Let's Take This Show on the Road!

A STEM-focused Antiques Roadshow engages second- and third-grade students.

By Catherine Scott and Kimberly Carroll

When early childhood education intern Heather showed her classmates the sweet corn her family grew along with her corn sheller from the late 1800s, we immediately saw a unique teachable moment. Antiques are found all around us: in our homes, schools, garage sales, and even toy boxes! Antiques used in the classroom provide chances to investigate, explore, and answer questions about objects of the past. During this exploration unit, where we focus on using antiques to learn how to teach elementary children about STEM in a historical context, we refer to the historical objects as "antique artifacts." Young students in our partnering elementary school, where science, math, and social studies methods courses are taught, were peeking into the classroom as Heather was demonstrating how to use the corn sheller. The students passing by asked questions to our class about this innovative, rusty antique artifact such as: How is corn taken off the cob now? How does the corn get cleaned so that we can eat it? Was there anything else you could use this machine for? Were there more kinds of shellers? Can we use it? Does your family still use this machine? By studying antiques, students get a real-world opportunity to learn how people in their local area and beyond harvested food, entertained themselves, and explored new technologies during a time before they were born, hence fostering the inquiry-based instruction needed to get young children interested in STEM.

With this excitement, our preservice candidates created an Antiques STEM Roadshow for their second- and third-grade students. The students were to explore objects that were older than their birth year and explain the STEM history behind the objects in the style of the popular television show *Antiques Roadshow*. For our unit, we focused on physical science and forces and motion, but this research could easily be adjusted to account for other standards and inventions. In this manuscript, we explain how teachers might implement a similar project in their own classroom.

Suggested items for student inventions

- Craft sticks
- Glue
- Hot glue (to be used only with adult assistance/supervision)
- Rubber bands
- Recycled bottles/containers (applesauce cups, yogurt containers, drink bottles, etc.)
- Cardboard
- Cardstock/paper
- Stapler
- Tape
- Newspaper
- Round pasta or bottle caps for wheels

What Is *Antiques Roadshow*?

Antiques Roadshow is a British show that started in the late 1970s and is currently offered on PBS. In it, people bring items from their homes to have them appraised. The appraisal is taped, and the individuals learn about the items they have had in their house. For our project, we introduced students to the *Antiques Roadshow* and explained that often items have an interesting background or value that their current user knows nothing about. We explained that although most experts agree that an antique is 100 years old or older, we would look at items at least 10 years older than the children to ensure that all would be able to participate in the latter part of our lesson. For children, the idea of objects being at least 10 years older than them made things "really old!"

Although our activities focused on inventions in general, a teacher could consider ways to tailor this to specific content

areas and topics. For instance, when examining physical science and the impact of forces and motion on objects, children could investigate the development of the lawnmower from the rotating blades to a gas-powered, self-propelled machine, or the move from basic metal wheels attached to shoes to rollerblades (See Table 1 for examples).

Engage: Introducing Antiques as an Investigation Into STEM

On the first day of our unit, we fostered student engagement by showing the students antiques the interns had collected from their families and friends. We told the students that we needed help investigating and documenting facts about each antique item—they were going to be antiques curators and historical scientists for the day! The items that we shared with students included a pair of vintage metal roller skates from the early 1900s and a record player. Students marveled at these items, mostly recognizing that they were similar to modern equipment such as the roller blades and mp3 players that they had in their homes and on their phones. Students shared their questions and what they thought they knew about each object, which allowed us to assess prior knowledge and determine what questions or misconceptions stu-

TABLE 1

Connections between objects and physical science concepts.

Standard: K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or pull.

ITEM TO STUDY	HISTORICAL SUMMARY	CONNECTION TO STANDARD	HOW IT WORKS
Lawn Mower	First invented in 1830, the lawnmower was meant to more efficiently cut grass, as a scythe was used prior to the mower. The first mower was made of iron and had a cylinder with iron cutting blades. In the United States, mowers became gas powered in 1914 and self-propelled in 1922 (along with having more blades than the first mower!)	The first mower worked well, but it was heavy to push. Improvements, including self-propelled mowers, allowed the mower to be pushed more easily, and more blades allowed the grass to be cut more efficiently. This reduces the force required by humans to operate the machinery.	In a modern rotary mower, the fuel allows the motor to run. The motor powers the blade, which is attached to an axle. The blade spins on the axle and cuts the grass. In an original push mower (a reel mower), a person would push the mower, and the pushing would cause the wheels to move. The wheels were connected to the axle, which held a cylinder of blades. As the wheels moved, the cylinder of blades would rotate and cut the grass.
Roller Skates	Roller skates were first reported for use around 1760. In 1819 the first patented skates included leather straps and wooden, metal, or ivory wheels. They could only move forward! In 1863, James L. Plimpton designed the four-wheeled skate that could turn and allow the skater to go both forward and backward.	While the first skates were fun for movement, they would not allow the skater to change direction. Improvements to the design allowed for greater opportunities to change directions by changing the ways in which the skater pushed on the skate.	Roller skates rely on wheels and axles to move. The wheels are attached in pairs to an axle with bearings, which allow the wheels to move quickly. The bearings help to eliminate friction that would cause the wheels to be slow.

dents might have. For example, students were curious about the older pair of roller skates, asking "How do you keep them on your feet, though?!" They also wondered why someone would need a tool to shell their corn, rather than just do it by hand.

Explore: Becoming an Antiques Sleuth

Once students observed our objects and shared their initial ideas, we explained the concept of an *Antiques Roadshow*. Students were shown a short clip from an *Antiques Roadshow* episode (*www.pbs.org/wgbh/roadshow*), all of which are readily available online. With so many options available, a teacher can easily find a clip that includes an item that would be of interest to his or her students or that may be geographically close to his or her location. Each show is labeled on the website with the location, and clicking on the location link allows the watcher to preview items featured in the show. We do encourage teachers to preview the clip that they've selected prior to use with students, as some items may be developmentally inappropriate for children or school (e.g., weapons).

Once students watched the clip, we asked them what some of the key information was that the appraiser shared with the owner of each item. The children noted that the appraiser was able to tell the time period of the item, what it was used for, who made it (when applicable) and the general value of the item. We also pointed out that the appraiser was also able to indicate what the items were made out of.

Next, we had the students get into groups to look at one of the artifacts that we provided (roller skates, corn sheller, bag, cell phone, reel lawn mower, record player). Students were grouped by their classroom seating arrangements, but the teacher might consider grouping students based on students' personal interests in each item, or using other criteria. We recommend keeping the groups small (three to four students), to allow time for each student to examine the object. Using the observations that they had from the video clip, we had the students investigate their antique item and determine if they could find the same information for the object. Students were provided time to explore their item and collect their data on a data collection sheet (see NSTA Connection). We allowed the students to conduct internet research to find information that they could not locate on the item itself, such as the inventor or the manufacturing time period. We focused on these inventions in our physical science unit, so we made sure to provide artifacts related to physical science and texts to support their research (see NSTA Connection). Because our students are in early elementary grades, we focused on forces and motion in studying physical science. The tools that we used relied on pushes and pulls for movement (such as the roller skates), or changes in the strength of the push and pull to make them move (speeding up on the skates required a greater force, for instance). As students looked at their items, we encouraged them to consider how pushes and pulls, or forces, impacted

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Antique roller skates captured students' attention.

the way that the object worked or was utilized. The students also looked for the crosscutting concept of patterns in their object's movement; for example, did the roller skates always go in the same direction as they were pushed? How does someone wearing roller skates change the way that they would move? Does this happen every time? This section of the unit took three 45-minute sessions to complete but could be adjusted based on class needs.

Safety Caution: When working with older items, it should be noted that ensuring the safety of teachers and students is a priority. All of the antiques roadshow objects were preapproved by administration and faculty before preservice teachers brought them to share with students. Gloves and safety goggles were provided to avoid objects flying or rust getting on hands, when applicable. Classroom teachers checked health records and allergies as a necessary precaution.

Explain: Considering the STEM Perspective

After providing exploration time, students came back together to share their findings with the class. As students shared their observations, we reinforced terminology, including *artifact*, *appraisal*, and *manufacturer*. We discussed how these items contributed to items that our students used in today's times; for example, the size-adjustable rollerblades that our students use now are based on the original key skates but don't require the owner to keep a skate key readily available! To review our Explore section, we reinforced the idea of learning about history through the use of the trade book *Be an Artifact Detective* by Kylie Burns (2017). We shared that, as the trade book notes, scientists can learn quite a bit about history and engineering through the exploration of artifacts from history (K-2-ETS1-1). Often, people create objects to solve a problem or to improve life. To make connections back to the artifacts that we shared with students, we had students provide explanations for why a record player was helpful (to provide entertainment), as well as objects like roller skates (to stay healthy and have fun). In addition to learning about history from artifacts, we explained that people can also use science, technology, engineering, and math to make products even better. As one student noted, "An iPhone is a lot easier to carry around instead of a record player!"

With their newfound knowledge, our students were then informed that they would be taking on the role of antiques appraisers. Students were told to find an "antique" object at their home, or a family member or friend's home, that they could investigate. The objects did not have to be valuable; they simply needed to be older than the student (we allowed flexibility with the age of the item to enable student participation). We also made sure to provide additional objects for children lacking the resources or support at home to find an object. We explained that the students would pretend to play a role on the Antiques STEM Roadshow, where they would appraise a found item, tell the audience about the item, and then explain its contributions in relation to STEM—for instance, how it improved a job or solved a problem and how it was further improved for today's use. Students were encouraged to bring both the antique item and its modern-day counterpart if they were able to do so.

We modeled the process for students by doing a simulation first. In the classroom, the teacher or preservice teacher pretended to present their antique artifact in the style of *Antiques Roadshow*. They again included the object; description of the antique's period, use, and value; materials used to make the object; an explanation of why the object was created; and ultimately what an examination of the change of the object tells us about science and technology. The students drew a picture of their object and explained how it used forces and motion to work. Students were encouraged to consider if there was more than one force or motion at work for their object and how balanced or unbalanced forces contributed to the object's design. Questions that students were also asked to address included:

1. What was the purpose behind this object? Did it help people to have fun, or did it make a job/process easier?
2. How does your object use forces and motion to help it function?

Students were tasked with creating new products, like this trash-catapult.

3. What did you find out about how your product has changed? Why do scientists/inventors/engineers change products like yours?

In asking these questions, our goal was to have students attend to the ways in which people create tools and objects to help them solve problems, reinforcing the science and engineering practices and performance standards from the *NGSS* (NGSS Lead States 2013). Additionally, allowing students to conduct research to answer these informational questions allowed us to also focus on the *Common Core State Standard ELA*.Literacy.W.2.8, which has students gathering information to answer questions. A copy of the questions and directions provided to students is included online (see NSTA Connection). While our students worked independently on their research, one could easily adapt these projects to be conducted with a partner. The teacher may also select the texts for students that they feel best fit the child's reading level, so that all students feel success in the project. Our tables were left blank so that students could enter their own responses, but the teacher could also assist students by providing sentence starters to guide their work.

After students obtained an item and conducted research, it was time for the antiques presentations! Students took turns providing information on the object and sharing what they learned with the class. Students were interested in the age of each item shared, which we placed on a timeline to show important points in their class collection. The use of a timeline was helpful for students to see items in chronological order and to make connections between a series of scientific ideas, one of the Common Core Literacy Standards (CCSS.ELA-Literacy 2.3). The teacher might consider using *Scutori.com*, a free website that includes timeline templates, to create the whole-class or small-group timelines for the inventions. The Explain section of our lesson took four days to complete, but like the Explore section, it could be shortened or extended to meet students' needs.

Extend: Investigating the Role of STEM in Product Improvement/Invention

Now that students had experience researching and presenting an item, we then informed them that they would become inventors of their own products meant to help others. Over the next four days, the students were challenged to consider how they could use physical science concepts, such as force and motion, to solve a problem or create a tool that would be useful for other people. They then had to develop a description of the product, its origin, the process of development, and specific concepts related to forces and motion using the key questions from our *Antiques Roadshow* chart to guide their thinking.

Students were introduced to an antique corn sheller.

Using classroom items and found objects from home, we had students work in groups of three to four to develop their products. Our groups were based on student interests; students were matched with peers that had similar ideas to allow them to work together. Teachers might also consider pairing students so that English language learners or students with special needs had a support partner who would work alongside them. While we encouraged students to use their creativity, we also took care to make sure that students were careful with items, such as staplers, and we assisted in the use of hot glue. Students wore goggles to protect their eyes during the construction phase.

The projects that our students developed were both entertaining and surprising to see. For instance, one group of students decided to develop a device that would catapult trash into the trash can, to make cleaning up more fun. They were able to explain to the class, "the more force you put on the cup [by pushing down], the farther the trash can fly!" Another group wanted to build a slide to go alongside the stairs at their houses, so they built a miniature model of what this would look like, and a third group tried to make a silent hamster wheel for one student's noisy pet! Each group was able to identify how pushes and pulls impacted the use of their invention; for instance, students shared that the harder the push, the faster you could go down the slide. In addition to allowing students time to develop their own inventions, a teacher might also consider having a guest speaker in engineering or development come speak to their class about the invention process and physical science. A Skype or Google Hangout session with a local museum curator, historian, or engineer would further assist students in learning about real-world applications of their work, and provide them with opportunities to ask questions of someone in the field.

Evaluate

Allowing students to share their ideas during the Engage, Explore, and Explain sections of our lesson enabled opportunities for us to formatively assess what students already knew, and provided guidance in terms of lesson structure and support for subsequent activities. On the final day of the unit, student presentations for the Antiques STEM Roadshow were evaluated using an "I can" checklist to assess both the information gathered and the students' abilities to articulate that information to others (see NSTA Connection). In addition, students could write a paragraph at the end of the lesson to reflect on what they learned both about inventions and forces and mo-

tion. They can also draw a model of their invention, labeling the forces and intended motions of the invention.

Considerations

While our project was done with early elementary students, it could easily be used at the older grade levels too, with students researching both the item of interest and its inventor. Older students may be fascinated with how the inventor went through the processes of developing a product, which further highlights the nature of science. Social studies and English content may be integrated through biographical research of the inventors, as well as research on the production of goods and items meant to improve daily lives.

The teacher may also choose to provide more or less scaffolding for students, depending on both the students' ages and ability levels. Because our students were young, providing a graphic organizer to help them write down and draw out their information was necessary. The teacher may opt to provide a finite list of items or individuals to study, depending on the needs of his or her students. Additionally, the teacher might consider having students write about what their developed invention might look like 10 years in the future, so that they can consider changes in technology and science over time while integrating writing skills.

Conclusion

During this investigation, students become scientific historians. They interacted with antique artifacts, invoked in evidence and historical timelines, and became somewhat of a museum curator for science and industry. They learned about objects from the past and the evolutionary process of simple machines, toys, and entertainment that were relevant to their region. Interns and students applied the foundational concepts and workforce skills of anthropologists, mathematicians, engineers, scientists, and informal historical science educators. Given the evidence and smiles we observed, all of our students left with a newfound appreciation for STEM! In fact, many stated they were interested in learning to design new toys and inventions one day! ●

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National Museum of Roller Skating. 2016. Homework Help. Retrieved from *www.rollerskatingmuseum.com/homework.html.*

NGSS Lead States. 2013. *Next Generation Science Standards: For states, by states*. Washington, DC: National Academies Press. *www.nextgenscience.org/nextgenerationsciencestandards*

Old Lawn Mower Club, n.d. Mower History. Retrieved from *www.oldlawnmowerclub.co.uk/aboutmowers/history*.

RESOURCES FOR TEACHERS

Royce, C. 2016. Teaching Through Trade Books: Recording Scientific Explorations. *Science and Children* 54 (3): 21–27.

INTERNET RESOURCES

Full Episodes of The Antiques Roadshow *www.pbs.org/shows/antiques-roadshow*

TRADE BOOK FOR STUDENTS

Burns, K. 2017. *Be an artifact detective*. St. Catharines, Ontario: Crabtree Publishing Company.

NSTA Connection

Download supplemental resources at *www.nsta.org/SC0819*.

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013)

Standard

K-2-ETS1 Engineering Design

www.nextgenscience.org/dci-arrangement/k-2-ets1-engineering-design

- The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities.
- The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectation listed below.

Performance Expectation

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

DIMENSIONS	CLASSROOM CONNECTIONS
Science and Engineering Practice	
Asking Questions and Defining Problems	Students research an antique, describe its purpose, identify how models change over time, and identify the physical science concepts used in the item's design.
Disciplinary Core Ideas	
ETS1.A: Defining and Delimiting Engineering Problems A situation that people want to change or create can be approached as a problem to be solved through engineering.	Students identify the purpose behind an antique and the way it contributes to an improved quality of life.
PS2.A: Forces and Motion Pushes and pulls can have different strengths and directions.	Students explain how force and motion impact the movement of the invention, including its direction, speed, and strength. Students explore the advancement in tools to learn how humans have improved their design.
Crosscutting Concept	
Patterns	Students investigate if forces impact an object's speed and direction the same way every time the object is moved.

Engineering, Technology, and Application of Science

Influence of Science, Engineering, and Technology on Society and the Natural World	Students identify the purpose behind an antique and the way it contributes to an improved quality of life.

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