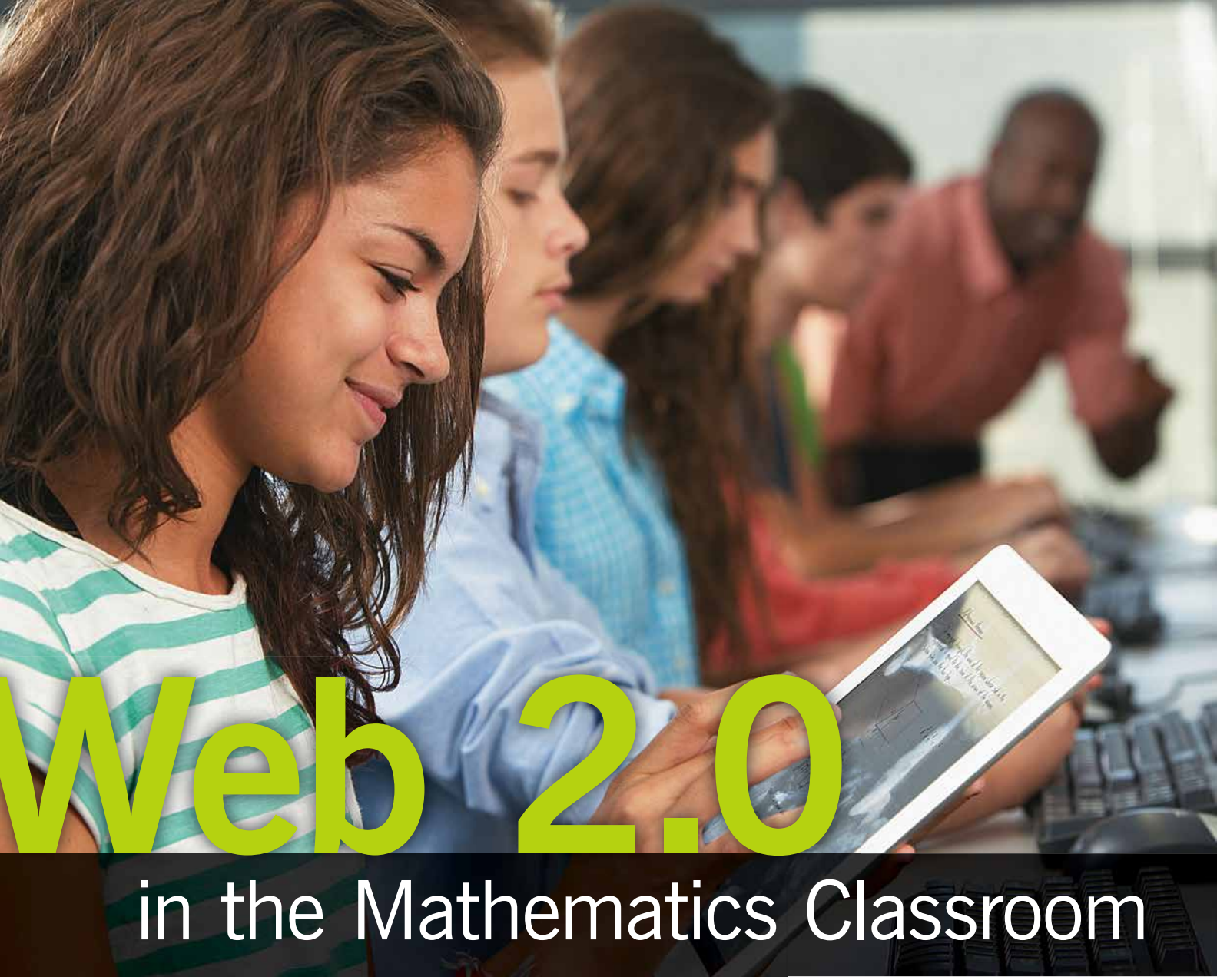

Web 2.0 in the Mathematics Classroom

Leah P. McCoy

To promote creativity, collaboration, and communication, look to interactive applications, broadly called Web 2.0.

A key characteristic of successful mathematics teachers is that they are able to provide varied activities that promote student learning and assessment. Web 2.0 applications can provide an assortment of tools to help produce creative activities. The term *Web 2.0* designates Internet applications that provide a context in which students create, collaborate, and communicate. The Internet technology is not unique, but the applications that are accessed and used are interactive and go beyond static browsing. A Web 2.0 tool enables the student to enter data and create multimedia products using text, graphics, audio, and video. The possibilities for

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creativity and variety are endless.

The Standards for Mathematical Practice (SMP) in the Common Core State Standards include a strong emphasis on student reasoning and sense making and on demonstrations of understanding (CCSSI 2010). In describing mathematical proficiency, these standards recommend that students should work collaboratively, explaining and discussing concepts to refine understanding (CCSSI 2010, SMP 2 and 3, p. 6). Students should model and apply their mathematics knowledge (SMP 4, p. 7) and use technological tools and communicate their understanding precisely (SMP 5 and 6, p. 7). Web 2.0 tools can be useful in structuring a variety of learning experiences to enable the development of students' habits of practice, as recommended by the Standards for Mathematical Practice. In the following activities, students interact with the mathematics in a creative and collaborative context and communicate their understanding both individually and in groups while working on projects.

Web 2.0 tools can be useful in structuring a variety of learning experiences to enable the development of students' habits of practice.

THE GLOGSTER PROJECT

Glogster® is a Web 2.0 tool that is used to create a *glog*, which is "an interactive visual platform in which users create a 'poster' containing multimedia elements including text, audio, video, images, graphics, drawings, and data" (Glogster™EDU). The tool uses a simple drag-and-drop interface that is easily mastered by students of many ages and learning styles. It can be useful in not only a lower-level general math class but also an advanced course. The Glogster (http://edu.glogster.com) free version was used for this project. A commercial version includes additional features.

The Glogster Project was implemented in two algebra classes in a rural southern middle school. Each class included about twenty students who were in eighth and ninth grade. The students worked in groups of three or four to create a multimedia representation of an assigned algebra topic. This project was assigned late in the school year as a way to further examine major topics already studied in the course, including the Pythagorean theorem, the distance and midpoint formula, scatter plots, and the quadratic formula. The purpose of the activity was to engage students in revisiting and modeling their understanding of the concepts and to broaden and deepen their understanding. The group assignment was used to promote a discussion of the concepts.

The students were first oriented to Glogster by viewing examples of glog posters and learning how to use the software. Preparing the glog was a two-step process. Students first determined their content, and then created the design. The assignment stipulated that students create a glog for their topic containing the following content features:

- An introduction of the topic and basic definitions
- Problems represented algebraically and graphically
- A statement to show where the topic fits in the "big picture" of mathematics
- An example of a real-world problem

Each group planned extensively. Students began by discussing the topic, definition, model, and application. Rich discussion was evident as students debated and constructed a group understanding of the topic. An informal storyboard was used to encourage students to take notes and keep track of their ideas.

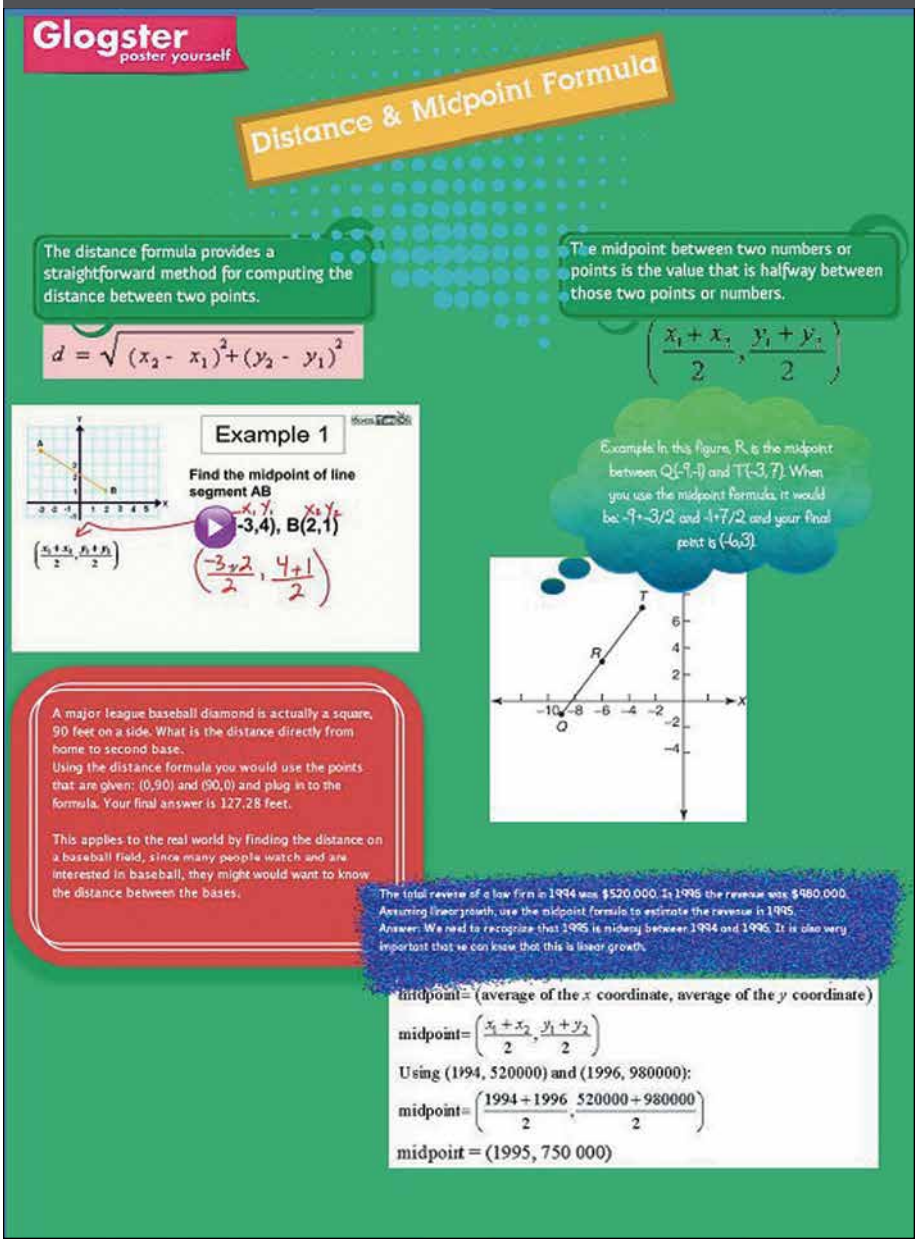
Once the ideas were in place, the groups decided on the design features that they would incorporate into their glog. They were asked to include text (words, equations, algebraic expressions), images (pictures, graphs), and audio/video (an original podcast, a link to an online video, a link to their original video uploaded to YouTube). They could select from a wide variety of color schemes and could arrange elements as they chose. Computer lab time was allocated so that the groups could complete the design process. Video cameras and digital audio recorders were available for original media, which was encouraged. Each group completed a glog that was presented to the class at the end of the two-week project. Assessment was based on a rubric.

The glog in **figure 1** described the distance formula and the midpoint formula. It included graphs, formulas, video of a problem under construction (from SchoolTube®), and two applications: a baseball diamond and finance. Another glog, shown in **figure 2**, explored scatter plots and included several graphs, definitions, applications, and video calculator instructions.

RESEARCH STUDY

The research study spotlighted here examined the effect on attitudes

Fig. 1 This glog demonstrated a group understanding and application of the distance and midpoint formulas.



toward mathematics when the Glogster activity was used in a middle school algebra class. Participants in the study were thirty students in two classes. Data were not included for students who failed to return consent forms. The data collection involved both a presurvey and a postsurvey of student attitudes toward mathematics. A focus group discussion with students at the end of the study collected comments about the project activities.

Results from both the pre-attitude and post-attitude measure showed that the students were more positive toward mathematics at the end of the study. The focus group discussion indicated that students enjoyed the activities, liked the active involvement, and found it motivating. One student said, "It is better than taking notes because then I get tired and I zone out. With this, you actually want to focus and figure out what you want to do because you have to present it and you want it to be good. And it will reflect on you." Comments indicated that the presentations were a source of motivation for many students.

Students also reported that they enjoyed the multimedia, especially the color and the videos: "I like it when we get to do different colors and we got to personalize it and that made it pop out." They said that they appreciated the collaboration because they found it was "cool to see everyone's view on the math and their applications." The students further revealed that they were quite pleased with their creations. One student said, "This makes math real and fun. I understand it better now." An evaluation of their projects confirmed that they were able to accurately model the mathematical concepts, including real-world problems, in varied representations.

One disappointment was that groups used online video material rather than creating their own videos. The Khan Academy® (https://www.khanacademy.org) site was appealing to students, as were other videos available in SchoolTube (http://www.schooltube.com). Although students knew how to create a video or a podcast, this create-your-own video was only an option, and students chose the finished products that were available online. This may have occurred because of their lack of experience, thus making them unwilling to take a chance on original video. In future projects, additional instruction will be given on creating video, and an original video or podcast will be required.

Conclusions from the research component involved attitudes, engagement, and collaboration. From evidence based on survey results and comments, students' attitudes toward mathematics showed improvement after the project. Their comments confirmed that they were engaged and interested. They indicated that the

group collaboration was important in helping them talk about the content and understand it better. They felt that they learned mathematics, and they enjoyed it, as well. The Glogster tool was effective in providing a context for students to create (model), collaborate (discuss), and communicate their understanding.

OTHER WEB 2.0 TOOLS

Other creative, interactive Web 2.0 tools offer similar benefits and are briefly described below.

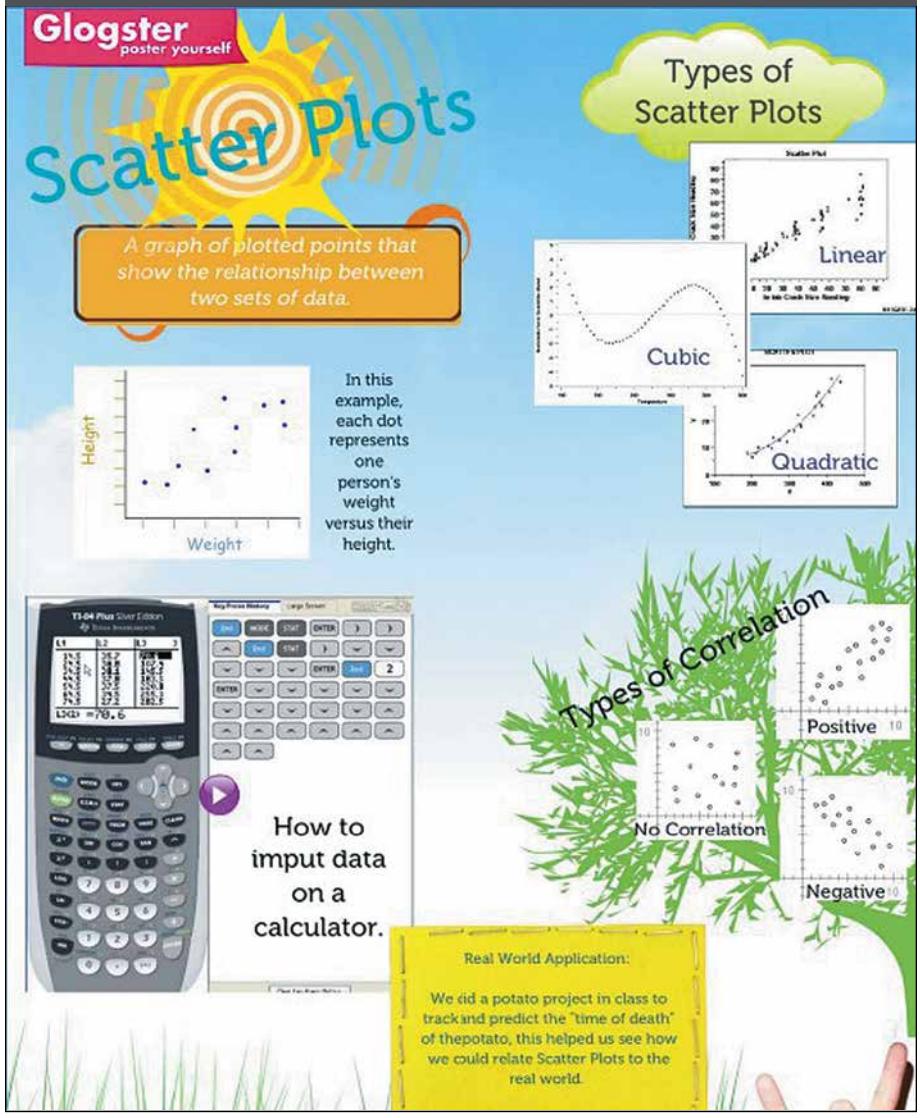
Wordle

An application that generates "word clouds" or pictures composed of words is the principle behind Wordle™ (Feinberg; http://www.wordle.net). The relative size of the words is proportional to their frequency in the chosen text. In addition to being fun and colorful, a Wordle is an effective way to assess student understanding and emphasize vocabulary. It can be used for guided reflection and discussion to promote a deeper understanding of the vocabulary. For example, student pairs were asked to generate a ten-word vocabulary list once they had finished a unit on equations. These lists were entered into the Wordle application. **Figure 3** shows one resulting graphic. Students were asked to discuss the Wordle in their groups and decide whether they agreed with the vocabulary terms that were identified as most important by the class. This guided reflection resulted in deeper learning of the vocabulary. A similar activity would be appropriate to emphasize the vocabulary in any topic or at any level.

Poll Everywhere

For a quick and easy way to collect data from students, use Poll Everywhere (http://www.pollevery where.com). This application allows the teacher to set up a survey, and students can respond either by computer or by text message. (Yes, cell phones in the classroom!) The survey questions may be true or false, multiple choice, or open ended. Poll Everywhere will then display the results instantaneously, either as a table, a graph, or as text. The text can be transferred to a Wordle or simply used for discussion. This tool provides formative assessment that is similar to personal response systems, known as "clickers," which involve considerable expense and set up. The only requirement for Poll Everywhere is that each student or group has access to a smartphone or computer.

Fig. 2 Scatter plots were used appropriately by the group that produced this glog.



Pixton

To enable students to create their own comic strips using a simple click-and-drag interface, look up the online tool called Pixton® (http://pixton.com). This tool allows students to write their own application problems. **Figure 4** shows a simple Pixton example that students constructed in response to being asked to generate an arithmetic or geometric sequence of their own. Students then presented their comic strips to the class the next day, and the class discussed the problems. Problem posing has long been recognized as a motivating instructional practice in

Fig. 3 The word *equations* provided the impetus for this student-created Wordle. The assignment asked students to generate ten associated words and plug them into the Wordle application.

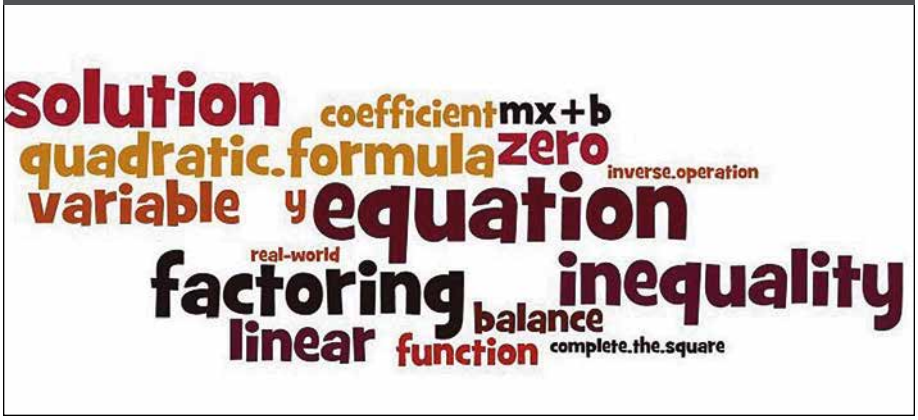
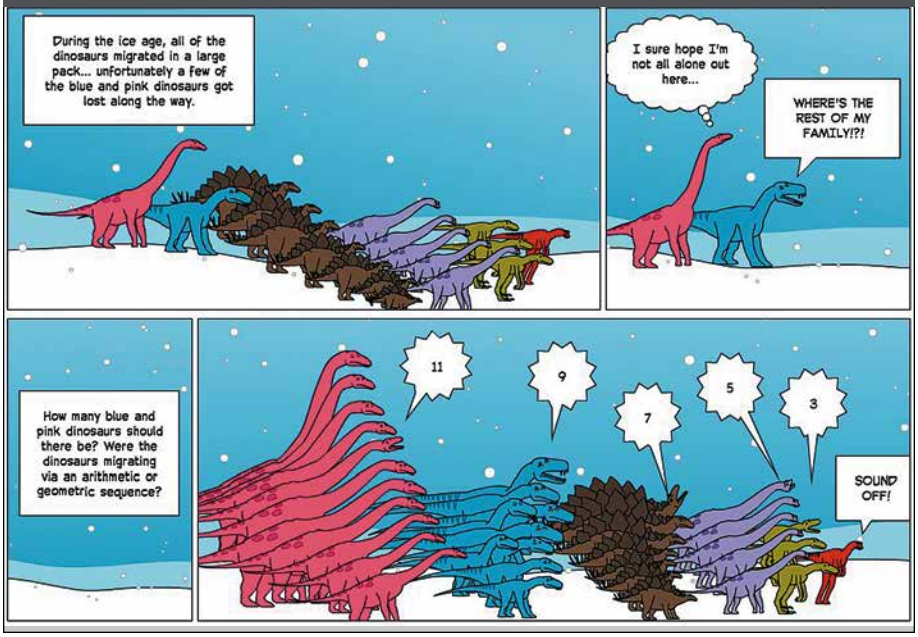


Fig. 4 This Pixton, or comic strip, was constructed by a student group in response to an assignment to produce an arithmetic or geometric sequence of their own.



mathematics (e.g., Polya 1957), requiring students to reflect on the mathematics and model it in a real-world context. Pixton provides a graphic, electronic interface that broadens this traditional activity using a twenty-first-century learning tool.

Voki

To create podcasts and customize characters that speak, students can access Voki® (http://www.voki.com/). They can choose a character, a background, and a voice or accent or use their own. Students might create a series of vokis to explain a concept or give examples or steps for solving a problem or understanding the context of a problem. In any of these uses, the student or group must reflect and plan how to articulate their understanding through a podcast. A sample voki created by a student group shows a character stating the steps for solving a word problem. The group discussed the problem at length and planned carefully so that all members were in agreement and could justify each step. The final product can be accessed at http://www.voki.com/pickup.php?scid=7151891&height=267&width=200. This activity provided a different communication medium—audio—which involved both reflection and discussion as the group had to articulate about and agree on their understanding. The presentation could be given to the class or collected and evaluated by the teacher as formative or summative assessment data.

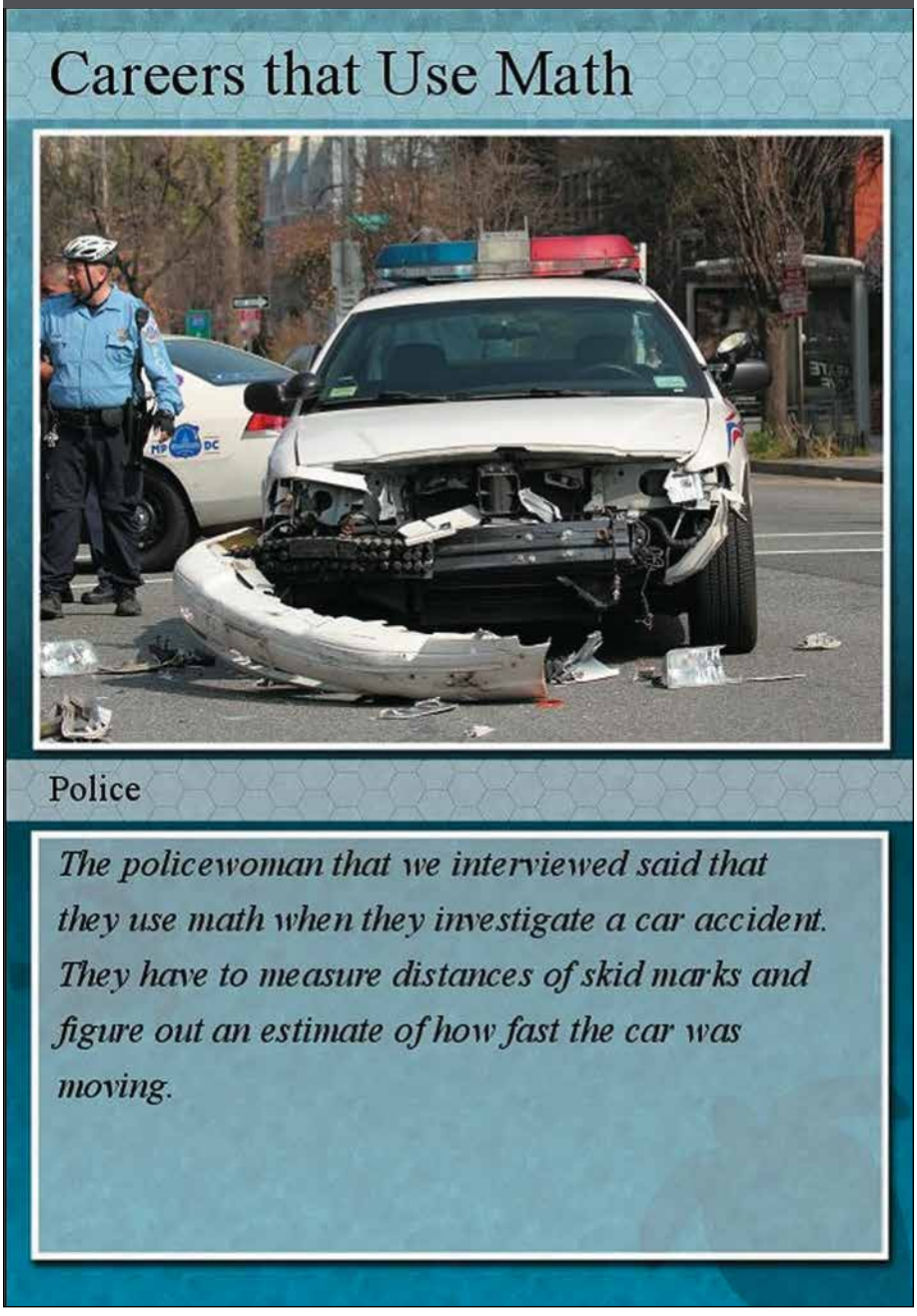
Trading Card

To create a product that resembles a baseball card, including graphics and text, students can access the Trading Card application (http://www.bighugelabs.com/deck.php). This online tool could be used, for example, to create a project to study the history of mathematics. Students can select a mathematician and create his or her own card. Another project involved student groups interviewing people in the community and making a card to show how mathematics was used in their work. **Figure 5** shows a student-created card for a police officer. In this project to facilitate connections between mathematics and the real world, the cards created by class groups were displayed on a bulletin board titled, "When are we ever going to use this?"

EduCreations

An online whiteboard called EduCreations® (http://www.educreations.com) allows the user to write and record audio. It produces Flash Videos similar to those found at the Khan Academy site and is an iPad® application that also works in any computer browser. This tool can be used by the teacher to produce online learning materials. However, it is most valuable when accessed by students. Student groups can be

Fig. 5 The question, "When are we ever going to use this?" resulted in this Trading Card generated by a student to show connections between math and the real world.



assigned a problem and can write on the electronic whiteboard as they explain what they are doing and why during their presentation via EduCreations. They can also import graphics, such as a grid for constructing a graph. The resulting video can be presented to the class or it can be viewed later by the teacher for assessment.

TOOLS FOR STUDENTS

The activities described here show examples of Web 2.0 tools that can be used effectively in a variety of mathematics classes. They can assist students in creating, collaborating, and communicating understanding. It is important to remember that although a tool might be good for the teacher, it is almost always better to put it in the hands of the students. The maximum benefit will occur when students create and communicate a model of their understanding in a hands-on collaborative environment that also engages them mathematically.

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Any thoughts on this article? Send an email to **mtms@nctm.org**.—*Ed*.

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