



CELL AND TOWERS

by Michelle Klosterman,
Jennifer Mesa, and Katie Milton

Most of us have been there. You're just starting a lesson and everyone's attention turns to the cell phone ringing in the middle aisle. The owner, one of your students, turns red and apologizes, but still looks down to see who's calling. Students rely on cell phones, and whether they are used for emergency or entertainment, they are dominating our students' culture. As teachers, what are we to do? Ignore the rings? Chastise students for bringing them to class?

This article discusses how we used our common addiction to cell phones to launch a discussion about their use, impacts on the environment, and connections to issues of civic concern. By encouraging students to adopt the perspectives of special-interest groups debating communication tower restrictions designed to protect migratory songbird populations in a role play, we connected middle school science with language arts and social studies in a meaningful way while focusing our students' attention on the larger impacts of cell phone use.

The role play is designed to take advantage of the naturally occurring intersections among science, language arts, and social studies. In alignment with the National Science Education Standards, students will learn about the ecological role of birds and the impact of humans on bird populations and

SONGBIRDS

the environment through the exploration of a current science, technology, and societal issue. More specifically, students will learn about how the construction of communication towers for cell phones and other digital communication technologies impacts migratory songbird populations.

Cell phones, towers, and birds

Communication towers are necessary to expand access to many vital services, such as digital communication and emergency services, in small communities around the country. However, communication towers result in the death of millions of migratory songbirds each year (Erickson, Johnson, and Young 2005). Birds may be killed when they collide with the towers or the towers' guy wires, which are the tension cables that stabilize the towers by attaching the tower to the ground. Alternatively, the lighting of towers may cause birds to become disoriented and fly in circles until they die from exhaustion. Most concerning, the construction of new towers has accelerated in recent years with the increasing demand for digital communication services. An estimated 5,000 to 10,000 new towers are being built each year, mostly in rural areas (Erickson, Johnson, and Young 2005).

Songbirds migrate because of seasonal food scarcity, and their migrations are timed with the seasonal changes in temperature and sunlight. Migratory songbirds fulfill many ecological roles, including pollinating flowering plants,



dispersing seeds, preying on invertebrates, and falling prey to other animals. Each new communication tower not only impacts migratory songbird populations, but also populations of innumerable other animals and plants. When populations of migratory songbirds decline, entire ecosystems are impacted.

In the course of this role play, students will participate in a town hall discussion of the advantages and disadvantages of building an additional communication tower in a small, rural community. The economy of the community is based on ecotourism; that is, tourists visit to watch the migratory songbirds in the late spring. Representing stakeholders at the town hall meeting, students will practice the language arts skills of crafting and communicating effective arguments to an audience. Furthermore, students will identify and share negotiation points in a debate to convince their peers of the validity of their arguments before a class vote.

Citizens in a democracy can participate in their government in a variety of ways. U.S. citizens, in particular, can participate at the local, state, and federal levels of government. The activities of students in this role play mirror many of the actual roles of citizens in the local level of government. Students practice the social studies skill of considering multiple perspectives of an issue. They also practice weighing the costs and benefits of proposed legislation: in this case, an ordinance restricting the construction of new communication towers. In the end, students vote on the ordinance based on their individual cost-benefit analysis.

Setting the stage

The role play was part of a lesson designed to introduce science-technology-society (STS) issues in the classroom through the use of role plays. Setup for the activity takes less than 30 minutes and includes making copies (one for each group) of the instruction sheet (Figure 1) and the role cards (Figure 2). The instructor also needs to copy a student record sheet (Figure 3) for each student.

Prior to beginning the activity, teachers can use an anticipation guide to determine how much students already know about communication towers and migratory songbirds. As an example, five statements including the statistics and impacts of towers on migratory songbirds from the previous section can be given to students. Students can then decide if each statement is

true or false. A class vote on each statement or a brief class discussion of student responses can illuminate students' prior knowledge.

Day 1

When we used the role-play with our students, each student was first assigned to one of five groups: ornithologist, consumer, Chamber of Commerce, state highway patrol, or the communications company. When possible, equal numbers of students were assigned to each group. The teacher then passed out copies of the instruction sheet and student record sheet and reviewed the procedures for the role-play, including appropriate behavior, with students as a whole group. Students were asked to record the five groups and then predict each interest group's position on their student record sheets (item #1 and #2 on the student record sheet). To check for understanding, the teacher led a brief discussion of the class's predictions. As an alternative, teachers may find it helpful to ask students to name some groups in the community who might be interested in or concerned about communication tower construction *before* completing item #1 on the student record sheet. Asking students before assigning them to groups is another way to assess student background knowledge.

Afterward, students read their role cards and discussed their position on the proposed legislation to restrict construction of new communications towers with their group. They were encouraged to conduct further research to support their position using the internet. Some websites used by students were the U.S. Fish and Wildlife Service's website on migratory songbirds (www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm), a news article about U.S. Coast Guard use of towers (www.sierrasun.com/article/20090729/NEWS/907299994/1066&ParentProfile=1051), and a HowStuffWorks website on cell phones (<http://electronics.howstuffworks.com/cell-phone10.htm>).

Last, students were given time to discuss signs, costumes, or other props that they could bring in the following class period to identify their groups and get into character at the town meeting. At a minimum, students were asked to bring in a sign that would identify their group in the town meeting. The signs were brought into class on the next day for the town hall meeting. Other props or costumes were optional and were also brought in the following day.

FIGURE 1 Instruction sheet**Scenario**

You live in a small town whose dependence on digital cell and TV towers has increased over the years. Due to this identified need and the rising population of your town, communication companies have approached your city commissioners about installing another cell tower in your town. Unfortunately, local residents and scientists have found that cell towers are killing millions of migratory songbirds each year. In fact, your town is a well-known migratory point for songbirds during the spring season. The songbirds that stop to rest in your town attract several thousand tourists each year. Several special-interest groups will be participating in a town meeting to discuss whether the installation of additional cell towers should be allowed in your town. The participants will include consumers, Chamber of Commerce members, highway patrol officers, ornithologists, and communications company employees. At the conclusion of the meeting, a vote will be taken by the residents of your town to decide whether further cell towers will be allowed in your town.

Instructions

You have been assigned to one of five interest groups: consumer, Chamber of Commerce, highway patrol, communications company, or ornithologist. With your group members, you will act like a member of the group you were assigned. Using the role cards provided by your teacher, become familiar with your group's role and position. Discuss your feelings on the issue at hand as a group.

You will participate as a group in a town meeting with the rest of the class. The discussion will take place in four rounds: introduction, negotiation, voting, and debriefing. Your teacher will be the moderator of the discussion and will call on groups to speak one at a time. When the teacher calls on your group, any group member may speak. All groups are expected to participate.

1. Introduction (25 minutes)

- Each group will have four minutes to speak and introduce their role and perspective on the tower restrictions. Personal feelings and creativity are allowed and encouraged.

2. Negotiation (10 minutes)

- Groups will take turns, in no particular order, sharing their position on the issue: Should digital and TV tower installation be discontinued to protect migratory birds? Groups are also encouraged to share "negotiation points" that may appeal to other groups.

3. Voting (5 minutes)

- As a class, a decision will be made through a vote as to whether the restriction should be passed. This vote will be based on your personal opinion as a citizen of your town, and not as a member of your assigned special interest group.

4. Debriefing (10 minutes)

- The class will discuss what determined each person's vote and the significance the vote might have on each group's role.

Rules

1. Address other groups and classmates with respect.
2. Keep your comments to the topic of discussion.
3. Speak only when the teacher calls on your group.
4. Participate in discussion.
5. Remember to complete the student record sheet.

Consequences

If the teacher needs to remove you from the discussion, you will not receive any participation points for the day and you will not be able to vote during the voting stage. You are still expected to complete the student record sheet.

Grading

Participation	30 points
Student record sheet	70 points
Total	100 points

FIGURE 2 Role cards**Consumer**

You are a devoted cell phone user. Your mother depends on your cell phone to keep track of you, and you use the cell phone to keep track of your friends. Cell phones have made your life easier because you are able to communicate with whom you want, when you want. You can also depend on your cell phone in case you are in a dangerous situation or car accident and need to contact emergency personnel. In fact, the OnStar navigation and safety feature in your car depends on communication towers. Lastly, the same tower that provides service to your cell phone provides service to your digital TV. Although you know digital TV is not a necessity, it is a luxury that you enjoy nightly.

You are not thrilled about the rising costs of cell phone plans, especially since your parents make you pay your own cell phone bills (except for the calls they make to you). If the cell phone tower installation restriction passes, you will no longer be able to use your cell phone, or may be limited to how frequently you can use it. This is because limited towers mean limited users, and the cell phone towers in your area will primarily be used for emergency personnel such as EMTs and police officers.

On the other hand, if the restriction does not pass, your cell phone bill may increase. It costs money to build towers and it will cost the communications company more money to fulfill the U.S. Fish and Wildlife Service's recommendations for cell towers. This increase in cost will be reflected in your increased cell phone bills.

Chamber of Commerce

You are a member of your town's Chamber of Commerce. The Chamber of Commerce supports local businesses in the area and tracks the impact of tourism on your town. Your town credits the unique population of migratory songbirds with thousands of tourists who visit your area annually. These songbirds visit the area between March and May when many of the part-time residents have returned to their summer homes, and before the influx of summer tourists. More tourists mean more money for the local businesses and an improved economy for your town.

You are not thrilled by the idea that communica-

tion towers kill millions of migratory birds each year. A decline in migratory birds to your area would mean fewer tourists and less money to local businesses. On the other hand, you recognize that in order for your town to grow, technology needs to meet the town's demand. Furthermore, an increase in tourists puts a strain on your current communication tower, and a second tower may alleviate any overload.

Highway patrol

You are a member of the state highway patrol and the safety of your local residents is paramount. You frequently use a cell phone or other device that relies on communication towers to do your job. Other emergency personnel such as EMTs and firefighters also use this technology. You also recognize that the town's citizens use cell phones to help you with your job by reporting medical emergencies, drunk drivers, crimes, and car trouble.

Although limited cell phone use may not impact you directly because you will still be able to pull service off of the existing tower, it could impact the amount of help you receive from the local residents. Additionally, when car accidents occur, they are less likely to be fatal when they are reported immediately.

On the other hand, you are aware of the complications cell phones cause. The likelihood of collision is four times higher when a driver is using a cell phone. For drivers over the age of 50, a cell phone can increase their response time (the amount of time it takes to react to a situation) by 200–300%.

Many states, such as New York, have implemented hands-free cell-phone use laws that have reduced the number of accidents, but they also increase the amount of time the highway patrol spends on traffic violations rather than on general safety issues.

Communications company

You are a member of the communications company that has approached the town's commissioners about installing a new communication tower. You have identified that this town is in immediate need of an additional tower because of its rapidly increasing population and increase in the town's cell phone and digital TV use. In the United States alone, 100,000 towers will be needed over the next 10 years to accommo-

date cell phone and digital TV use demands. Your company plans to pay top price to the land owner on whose land you intend to place the tower. The increased availability for cell phone and digital TV use will increase the town's technological capabilities, population, and economy. More people mean more money for the town.

You recognize that environmentalists are concerned about how communication towers affect migratory bird populations. While they report that 5–50 million birds are killed annually by towers, no extensive research has been done on the matter. In comparison to window strikes, which kill 97–976 million birds per year, and pesticides, which kill 72 million birds per year, communication towers do less damage.

Your company agrees to follow some of the U.S. Fish and Wildlife Service's recommendations for communication towers such as modifying the lighting system to white strobe lights to limit the attraction and disorientation of migratory birds at night. Your company could also spend an additional \$70,000 per tower to make the tower without guy wires. Birds are frequently killed by colliding with guy wires. Unfortunately, making these accommodations will mean higher prices for cell phone and digital TV users.

Ornithologist

You are an ornithologist (bird expert) concerned about the impact of communication towers on migratory bird populations. It has been found that towers kill an estimated 5–50 million birds annually. The birds usually migrate at night and become disoriented by tower lights. Communication towers over 199 feet in height are required to have lights. Red lights are particularly disorienting to the birds. Birds fly around the towers in circles until they die from

exhaustion. Birds also die when they collide with the guy wires of the towers.

Over one-quarter of all avian species have been estimated to be affected by communication towers. Birds from 52 species that are considered "in decline and [in] need [of] special attention" (American Bird Conservatory 2000) are affected. Migratory songbirds play many important roles in ecosystems and their decline has serious consequences for ecosystem health. In the fall, many migratory songbirds feed on ripe fruit and insects to build fat stores for their migration to Mexico, Central America, and South America. When these birds eat fruit, they disperse the seeds in their droppings throughout their habitat. Seeds that germinate away from the parent plants have a better chance of growing into new plants because of less competition for sunlight, space, water, and nutrients.

Upon their return to North America in the spring and summer, many breeding migratory songbirds feed almost exclusively on insects, keeping insect populations in check. Insect populations that grow too large can threaten humans and other animals by spreading diseases or destroying food sources. Some migratory songbirds, such as hummingbirds, are nectar eaters. These birds pollinate many flowering plants in their search for nectar. All migratory songbirds are food for predators and scavengers. Natural predators of migratory songbirds or their nests include snakes, foxes, skunks, raccoons, squirrels, and other birds (e.g., hawks and crows).

It is important for small towns such as this one to consider the cumulative impact of towers in the area. One tower may do significant damage, but two towers will do twice the damage, especially in a popular migratory location such as this town.

Day 2

Before beginning the town hall meeting on the second day, students were reminded of the procedures for the day and given the opportunity to review their student record sheets. Students were also reminded that the town meeting would occur in four stages: the introductory round, the negotiation round, the voting round, and the debriefing round.

During the introductory round of the town hall meeting, student groups presented their position on the proposed communication tower restrictions. Students in the audience were asked to take notes on the information presented by each group in order to familiarize themselves with the various special interests present at the town meeting.

Following the first round, students were given 10

FIGURE 3 Student record sheet

1. List the five interest groups involved in the discussion.

2. Predict each group's position and reasons for their positions.

Group	Position (for or against restrictions)	Reasons for position
-------	--	----------------------

3. Come up with two negotiation points for each group that may help sway their vote to your position.

Group	Point #1	Point #2
-------	----------	----------

4. What are the economic costs and benefits of discontinuing cell tower installation?

Costs	Benefits
-------	----------

5. Name three reasons given by your classmates in support of the restrictions.

1. _____
2. _____
3. _____

6. Name three reasons given by your classmates in opposition to the restrictions.

1. _____
2. _____
3. _____

7. Decide whether you would vote for or against the communication tower restrictions. Identify your decision and explain why you plan to vote this way.

minutes to brainstorm “negotiation points” that may appeal to other groups in the voting process. (This task is #3 on the student record sheet.) Students then shared these negotiation points during the second round of the town hall meeting in an open discussion. More specifically, students referenced the economic

and ecological impacts of communication towers in this discussion. Immediately after the discussion, students were asked to reflect on the economic costs and benefits of communication towers and record reasons given in support of and opposition to the restrictions. (These tasks correspond to #4–6 on the student record

sheet.) Each group was then given one minute to address the class with their closing argument to conclude the negotiation round.

Finally, students were asked to put aside their role-play character and return to their own way of thinking for the voting round. Students, as themselves, completed #7 on their student record sheet to commit in writing how they would vote on the communication tower restrictions based on all of the arguments presented in the town hall meeting. The student record sheets were then collected and the results for #7 were totaled and shared with the class. After returning the student record sheets, the teacher led a 10-minute debriefing round in which students shared the arguments they found the most convincing and explained why.

Assessment

Any time group work is used in the classroom, assessment decisions should revolve around the purpose of the activity; that is, whether it is to increase content knowledge, promote collaborative group work, or both. Through the use of role plays like the one presented here, teachers can assess student work at both levels without increasing teacher workload.

As frequent users of role plays, we have found peer evaluation to be a valuable tool to evaluate collaborative group work. Students can evaluate each other on how well they worked together to brainstorm and plan during session one and how well they supported their spokesperson(s) during session two.

Additionally, teachers can conduct formative assessments during the group debriefing sessions and review responses to the first few items on the student record sheet. Summative assessments can be made at the conclusion of the role play by examining student responses to #7 on the student record sheet. Examination of this one item allows teachers to see if students really understood the issue and how it related to science content by examining students' ability to use supporting evidence to support their positions. As mentioned earlier, the use of evidence to support an argument is an essential skill in both social studies and language arts.

Other skills addressed by role plays that are easily assessable by teachers are students' ability to consider both the costs and benefits (pros/cons) of the issue when choosing a side (for or against tower restric-

tions), participate civilly in group discussions, craft a persuasive argument, communicate ideas, and engage in active listening; each of which are skills required in both social studies and language arts.

Conclusions

In general, students seem to love role plays. Role plays involve students and encourage them to have a voice in the classroom. Teachers enjoy role plays because they become facilitators, rather than directors, of their classrooms.

Using role plays that integrate science content and STS issues relevant to students' lives brings a whole new meaning to "doing science." As one student wrote, "I like this activity because it allows students to see both sides of a situation. They learn facts about a situation in which they may not have learned if given normal instruction on a topic." Another student commented, "I really enjoyed this activity! I think it's a great idea for kids of any age to put on someone else's shoes and take another perspective. It allows them to stretch their minds and really pushes them to look at things differently."

Science expands beyond the classroom walls, and science classrooms should integrate the knowledge and skills of other disciplines to strengthen the future capacities of all students. ■

References

- American Bird Conservatory. (2000). *Communication towers: A deadly hazard to birds. A report by the American Bird Conservatory*, Washington, DC: American Bird Conservatory. Retrieved from www.abcbirds.org/newsandreports/towerkillweb.pdf.
- Erickson, W.P., G.D. Johnson, and D.P. Young. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collision. USDA Forest Service. www.fs.fed.us/psw/publications/documents/psw_gtr191/Asilomar/pdfs/1029-1042.pdf.

Michelle Klosterman (klostem1@ufl.edu) is doctoral candidate in the School of Teaching and Learning at the University of Florida in Gainesville, Florida. **Jennifer Mesa** (uloa@ufl.edu) is an elementary science specialist at Terwilliger Elementary School in Gainesville, Florida. **Katie Milton** (ecobeagl@yahoo.com) is a doctoral student in the School of Teaching and Learning at the University of Florida in Gainesville, Florida.

Copyright of Science Scope is the property of National Science Teachers Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.