

Cosmic Times Jigsaw

Suggested Grade Level(s): 7-12

Estimated class time: one class period

Summary

This activity uses cooperative learning to help your students understand the primary scientific advances over the past century that have led to our current understanding of the nature of the universe. Students work in teams to learn about how scientists have come to know what they do about the Universe using articles from the Cosmic Times posters.

Objectives

- Students will collaborate in teams to familiarize themselves with the big questions that faced cosmology through the twentieth century.
- Students will recognize that science is ongoing, with technologies driving new discoveries.
- Students will discover and trace the broad history of discovery that has led scientists to their current understanding of the nature of the Universe.

National Standards

National Science Standards

- NS.5-8.7 HISTORY AND NATURE OF SCIENCE
As a result of activities in grades 5-8, all students should develop understanding of
 - Nature of science
 - History of science
- NS.9-12.7 HISTORY AND NATURE OF SCIENCE
As a result of activities in grades 9-12, all students should develop understanding of
 - Nature of scientific knowledge
 - Historical perspectives

National Language Arts Standards

(From the National Counsel of Teachers of English)

- NL-ENG.K-12.3 EVALUATION STRATEGIES
Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

Knowledge Prerequisite

The students should be able to summarize reading material.

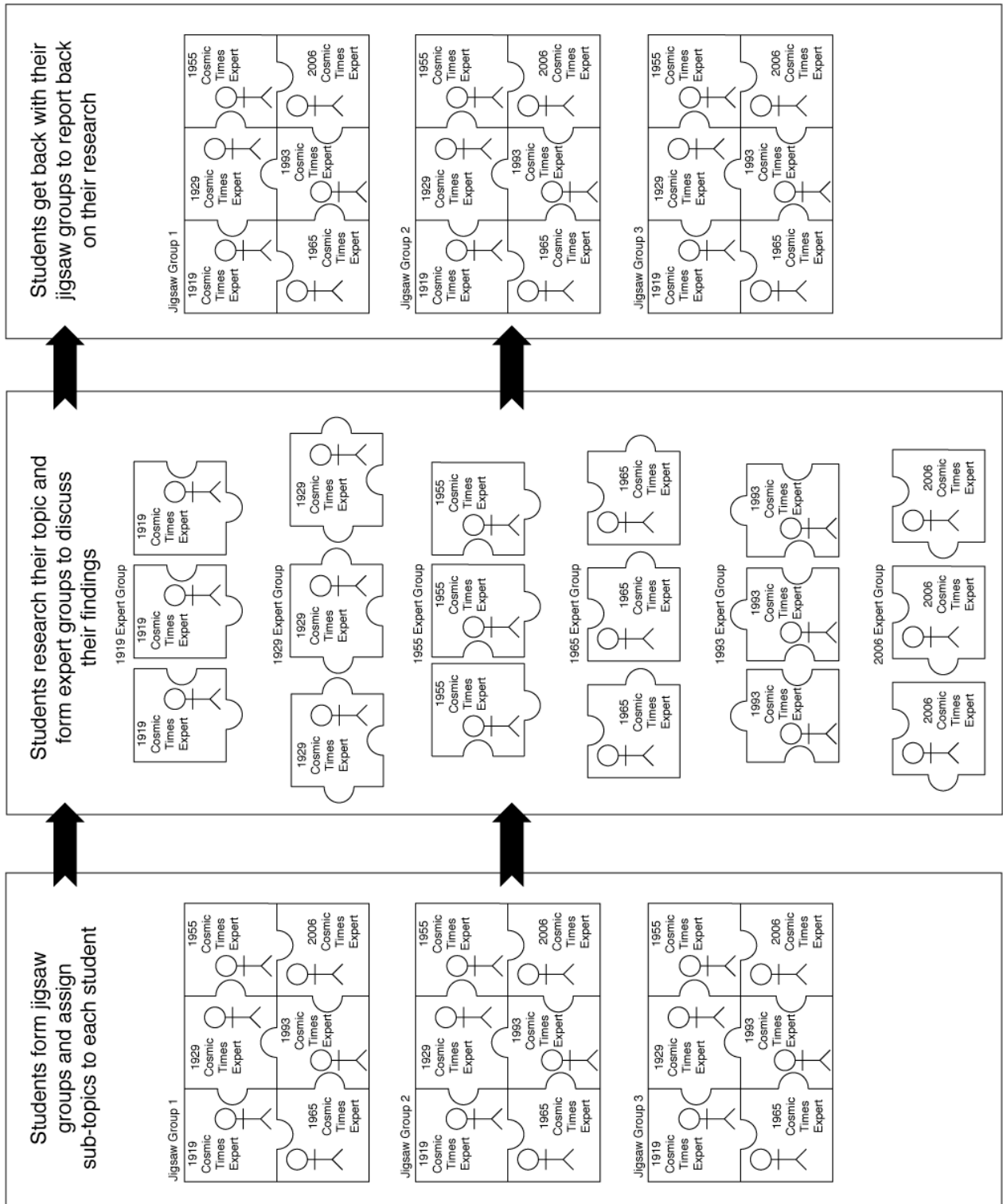
Teacher Background

The jigsaw classroom is a cooperative learning technique wherein each student in a group becomes an expert on one particular part of a topic. The groups need each student in order to fully understand the topic, so that every student is essential to the assignment.

The jigsaw technique works by placing students into jigsaw groups. Each jigsaw group is responsible for researching and reporting back on a topic. Each student in the group is assigned a sub-topic within the group's overall topic. The students research their small part of the whole and get together into expert groups composed of the students from the other jigsaw groups who are also responsible for the same sub-topic. The expert groups share and discuss what they find out about their sub-topic. Finally, students go back to their jigsaw groups and report back on what they learned about their sub-topic. In order to have a complete picture, the group must understand the contributions of each student in the group.

For this Cosmic Times jigsaw activity, each jigsaw group is responsible for understanding the main discoveries in of the Cosmic Times articles and tracing the major advancements in our understanding of the Universe over the past century. Each student in a jigsaw group is responsible for one of the Cosmic Times issues (1919, 1929, 1955, 1965, 1993, or 2006). Then, all of the students responsible for each issue of Cosmic Times get together to form the expert groups (all students responsible for reporting on 1919 to their jigsaw group form an expert group, all student responsible for reporting on 1929 for another expert group, etc.). Finally the jigsaw groups reconvene and put all of the pieces together to get a picture of how our knowledge of the Universe has advanced over the past century.

The jigsaw process is illustrated in the figure below.



Materials

- Cosmic Times Posters and/or Cosmic Times newsletters
- Walk Through Cosmic Time Worksheets (if using)

Preparation

The Cosmic Times posters readings are aimed at high-school readers. We have provided differentiated newsletter versions on our website for readers at the 7-8 grade level (the “Early Edition”), 9-10 grade level (the “Home Edition”), and 11-12 grade level (the “Late Edition”). The posters have the Late Edition text. You should use whichever version of the text is most appropriate for your classroom.

Procedure:

I. Engagement

Ask students what they know about Big Bang theory. Was this always the leading theory for the origin of the Universe? Does our understanding of the Universe change over time? What drives scientific discovery?

Students may think that science is “done,” and that we have all the answers. Hopefully, they recognize that science is an active discipline where new technologies are feeding new discoveries. Either way, this jigsaw activity will help students see how scientific advances have helped astronomers come to their current understanding of the nature of the Universe.

II. Exploration

Start by dividing the class into groups of 6 students. (It’s better to have a group or two with an extra participant than to have groups with fewer than 6 students.) These groups should be diverse in terms of student ability. Appoint a student leader for each group.

Each student in a group is responsible to learn about the main stories in one year of the Cosmic Times papers. (In the case of an extra student in the group, pair up two of the students to work on the same Cosmic Times year.)

Assign each student to one Cosmic Times year. The students assigned to each year will be responsible for reading/learning the following articles:

- 1919
 - Sun’s Gravity Bends Starlight
 - Why a Total Eclipse?
 - Expanding or Contracting?

- 1929
 - Andromeda Nebula Lies Outside Milky Way Galaxy
 - Universe is Expanding
- 1955
 - Yardsticks' in Neighbor Galaxy Double Universe's Size
 - Origin of Everything: Hot Bang or Ageless Universe?
 - Hoyle Scoffs at "Big Bang" Universe Theory
- 1965
 - Murmur of a Bang
 - Big Hiss Missed by Others
 - Galaxies Still Misbehaving
- 1993
 - Baby Universe's 1st Picture
 - Pancake or Oatmeal Universe – What's for Breakfast?
 - Dark Matter Hunt Heats Up
- 2006
 - Faster Walk on the Dark Side
 - Biggest Mystery: What is Dark Energy?
 - Sorting Out the Dark Stuff

Give students enough time to read their articles through twice and become familiar with the content of their articles. They don't need to memorize the information.

III. Explanation

Form "expert groups" by having all students responsible for each year get together (in other words, the students responsible for the 1919 articles from each jigsaw group meet as an "expert group", all 1929 students get together, and so on.) Give the expert groups time to discuss the main points of their articles and rehearse presentations they will make to their jigsaw group.

IV. Extension

Bring students back into their jigsaw groups and ask each student to present his or her year to the group, in order. Encourage others in the group to ask questions for clarification.

Observe the small and large group interactions. If there are problems, encourage the leaders to intervene, help as needed by whispering suggestions to them. During the jigsaw group presentations, students take notes on all 6 Cosmic Times.

V. Evaluation

To assess student's understanding of Cosmic Times, have students write out a summary of each year, making connections between the discoveries from year-

to-year, as appropriate, and/or have students fill out the Walk Through Cosmological Time Worksheet (available on page 7).

Walk Through Cosmological Time worksheet answers: 1919: B; 1929: E, F; 1955: C, J; 1965: A, I; 1993: D, G; 2006: H. There are many possible answers for the questions in the box. Here are just a few possibilities. *“Scientists depend on the research and discoveries of previous and other scientists to make new discoveries. Knowledge is built on knowledge. Also, the sophistication of the technologies plays a role in the level of scientific discoveries – new technologies often bring new discoveries, and will influence the sequence of discoveries.”*

Resources

Aronson, Elliot. (2012) Jigsaw Classroom

<http://www.jigsaw.org/overview.htm>

Education World: “The ‘Jigsaw’ Technique”:

http://www.educationworld.com/a_curr/strategy/strategy036.shtml

Tewksbury, Barbara. (2009) “The Jigsaw Technique”

<http://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/jigsaw.html>

Name: _____

Date: _____

Walk Through Cosmological Time

Using the letter of each scientific term, match the concept to its year of discovery.

- A. CMB
- B. Relativity
- C. Big Bang
- D. CMB Mapping
- E. Hubble's Law
- F. Red Shift
- G. Inflation
- H. Dark Energy
- I. Dark Matter
- J. Supernovae



1919	1929	1955	1965	1993	2006

What connections can you make from this timeline? Is there anything influencing the sequence of discovery? What conclusions might you draw from this?