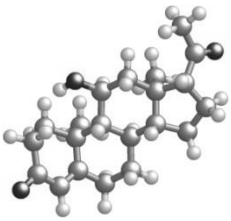


Sc!ence

Name: …… **( )**

Class: ……

Date: …… **/** …… **/** ……

The Nature of Science – The Extra Piece

Background Information

In this activity, students assemble a tangram as a square and then reassemble the tangram incorporating an additional piece that they are given. Parallels are drawn to particular aspects of the nature of science.

Learning Objectives

By the end of this activity, students should be able to:

1. Use this tangram activity as an analogy to describe aspects of the nature of science, such as the tentative nature of scientific knowledge.
2. Explain several courses of action that scientists may take when confronted with an unexpected discovery.
3. Provide at least one authentic example of the tentative nature of scientific knowledge.

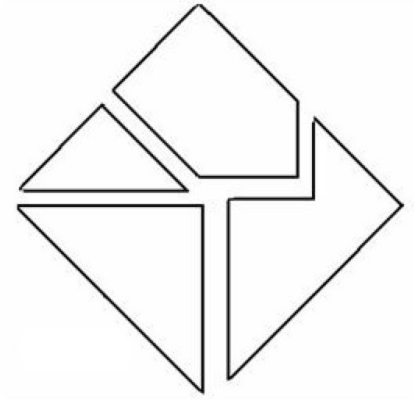
Introduction to the Activity

The activity is designed to explicitly teach ideas about the nature of science. It contains no specific scientific content knowledge. This means that students can learn about the nature of science without having to understand new science content at the same time.

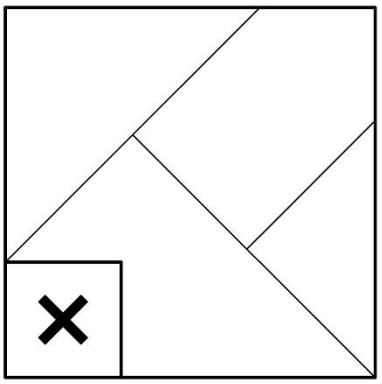
Although it is reliable and durable, scientific knowledge is neither carved in stone nor perfect. Rather, it is subject to change in the light of new evidence or the new interpretation of existing evidence. Because of its tentative nature, we cannot claim “absolute truth” in science. The tentative nature of scientific knowledge also means that laws and theories may change.

Materials

Copies of the tangram template, cut into pieces. It is recommended to prepare one tangram for each student in the class, but students can also complete the activity working in small groups at the teacher’s discretion. For variety, the tangrams can be printed on different coloured paper. Printing the tangrams on card, and then laminating them, makes the tangrams more durable.



• **Figure 1.** Proposed solution for the first activity.



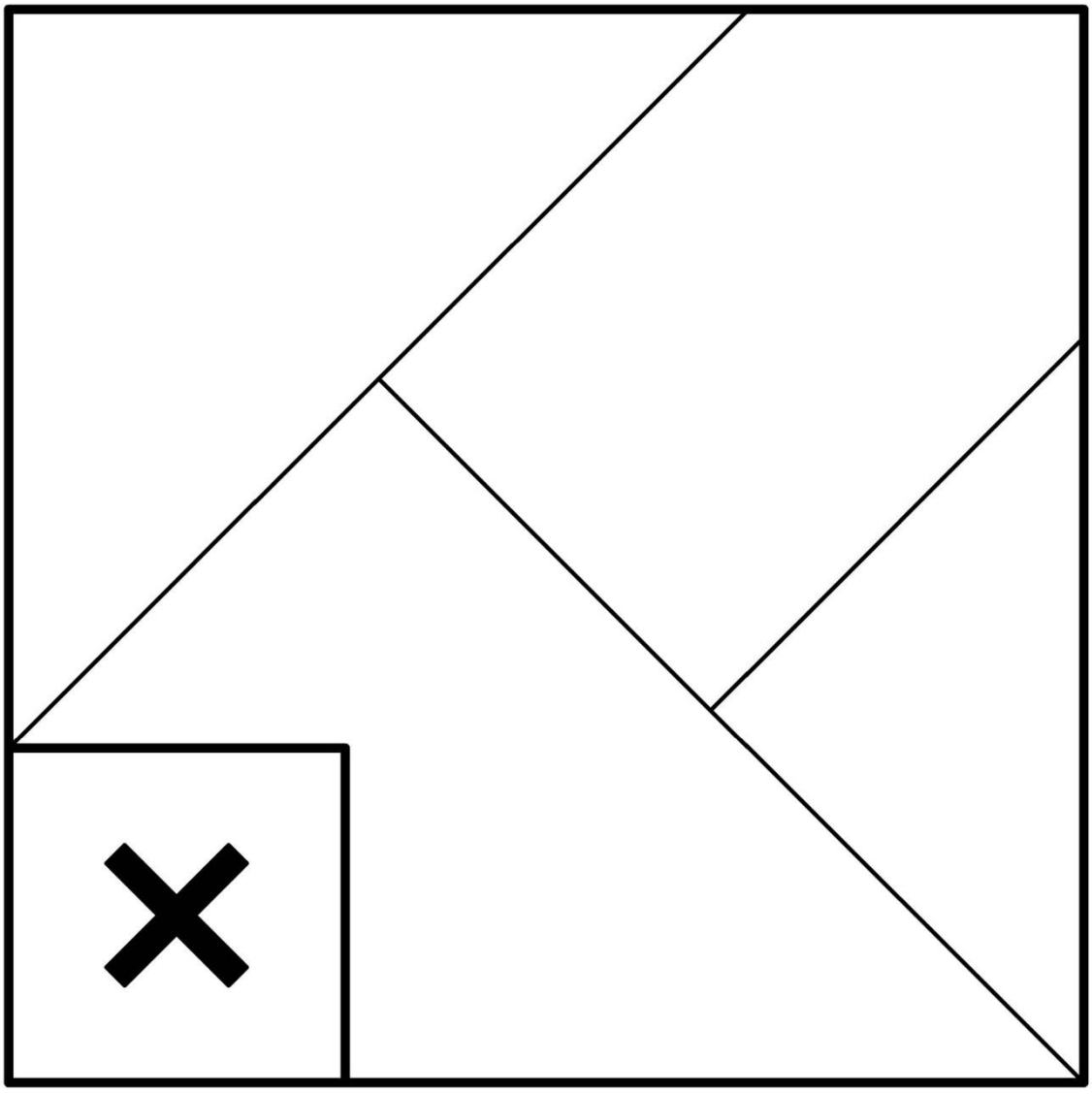
• **Figure 2.** Proposed solution for the second activity, including the extra piece.

Instructions

1. Give each student their tangram pieces – all pieces except for the small square marked with a "×". Explain that the pieces represent current scientific data. Ask the students to arrange the four pieces into a square, which represents scientists understanding sets of data to produce a new model, theory or law (see **Figure 1** for the proposed solution).
2. Once all of the students have arranged the four pieces into a square, give each one the additional small square marked with a "×". Explain that a new scientific discovery has been made or a new piece of data has been found or that a new idea has been presented. Students must somehow incorporate this new information into their tangram to form a new square (see **Figure 2** for the proposed solution).
3. Encourage students to work individually at first, and then collaborate in groups if the level of frustration increases. Hints can be given by the teacher if necessary.
4. Once most or all of the students have arranged the pieces correctly, ask them to brainstorm and share how this activity is similar to really "doing" science. Some examples include:
    - Assembling the pieces into a square shape can represent scientists assembling data into evidence, ideas into an explanation or coming up with a model, theory or law.
    - Students assume that the pieces of the tangram fit together to form a square. Scientists assume that patterns, models, explanations, theories and laws can be made.
    - Trial and error can be an essential component of scientific research.
    - New information may require old models, theories or laws to be modified or discarded.
    - Our current information may be incomplete and therefore scientific knowledge, while durable, is always tentative and subject to change.
    - Serendipity has a role to play in science. Sometimes scientists are "lucky" and find the pattern or "answer" by chance.
    - Collaboration may be useful.
    - Once scientists arrive at "the answer", it makes perfect, elegant sense.

Extension

Discuss with students examples of how scientific knowledge has changed, for example, our knowledge of atomic structure.



- Adapted from an activity by Jason Choi, Sleepy Hollow High School, Westchester, New York, 2004.
- Additional information taken from Science Learning, New Zealand, http://sciencelearn.org.nz.