I Wonder...

We invite you to use this piece of literature as a springboard to deepen discussions about science and how investigation and observation can occur all around us. The science experiences of all children should enable them to enjoy and value learning as demonstrated by Tanner's experience.

A Crack in the Night

A Teacher's Guide

Summary

A Crack in the Night is an example of a student applying science in a real investigation. This book illustrates that science is not just done in the classroom or laboratory, but can happen where you least expect it... in your bedroom!

Use this book as an introduction to the nature of science and scientific processes. Engaging learners with Tanner's story of discovery with the Ponderosa Pine provides an introduction to science fairs for your school or classroom. In this story Tanner and the other characters expose numerous impacts affecting science education today, including:

- Female/male roles in science
- Who is a scientist?
- Recording results and journaling
- How to conduct an experiment
- Ethics of evidence collection.

Science and Content Related Concepts

Nature of Science, Science Process Skills, Science Notebooks, Science Fairs.

Content Related Words

Research, specimen, phenomena, data, formulate, observations, theory, hypothesis, ethical, and controlled experiment.

Also in this guide:

1. Questions for Discussion
2. Activities for Teachers

Questions for Discussion

The following questions are intended to be posed as you read or at the conclusion of reading the book. Each discussion question may lead to an investigation or realization about the nature of science.

- What do you think caused the "crack" in the night? - *Page 9*
- In what ways did Tanner try to determine the source of the "cracking" noise? - *Pages 9-15, 20, 25*
- Tanner thinks that "Every scientist knows there's a reason." What do you think? - *Page 11*
- What kind of information did Tanner put in his logbook? - *Page 15*
- How did Tanner's logbook help him determine the source of the cracking? - *Page 20*
- Why do you think that Tanner checked out books on Ponderosa Pines before doing his experiment? - *Page 20*
- What are the implications of Tanner breaking a branch? Should Tanner have broken a branch off of a living tree for his experiment? - *Page 22*

Special Note:

There are numerous peer reviewed studies indicating that using the outdoors for educating our youth has many benefits for their health and academic performance (childrenandnature.org).

A Crack in the Night offers an exciting, exploratory methodology and encourages the use of the outdoors for the study of science in a highly engaging fashion.

As an educator of 40 years with many institutions and in a great diversity of situations, I've personally made use of the outdoors whenever feasible, including the winter season! Realizing this can be difficult depending on the students we are serving, weather, health, etc., consider bringing the outdoors indoors with plants, soils, terrariums, aquariums, and using day-lit areas whenever possible.

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Activities for Teachers

1. Discovery by Observation

Tanner's experiment did not come from a science book, but from an observation that he made in the natural world. Have students make observations on the school grounds. Have them form questions about anything that they observe. Back in the classroom, write the questions on the board. Select a question from the list to do a class project.

2. Science Notebooks

A Crack in the Night provides an example of how one might record new understandings through a science notebook. Have students discuss methods of recording ideas and observations of things around them. Have students discuss how Tanner's notebook was used for scientific discovery. Provide an open-ended question for students to develop their own methods of recording observations.

3. Communicating Your Plan

As Tanner and Chris return to collect more specimens, they get permission from the Ted's Tree Trimming worker to collect more branches. The worker climbs down from his ladder and asks what the boys are planning to do with the branches. Have the class write responses as if they were Tanner responding to the worker's question, including the questions and answers they are hoping to discover by conducting the experiment.

4. Scientific Process

Describe what is occurring in the picture where the controlled experiment is being conducted. (Page 25) Have students explain Tanner's scientific process.

Activities for Teachers, cont.

5. Unique Characteristics

Investigate other pine trees including the Lodgepole Pine; super-hot temperatures help this pine continue to survive. Are there other plants that have unique characteristics that help them survive? Have learning groups discuss, research, and share unique characteristics of various plants.

6. Science Fair Projects

After reading *A Crack in the Night* with your students, have them share discoveries that they have made in their lives. Then, have students choose a question relevant to their lives that they could investigate. This could launch the student's investigation into a personal science fair project.

7. Design an experiment!

Assign questions below to small groups of students to explain how they would scientifically answer the question.

1. Which bubble gum blows the biggest bubble?
2. Which paper airplane design flies farthest?
3. Which is safer - planes, trains, or automobiles?
4. Which uses more water - a shower or a bath?
5. Which state has the most tornadoes?
6. Archaeologists find a bone fragment (show picture). What animal do you think it belongs to?

After all groups have shared their scientific plans, consider the following questions:

1. Did everyone follow the same method for solving their problems?
2. What does this process tell you about solving problems in science?

8. Success or Failure: Judging a Science Experiment

Elaborate on what must have happened on Page 26 when everyone exclaimed "Go Tanner!" "Awesome." Most students will make the assumption that the experiment happened as expected.

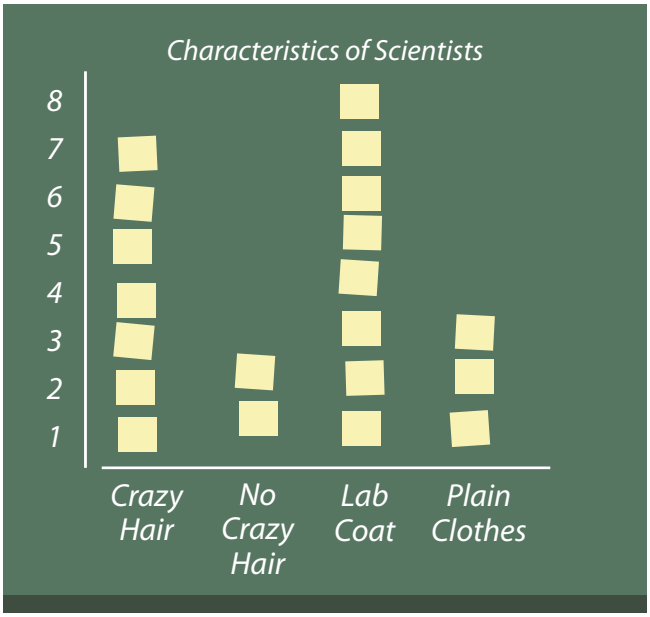
This is an opportunity to discuss with students the following issues of science:

1. Do all science experiments end the way we intend?
2. Can we always learn from any experiment even if it doesn't turn out the way we thought it would?

9. Stereotyping of a Scientist

Before reading A Crack in the Night, give each student a piece of paper, and have them draw a "scientist at work." Have students compare their drawings as a class.

On post-it notes, have them list the main characteristics of their scientists, and display the notes on your white board. Let your students create a class graph using these post-it notes to tally the characteristics of their scientists.



Graphs can include: male or female; in a lab or outside; glasses or no glasses; crazy hair or no crazy hair; wearing a lab coat or no lab coat; using scientific equipment (beakers, chemicals, calculators) or no equipment drawn.

After the students have made their graphs, discuss their findings. Most students (and adults for that matter) will draw their scientist as male, in a lab, with glasses, crazy hair and surrounded by equipment. Discuss the stereotypical views of scientists.

After reading A Crack in the Night, discuss the following questions:

1. Would you consider Tanner a scientist? Why or why not?
2. What does it mean to be a scientist? Based on your answer, is Tanner a scientist? Why or why not?
3. Does Tanner look like the scientist that you drew?
4. Has your view changed of what a scientist can look like? Why or why not?

Activities for Teachers, cont.

10. Creation of a Field Guide

On pages 26 and 27, there are pictures and scientific names of various pine trees. All plants (and animals) have common everyday names, but they also have a two-part scientific name that is unique to their species. Taxonomic keys are used to identify a plant's common and scientific name. Have students create a field guide of the trees growing in their area. Take students outside to the school yard or to a local park to explore the trees growing there. If there is an arboretum nearby, this is a great place to view many different species of trees. Using colored pencils, students can draw leaves, flowers or fruit that they find growing on the trees. Using taxonomic keys for trees in your area (these can be downloaded from your local forestry extension website), have students label their trees with their common and scientific names.

11. Investigation Persistence

Science discovery can include many twists and turns and provide unexpected opportunities for learning. In trying to prove one's hypothesis, one can confront opposition and many challenges along the way.

How does Tanner meet his challenges? Does he give up, or find a way to proceed?

Page 10 (too sleepy to acknowledge his discovery);
Page 14 (no batteries for his camera);
Page 18-19 (needs to negotiate and compromise);
Page 23 (can't find the branch he needs).

Ask your students how they would solve Tanner's problems and challenges. Have your students share what challenges they have encountered on a science project and their solutions.

12. Understanding Outside Impacts

Even in controlled science experiments, there contains a certain amount of error that might change the outcome of the experiment. Think about Tanner's controlled experiment with the Ponderosa Pine.

What could have been sources of error in his experiment that might have changed his results?

What could Tanner have done to try to control for these sources of error?

Have students consider the following scenario:

John cuts grass for seven different neighbors. Each week he makes his rounds with his lawn mower. The grass is usually different in the lawns. In some lawns it is tall, but not in others. He also notices that some neighbors water their lawns more often than others and their grass is usually longer. He makes the hypothesis that the lawns that receive more water will have taller grass. After several weeks of cutting lawns, he concluded that his hypothesis was supported.

What do you think about John's conclusion?

What are sources of error in the above scenario that John might not have considered?