



# Twisters, Tall Tales, & Science Teaching

by Dawn Renee Wilcox and Donna R. Sterling

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Legends and tall tales have been part of the American culture for ages. Your students are probably already familiar with the tales of how Pecos Bill fearlessly tamed a ferocious tornado, or Paul Bunyan effortlessly restrained a great river. Such tales have been passed down from generation to generation to explain humanity, the natural world, and scientific phenomena (Hall 2000). When tradition connects collective wisdom with innovative inspiration, it sparks students' desire to discover. This lesson, which incorporates tall tales in the classroom, ventures far from the stagnant teaching traditions of the past. But don't tell the kids! Let them discover that on their own. Have fun, but keep in mind that tall tales are more fiction than fact. Take care to avoid introducing misconceptions when using tall tales in the classroom.

### Using tall tales to engage the student

This five-day lesson follows the 5-E model (Engage, Explore, Explain, Elaborate, and Evaluate) for incorporating constructivism into science teaching developed by Roger Bybee (1996). The lesson begins by engaging students with an imaginary ride alongside an American hero, as students listen to the tall tale of *Pecos Bill* adapted by Brian Gleeson (2005). The humor and wit personified in the exaggerated legend instantly hook middle school students. Next, students work for 30–40 minutes in small groups to create a simple script and assemble props needed to tell the story. The next class period each group is allowed 5–10 minutes to present their scene. They have great fun acting out the tale of Pecos Bill (see Figure 1).

After a lot of laughs, encourage students to settle down and begin a discussion about the nature of science. Funnel students' energy into an active exploration of how weather phenomena in the world around them work. Understanding how science works through observing, thinking, and experimenting allows students to easily distinguish science from nonscience. Guide the discussion by raising questions about patterns or cycles in weather. Here are examples of the types of questions to ask students:

- How did humans predict the weather hundreds of years ago?
- How is that different from how we predict weather today?
- Have you noticed any patterns related to weather in our area? In other areas?
- Name some ways we could collect data to check for weather patterns.
- Terms such as *drought* and *heat wave* describe weather related patterns. Can you think of any more?

Point out that humans have learned a lot about weather phenomena but much more remains to be understood.

Afterward, students examine the weather phenomena and events that take place in the tall tale and make connections to real natural-world events. Draw the students' attention back to the tall tale. Remind the students that tall tales are more fiction than fact. Guide students along this journey by leading a discussion we like to call "Science or nonscience?" Students create either a T chart or a Venn diagram and list events from the story under the categories of "science" and "nonscience." Students choose one of their items to share with the class in the form of a question. Students then justify whether each statement is science or nonscience and explain their reasons to their classmates. Here are examples of the types of questions students ask:

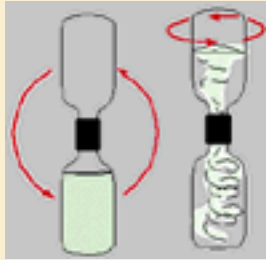
- Could a person really lasso a tornado?
- Could the Grand Canyon really have been formed by a tornado?
- What about the Great Salt Lake or Death Valley?
- Is there a difference between a twister, a cyclone, and a tornado?

With students motivated and excited about learning, they are ready for inquiry, research, reading, writing, and a lot of creative thinking. Over the course of these lessons, which we call *Twisting Science with the Arts*, students become familiar with the complex nature of tornadoes.

**FIGURE 1** Art and language integration

Integrate art and drama into science class by creating props using cardboard, bulletin board paper, and paint. Students use props to role-play the main events in the tall tale. When carrying out the events of the tall tale, students are instructed to pay particular attention to *hyperbole*, or exaggeration, a type of figurative language.

Props	Clouds, tornadoes, cowboy hats, ranger badges, horses, giant snakes, lassos
More drama	Create or tell riddles and jokes about the weather like the one below: Q: What did one tornado say to the other? A: Let's twist again like we did last summer.

**FIGURE 2** Tornado learning centers**Twister in a Bottle**

PICTURE RETRIEVED FROM  
[HTTP://WHYFILES.ORG/013TORNADO/6.HTML](http://whyfiles.org/013TORNADO/6.HTML)

**Skill or content objective:** Students will observe a vortex and describe how it is similar and dissimilar to a tornado.

**Background:** A tornado is a type of vortex. It is a spinning column of air with water vapor.

**Materials:** Two-liter clear plastic bottles, duct tape or tornado tube connectors (available from science suppliers), water, food coloring, glitter, beads.

**Preparation:** Fill one bottle with water. Food coloring, glitter, or beads can be added at this point to increase visibility. Turn a second upside down and join the two at the neck using a tornado tube connector or duct tape.

**Procedure:** Turn the two bottles over and swirl them in a circular motion to create a vortex that transfers the water into the lower bottle.

**Questions:** How does the vortex form? Can you change the size, shape or duration of the vortex? How is a vortex similar to a tornado?

**Blown Away**

**Skill or content objective:** Students will describe measures they can take to ensure safety in a storm.

**Background:** High-speed winds in a tornado can affect our trees, cars, homes, and schools.

**Materials:** Index cards, Popsicle sticks, tape, construction paper, pipe cleaners, small toy cars, small fan.

**Preparation:** Set out the supplies and review safety rules.

**Procedure:** Students will create a home with a yard and trees out of the materials provided. They will place it in the path of the fan and turn on the fan. (Alert students to safety issues related to flying debris.)

**Questions:** What sort of damage occurred to your home, cars, or trees? How might the fan act in the same or a different manner than a real tornado? How might the reaction of the model be different from a real home? How might you keep yourself safe during a tornado?

**Tales of Twisters**

**Skill or content objective:** Students will look for patterns in the weather to make weather forecasts.

**Background:** Integration of literature and history.

**Materials:** Weather-related books, tall tales, picture books, pictures of tornados and storms, pictures of damage caused by tornadoes, samples of weather proverbs.

**Preparation:** Gather the materials and arrange a display.

**Procedure:** Students examine and discuss materials.

**Questions:** Look for patterns. Do tornadoes occur in the same area year after year? Why do you think this happens? What do the tall tales and proverbs tell us about how storms were viewed by people in the past?

**Just the Facts**

**Skill or content objective:** Students examine a tornado and explain how it forms. They will examine the role of air pressure, temperature and humidity on weather.

**Background:** A tornado is a briskly twirling, funnel-shaped cloud that stretches out from a storm cloud to touch the ground.

**Materials:** Textbook, encyclopedia, internet, weather maps, pictures, and other resources. Hands-on materials such as weather instruments, a funnel and a water basin, and straws and pinwheels.

**Preparation:** Gather the materials and arrange a display.

**Procedure:** Students will examine and discuss materials.

**Questions:** What is a tornado? What is the role of air pressure in the formation of a tornado? What is the role of temperature in the formation of a tornado? What is the role of humidity in the formation of a tornado?

## Exploring twisters

In the next lesson, students are invited to work in cooperative groups to explore information about tornados or to become tornado experts. Students are able to explore twisters as they travel to a number of tornado activity centers (see Figure 2). Learning about, or attempting to understand, a weather phenomenon in greater depth is not a linear process. As students attempt to make sense of the phenomena, they use both their prior experience and firsthand knowledge gained from new explorations to poke, prod, and inquire until the event becomes less mysterious. The teacher is a facilitator in this learning cycle by providing materials and guiding students' focus. The students' inquiry process drives the instruction during a series of activities located in learning centers.

The four centers are designed to allow students the opportunity to observe, experiment, and think about weather phenomena. The centers are titled: (1) Twister in a Bottle, (2) Blown Away, (3) Tales of Twisters, and (4) Just the Facts. At each center there are questions for students to answer.

At the Twister in a Bottle center, students are able to observe a vortex in a two-liter bottle and describe how it is similar and dissimilar to a tornado.

At the Blown Away center, students are encouraged to describe measures they might take to ensure safety in a

storm. This activity involves the creation of a home with a yard and trees out of simple materials. The students construct their neighborhood on a 2 m × 2 m piece of cardboard. Each team creates a neighborhood. We taped a 10 cm high cardboard border around the edges to contain the building materials during the simulated tornado. Popsicle sticks and index cards simulate 2 × 4's and drywall and a fan simulates the tornado winds. After students construct their homes, the teacher is summoned to help with a tornado simulation. Safety goggles are a must at this center.



At Tales of Twisters, opportunities are given for students to look for patterns in weather and to make weather forecasts. They examine weather-related books, tall tales, picture books, photographs of tornadoes and storms, photographs of storm damage, and samples of weather proverbs. Students are encouraged to search for patterns and similarities as they examine the materials.

Finally, at the Just the Facts center, students are able to examine the effects of air pressure, temperature, and humidity on weather through the use of textbooks, weather instruments, and the internet.

Questions are posted to encourage discussion among students while visiting the centers. As students rotate through the centers the teacher should monitor them to determine if students are answering the questions correctly, understanding the science concepts, and transferring the information correctly to real tornadoes. The teacher can ask students to use the materials at the centers to demonstrate and explain the concepts they have learned. Allow 15 to 20 minutes at each center. Permit about five minutes at the end of each activity for students to answer questions before moving on to the next center.

To integrate art, students visit a center where they twist materials such as wire and pipe cleaners into funnel-shaped sculptures to illustrate the dynamic forces at work within a tornado. Examples of student artwork can be seen in Figures 3. At this time, the teacher can ask students questions about the shape of their projects to determine if they have achieved an understanding of the science concepts involved in tornado formation. For example, the teacher might show an example of a student's artwork and ask the other students to explain how that particular shape may or may not accurately represent a tornado.

## Explaining the threat

Now it is time to pull all of the pieces together. Students are ready to put the abstract learning experience into a written format. Have the students think back to the tall tale of Pecos Bill. Ask them to think about the citizens living in Tornado Alley. Ask them how these people would recognize the danger signs of a tornado. How might a tornado affect their homes? How would they warn people back in the late 1800s,

**FIGURE 3** Tornado art

Integrate art into science class by twisting recyclable materials into the form of a tornado. Students were encouraged to create curves that could be rotated to illustrate dramatic force. They twisted wire and pipe cleaners to create funnel shaped sculptures. They made swirls with brilliant colors of paint to create tornado images.



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**FIGURE 4 Texas Ranger checklist**

As a Texas Ranger, you and your deputies are responsible for deciding whether or not to evacuate the residents in the path of the tornado. You must relay the message to the citizens via the Pony Express and ensure public safety by sharing advice about tornado safety. Check the boxes on the left as each task is completed.

First, become a tornado expert by learning about air pressure, temperature, convection, and humidity and how these concepts relate to tornadoes. Do this by:

- Reading books
- Looking at pictures
- Accessing the internet
- Performing science activities and answering the questions at each of the science learning centers
- Decide whether or not to evacuate the residents of Tornado Alley, based on the facts about tornadoes in the Old West. Yes or No
- Prepare a Pony Express letter to send to the citizens that:
  1. Explains what a tornado is.
  2. Explains how a tornado forms. Draw and label pictures. Describe the danger signs of a tornado and explain what is the difference between a tornado watch and tornado warning.
  3. Tells the citizens of Tornado Alley how this tornado will affect their homes.
  4. Relays your decision whether or not to evacuate the citizens.
  5. Shares safety advice about tornadoes with the citizens.
- Create a map to show the best escape routes.
- Role-play or practice your Pony Express journey to share the information you learned with the class.

the time period in which the tall tale takes place? Lead them to a discussion about how slowly news traveled. Include the Pony Express as part of your discussion. Students will use the knowledge that they have gained through the lessons to create a one-page letter to send to the citizens of Tornado Alley that demonstrates their knowledge of tornado formation and safety precautions. This one-page letter will be carried by Pony Express to warn a town of an impending weather emergency, a tornado. The message should demonstrate the students' knowledge of weather conditions associated with a tornado weather emergency, the threat it poses to townspeople, and the precautions they should take to minimize potential damage and injuries (see Figure 4).

**FIGURE 5 Grading rubric for Pony Express letter**

	Defines <i>tornado</i>
	Explains how a tornado forms Picture is provided Picture is labeled
	Informs citizens about tornadoes Lists danger signs of a tornado Explains the difference between a tornado watch and a tornado warning
	Explains how the tornado could affect homes
	Includes a decision to evacuate or not to evacuate
	Provides safety advice to the citizens Includes a list of safety procedures Suggests an evacuation route
	Is presented neatly and written carefully

If two or more elements are missing, improvement is needed. (Students will be asked to finish the work.)  
If all elements are present, the grade is satisfactory.  
If all elements are present and the student goes beyond the standards by adding more detail to the project, the grade is excellent.

The writing process for creating the letters generally contains five steps: prewriting or planning, writing, revising, editing, and publishing. Students use the knowledge gained from the role-play and the answers they wrote to the questions at each of the center activities to help them create their letters. During the prewriting stage, students work in their groups to brainstorm ideas and review their notes. Next, they create a draft by writing their ideas into sentences and paragraphs. Then they revise their draft by making their ideas explicit and clear.

A well-crafted Pony Express letter to citizens living in Tornado Alley would answer the following questions:

- How is a tornado formed?
- How would you recognize the danger signs of a tornado?
- What is the difference between a tornado watch and tornado warning?
- What safety procedures should citizens take in the event of a tornado?

The letters are shared in the form of a skit in which a rider arrives in town to share the information with the townspeople (other team members) who have gathered. The other team members can ask leading questions to elicit the information in the letter. Students read the letter out loud to determine if the letter makes sense during the editing phase

of the writing process. Each team of students shares their learning with classmates by presenting their skit. They act out the drama, as they become Pony Express riders and share their news story to spread their letters of the tall tale events. After their skit, each team explains to the class the accurate and inaccurate science in their skit. Accurate science examples might include the fact that tornadoes develop in low, heavy cumulonimbus clouds; that changes in temperature or air pressure would be felt by the townspeople, or that specific dangers are posed by an approaching tornado. Inaccurate science examples might include the following: citizens probably would not have been able to accurately predict the path of the tornado without modern instruments, props were used to simulate real events or happenings, a real pony would have four legs, and the pony would have to stop to rest and get water along the way.

### Evaluating student learning

Throughout the lesson, examine student work to determine levels of understanding and dispel possible misconceptions. Common misconceptions include misunderstanding the meaning of weather-related words such as *watch* and *warning*, ideas that tornadoes might not strike big cities, and confusion about possible paths a twister might take. The script, drawings, and other communications provide evidence of the learner's development, progress, and growth. Evaluation and assessment occur at all points along the continuum of the instructional process. Tools include checklists, embedded assessments, and journal entry follow-ups each day. For a sample of a rubric for the Pony Express letter see Figure 5.

### Elaborating through drama

Students are now ready to expand on the concepts they have learned and are able to use their newly acquired knowledge to make connections to the world around them and their own personal experiences. Performance is a method of expressing diversity of ideas and thoughts. It also allows us to see students more clearly. This activity gives students an opportunity to express their feelings through short dramatic representations.

Begin the activity by asking students to brainstorm ideas and experiences they have in relation to the topic of tornadoes or other weather phenomena. Have students write a short narrative about their own experiences. Organize students into groups to collaborate with team members who share similar experiences or feelings. Ask the teams to act out their experiences in an improvisation, song, or dance. Take the time to discuss the experiences. Ask students to reflect on the differences in experiences within the group. Explain how both the tall tale activities and this improvisation can help us understand and explain scientific events.

### More activities to extend the fun

You can extend science learning by encouraging students to participate in these fun activities:

- Students read another tall tale and follow the lesson format to create a newscast about a different weather phenomenon.
- Students work in groups to create their own tall tale to explain or describe a weather phenomenon.
- Integrate dance and have a hootenanny hoedown with square dancing, or do the twist.
- Create a list of items students would place in a tornado survival kit.
- Explore convection, the transfer of heat by movements of a fluid.
- Investigate the formation of clouds. Have students create clouds.
- Examine the properties of air. Have students explore instruments used to measure air pressure and conduct air pressure experiments.
- Monitor weather components by measuring and recording weather conditions using instruments. Have students look for patterns in their data and use it to predict the next day's weather.

### Conclusion

In this lesson students are drawn into the Old West as they become characters in a tall tale that twists science with literature and the arts. Students enjoy role-playing the main events of the legend using props created with cardboard, bulletin board paper, and paint. Students are able to engage in an active exploration of how weather phenomena in the world around them works without realizing *they* are doing work! ■

### Resources

National Weather Service—[www.nws.noaa.gov](http://www.nws.noaa.gov)  
 Tornado project online—[www.tornadoproject.com](http://www.tornadoproject.com)  
 One Sky, Many Voices—<http://groundhog.sprl.umich.edu>  
 Severe Weather Institute Research Lab—<http://movies.warnerbros.com/twister/cmp/swirl.html>  
 Weather Wiz Kids—[www.weatherwizkids.com/tornado.htm](http://www.weatherwizkids.com/tornado.htm)  
 Scilinks—[www.scilinks.org](http://www.scilinks.org) Topic: Tornadoes Code: SFAWW25  
 Map of Tornado Alley—[www.spc.noaa.gov/faq/tornado/stalley.gif](http://www.spc.noaa.gov/faq/tornado/stalley.gif)

### References

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