arts to write artists' statements explaining their intent. They share their prototypes at a community art showcase where attendees vote on a "best in show" that will be produced for a park in the community. Credit: King Middle School, Portland Maine. Watch a video about the project at Edutopia: <http://www.edutopia.org/stw-maine-project-based-learning-kinetic-art-video>.

## **MATH**

### **45. Birthday Math: p. 132 (Grades K–5)**

Driving Question: How can we know who we are as a group?

It turns out that two students in class were born on the same day, which causes students to speculate, *How could we find out whether other kids in our school were born on September 7? Could we find and connect all the birthday buddies in the school?* Small groups propose research methods such as examining school records and surveying classes and then discuss the merits of each before settling on a plan. Once all birthday buddies are identified, students plan a social event through which all buddies become acquainted.

### **46. Eye-Opening Experience: p. 133 (Grades 3–5)**

Driving Question: How do we compare?

Students across the United States and around the world join Connecticut fifth graders to count the number of metal eyelets on their shoes. Shoes and eyelets? What kind of math project could this be? In it, students engage in prediction and estimation; data collection, representation, and analysis; review of variables; and calculating mean, median, and mode. In addition, they meet new friends around the world and learn about geography, culture, and differences and similarities in life (and shoes) around the world.

**47. Which Wheels to the Museum? p. 132 (Grades 6–8)**

Driving Question: How do we balance safety, speed, and expense to get where we need to go?

A group of 43 of us are traveling to the museum next month. What forms of transportation should we consider to get where we need to go quickly, inexpensively, and safely? Students study the public transit system, van rentals, use of parent cars, bicycles, and other means of travel and examine expense, safety, and liability issues associated with each to arrive at a recommended “best” mode of transportation.

**48. What’s the Plan? p. 132 (Grades 6–8, 9–10)**

Driving Question: How can we help consumers weigh their options?

Mobile phone plans are complicated, and families are trying to live within tight budgets. Students help families choose the best cell phone plan for their needs from among local providers. They use algebra as they analyze plans, create comparative graphs and charts, and write a letter justifying their recommendations. Credit: Telannia Norfar, Oklahoma City, Oklahoma. Learn about Telannia Norfar’s treatment of this topic at: <http://www.edutopia.org/economic-stimulus-education-technology-oklahoma>.

**49. Juice Boxes: p. 132 (Grades 6–8)**

Driving Question: What are the best ways to package goods?

How strange. These juice boxes can have different dimensions but hold the same amount of juice. What is going on? Students decide to measure different brands of juice box boxes to find out which has the greatest amount of juice while using the least packaging material. They compare prices to figure out who’s making more money, too! One group investigates the quality of the contents, determining which product is the healthiest. Ultimately, students select (or redesign) one product that meets the highest criteria for quality, container, and price.

**50. Home Improvement (Grades 6–8)**

Driving Question: How can we maximize the effort of volunteers?

In this math and service-learning project, students get on board with a Habitat for Humanity project, helping to build a home for a local family. The project manager asks them to recommend how to make interior painting more efficient. The problem? This stage of the process is popular with new volunteers but often results in wasted paint. Students calculate the interior surface areas that need to be painted in the new house and estimate how much paint should be needed to finish the job. Then they develop a quick training program to teach volunteers how to paint more efficiently. They recruit volunteers from their school community and lead

them through the training. Newly trained volunteers work in shifts to complete the painting job in a timely and efficient way. Credit: Jill Sumerlin, Tillamook, Oregon. Read about the project in an archived issue of *NW Teacher* magazine, downloadable as PDF at [http://educationnorthwest.org/webfm\\_send/347](http://educationnorthwest.org/webfm_send/347).

### **51. A Penny Saved (Grades 6–8)**

Driving Question: How can we use money wisely?

A local man wins a large amount of money in the lottery and asks for advice on how to invest his winnings wisely. Students contact local tax advisors, investment advisers, and financial institutions to understand how the financial industry works and learn from the stories and decisions of past lottery winners. Along the way, they learn investment terms, use algebra to explore compound interest, and create graphs showing how different investment schemes play out over time.

### **52. Human vs. Doll: p. 132 (Grades 6–8, 9–10)**

Driving Questions: How do our idealized selves compare with reality? Who decides what form our play takes?

Some dolls and action figures have extreme body proportions. Could toys with more realistic human proportions capture the market? Students bring in Barbies, GI Joes, and other dolls and action figures. They determine what the dolls' relative body proportions would be if each were the height of an average woman or man. Next, they design a doll or an action figure with the proportions of an actual human and figure out how to market it so it outsells Barbie and Joe.

### **53. Ball Skills and Parabolas: p. 133 (Grades 9–12)**

Driving Question: Do ball skills come down to technique or talent?

Student teams examine the projectile motion of a ball used in a favorite sport and explain mathematically and practically how to adjust its parabola for best scoring results.

### **54. Math Is Beautiful (Grades 9–12)**

Driving Question: In what ways can we represent math through art?

Students create an all-math art exhibit for the local museum. They present beautiful nature photos to illustrate Fibonacci's golden mean; create harmonograms, spirographs, and Lissajous figures using the online Encyclogram (<http://www.mathcats.com/explore/encyclo/encyclogram.html>); and create fractal art. Their projects involve Fibonacci series, sine curves in trigonometry, and algebra and complex numbers for fractals. Credit: Wendy Petti, Washington, D.C. See: Math Cats at <http://mathcats.com>.

**55. Knit Me Some Math Pants (Grades 9–12)**

Driving Question: How can we represent polyhedral patterns in tactile forms?

In this advanced geometry project, students explore polyhedral models as they knit hyperbolic octagon pants and three-dimensional Mobius strips called Klein bottles. Credit: Sarah-Marie Belcastro, Amherst, Massachusetts. See: The Home of Mathematical Knitting: <http://www.toroidalsnark.net/mathknit.html>.

**56. Angry Birds Physics: p. 101 (Grades 9–12)**

Driving Questions: What laws of physics hold in Angry Birds World? How do software engineers make decisions?

A best-selling video game becomes the basis for an investigation of projectile motion as physics students investigate the question: “What laws of physics hold in Angry Birds World?” Students seek answers questions like these: *Does the white bird conserve momentum when it drops its bomb? Why would the game designer want the white bird to drop its bomb the way that it does? The yellow bird changes velocity with the tap of a finger. Analyze more than one flight path to answer this: What are the details of its change in velocity?* To investigate these questions, students make screencasts of game play using Jing, Screencast-O-Matic, or Camtasia Studio, then do analysis. To support their scientific thinking, they use tools for data analysis and modeling, such as Logger Pro and Tracker Video. Credit: Frank Noschese, Cross River, New York, and John Burk, Delaware.

**57. The Floor Covering Scenario 2: Waste Not, Want Not: p. 11 (Grades 6–8)**

Driving Question: How can we divert usable material from the waste stream?

A hotel renovation nearby is the spark for a project on waste and reuse. Upon seeing piles of discarded carpet on the street, students estimate how much carpet, by volume, is destined for the landfill. They go on to look at issues of—and solutions to—dumping carpet and other bulky, composite waste. The project continues with students working with a reuse and recycling center to find ways to clean, donate, place, and even advertise and resell used carpeting. Learn more about diverting bulky waste from landfills at ReMade: <http://www.remade-southeast.co.uk/rse/docs/bulkywaste.cfm>.

**58. Geometric Forms in the Built World: p. 132 (Grades 6–8)**

Driving Question: How is geometry expressed in the built world?

Students investigate the driving question by examining famous architecture from around the world and identifying as many different geometric

solids as they can. Next, they design their own buildings in SketchUp and tell stories of their historical or architectural significance.

### **59. Perfect Wedding: p. 133 (Grades 6–8)**

Driving Question: How can we use longitudinal data to make a decision?

Let's pick the perfect evening for an outdoor wedding! In pairs, students collect temperature and sunset data for a major U.S. city and model the averages using sinusoidal functions. They present the data in a way the bridal couple understands so they can make an informed choice for a wedding date.

### **60. Buy Low, Sell High (Grades 6–8)**

Driving Question: How does money grow?

In a stock exchange project, teams of students research and then select two stocks they want to follow, such as McDonald's, Toys R Us, or Great Adventure. They make a brochure for prospective investors that includes a graph of stock prices over short- and long-term periods; figure out the amount of stock they can buy with a given amount of money; and learn what decision rules investors use to decide when to buy and sell. Ultimately, they advise the purchase of one company's stock over the other.

### **61. 20 Years Old and in Debt! p. 133 (Grades 9–12)**

Driving Question: How can we prosper and not go into debt?

College freshmen carry an average of \$1,585 in credit card debt, the cost of three iPads! Students create a scenario that shows they understand what it takes to manage their own credit cards and also consider alternatives to credit cards.

### **62. Let's Design a Shopping Mall (Grades 9–12)**

Driving Questions: How do we engineer the designed world? What considerations go into designing complex and multipurpose megastructures?

Students take on the role of architects to design a shopping mall. In teams, they research the design of malls by looking at blueprints made available by an architecture firm. They study land use considerations and research the cost of designing and building the mall. Next, teams pick features of the mall on which to concentrate. For example, one team works on parking: where to put it and how many employee, service, and customer parking spots to create. (This feature of the project focuses on linear programming and maximization: How much money does a customer space bring in at a mall? How many employee and service spaces should there be relative to the number of customer spaces?) Design teams need to work together to reconcile their contributions into a single plan, which they render in SketchUp (<http://www.sketchup.com/intl/en/industries/education.html>).

The end product is a presentation to a panel of architects and city planners, who will weigh in on the quality of their proposals.

### **63. Lockers, Schmockers (Grades 9–12)**

Driving Question: How do we make our environment work for us?

As a school becomes increasingly digital and paperless, students' needs for storage space change. When it's time to install new lockers, the principal asks students to investigate all options and propose a solution. As they proceed, students study students' storage needs, geometric concepts of volume and surface area, costs, aesthetics, and alternative storage approaches on their way to making a proposal to the principal, superintendent, and school board.

## **LANGUAGE ARTS**

### **64. Building Bridges to Tomorrow (Grades K–2)**

Driving Question: What's life like for other children?

In a project of cultural understanding, young children from around the world use digital media to collaborate around topics such as: How We Play, Celebrating Together, Part of a Family, Making a Meal, Sharing Stories, and Our View From the Window. Credit: Flat Classroom Project. Join A Week in the Life at the Flat Classroom website: <http://www.flatclassroomproject.org>.

### **65. Global Book Club (Grades K–2, 3–5)**

Driving Question: Is taste in literature universal?

Students partner with kids in other places to form book groups and read on topics of shared interest. In the process, they learn to set up and moderate group discussions, create a shared blog for each book, and negotiate time differences for real-time conversations. Conversations, not surprisingly, expand beyond the book and lead to several projects, including fundraising to put books into the hands of kids who can't afford them and collaborations on advertising of favorite books.

### **66. Story Like a Pebble: p. 79 (Grades K–2, 3–5)**

Driving Question: How do our stories shape who we are?

Students learn about oral traditions of storytelling as they interview family members for a podcasting project called Stories from the Heart (<http://blogs.egusd.net/mscheung>). By making their interviews public, the class helps listeners learn from each other's stories and recognize the importance of drawing out stories from their own families. Credit: Theresa Cheung, Sacramento, California.

## **67. The Monster Exchange (Grades 3–5)**

Driving Questions: Does communication always work? Do we all see the same thing?

Almost one-quarter of a million kids have participated in the Monster Exchange since 1995. Classes sign up for the online Monster Exchange and each is assigned a body part. Each draws and then describes its part as accurately as possible so other classes can recreate it perfectly. Their descriptions go into a shared table in a wiki so everyone can see all the parts. Each class constructs the entire monster as well as it can based on the descriptions. It turns out that writing precisely and interpreting what others describe is hard! And making a head that matches a neck that matches a body requires collaboration! Once the monsters are created, they are photographed and the photos are uploaded to a gallery for all to enjoy. Along the way, kids learn to read and write for a purpose, learn to work cooperatively and collaboratively, and make new friends. Teachers acquire new professional partners in the monster community. Credit: founders Brian Maguire, Suzie Calvert, and Terry Smith.

## **68. Let's Remember (Grades 3–5, 6–8)**

Driving Question: If it was important then, is it important still?

A teacher brings a neglected local monument to students' attention and gets them thinking, *How has our community documented what it cares about over time?* Along with interviews with elders, a search of newspaper and historical society archives reveals a trove of documentary evidence of ribbon cuttings, statue unveilings, and more. Some memorials no longer exist and others are in poor repair. Some students create a virtual tour using Google maps for a kiosk at the local visitors' center. Others research the stories that have gone untold and recommend ways to commemorate people and events deserving recognition. Still others campaign for a day of recognition for unsung heroes who walk among us.

## **69. Global Peace Movie Project (Grades 3–5, 6–8, 9–12)**

Driving Question: How can I make the world a more peaceful place?

The Global Peace Movie Project brings together schools in more than 20 countries for filmmaking around the message of peace. Each year, in conjunction with the International Day of Peace, fourth graders at Lafayette Regional School curate the 30-second to 1-minute film submissions into a longer film. Credit: Garret Ferguson, Franconia, New Hampshire. Join the growing community of peacemakers here: <http://globalpeacemovie.weebly.com>.

## **70. Transitions: p. 73 (Grades 6–8)**

Driving Question: How can our experiences help pave the way for others?

In the Transitions project, students draw from their personal experiences and apply reading, writing, speaking, and listening skills along with

visual literacy, creativity, empathy, and an understanding of media arts as they share their wisdom to help other children learn from life's challenges. The result? A book called *Transitions*, available on Amazon. Credit: George Mayo, Silver Spring, Maryland. This is one of many projects featured on the Nerdy Book Club. See: <http://nerdybookclub.wordpress.com>.

### 71. Language Comes Alive! (Grades 6–8)

Driving Question: How can we illustrate the essence of literary terms?

In this language arts and multimedia project, Wikistix, modeling clay, Legos, and action figures are all put to work as students create stop-motion animation to illustrate literary concepts, terms, and devices such as characterization, denouement, hyperbole, metaphor, literary conflict, personification, and plot. Credit: George Mayo, Silver Spring, Maryland. Learn more at The Longfellow Ten: <http://lf10.wordpress.com>.

### 72. Coming of Age in Literature (Grades 6–8)

Driving Question: What can literature set in the past teach us about how to live in the present?

Through reading *Roll of Thunder, Hear My Cry*, *Souder*, *To Kill a Mockingbird*, *A Member of the Wedding*, *The Watsons Go to Birmingham*, and *The Legend of Buddy Bush*, students analyze, explain, and support with details from the novels seven key themes: growing up, family relationships, understanding and empathy, justice and law, racial prejudice, courage and sacrifice, and life in a place. Students create a Glogster poster that illustrates the details of each theme and contrasts them with life today.

### 73. The Dane's Destiny (Grades 9–12)

Driving Question: What causes a plot to go one way rather than another?

English students examine how events unfold in *Hamlet* and determine whether Hamlet's fate would have changed if his actions, such as his timing for killing Claudius, were different. In doing this project, students focus on the causal elements of plot as well as character profiles to describe alternate scenarios.

### 74. A Hero in My Eyes: p. 49 (Grades 9–12)

Driving Question: Who are the heroes among us?

A Hero in My Eyes is a beginning-of-the-year project in which students produce a photo portrait that captures a heroic moment. Students learn photography through trips to a local museum of photography and by working with a local photographer. For their culminating event, students present their work in a gallery setting. Standing next to their exhibits, students talk with parents and other community members about what defines a hero to them. This "right-sized:" event gets them ready for the larger audiences they will share their work with later in the year. Credit: Diana Cornejo-Sanchez, San Diego, California.

**75. Invisibility Project: p. 13 (Grades 9–12)**

Driving Question: What does it take to open people’s eyes?

Students provide a public service by bringing the invisible to light through a multimedia exhibition that exposes hidden paradigms, underground cultures, and unresolved issues. Some of their topics include graffiti, rave culture, youth activism, self-mutilation, and the media. Student documentaries, photo/sound essays, and video installations showcase information gathered from on-the-street videography, expert interviews, and in-depth investigations of local professional, cultural, and institutional communities. Credit: Margaret Noble and Lacey Segal, San Diego, California.

**76. Hollywood Nights (Grades 9–12)**

Driving Question: How do our stories reflect what matters to us?

Through writing, storyboarding, and multiple cycles of critique, students create digital stories about a defining moment, message, or lesson learned from their own lives or the life of someone they know. In the process of creating their stories, students collect images, record voice-overs, and use digital movie-making software to produce short films. They share their presentations on the big screen for peers and parents at a Digital Storytelling Exhibition Night. Credit: High Tech High, San Diego, California.

**77. Every 26 Seconds: p. 79 (Grades 9–12)**

Driving Question: How can we all cross the finish line together?

Every 26 seconds, a student drops out of high school. High school students respond to this statistic by participating in “26 Seconds,” a national advertising campaign in which they challenge one another not to become statistics. Student-produced videos of inspirational stories, scary statistics, and even flashmobs are designed to motivate a specific audience—their peers. See 26 Seconds at: <http://www.26seconds.com>.