

THE UNIVERSE IN THE CLASSROOM



www.astrosociety.org/uitc

No. 53 - Winter 2001

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Using Multicultural Dimensions to Teach Astronomy

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What is Multicultural Astronomy?

We define multicultural astronomy as the variety of ways in which cultures of the past and present have observed, recorded, interpreted and made use of astronomy to structure their lives and or satisfy their curiosity about the universe. Based on different motivations, values, traditions and geographical locations (including latitude), students can come to understand that different cultures will interpret and use the same phenomenon in different ways. Multicultural astronomy may be manifested in written documents, oral traditions, and physical artifacts such as aligned buildings, stones or other markings. The study of such physical artifacts with astronomical connections is called "archeoastronomy". The examples covered in this newsletter will focus on observations that your students can duplicate either in the real sky or with planetarium software to help them understand how and why the sky looks different from different places on Earth. Then they will explore how these same observations have been incorporated by different people into their cultures.

See [Newsletter #31](#) for a discussion of the use of archeoastronomy in the curriculum. Examples of oral traditions and suggestions for how to incorporate them in your astronomy curriculum can be found in [Newsletter #42](#), (1998) entitled: The Story of Astronomy.

Why Include Multicultural Astronomy in Your Curriculum?

To introduce students to the differences and similarities between diverse cultures' interpretations of astronomical phenomena.

Using multicultural dimensions to teach astronomy can go beyond just showcasing the differences among various cultures' interpretations and representations of the universe, its objects and events. While such differences are often based on religion, they are not trivial or primitive, but have been central to the organization of many cultures' economic and religious activities. The cyclical nature of our universe has produced observable celestial events, such as Moon phases, eclipses, day/night cycles, and seasons, which are observed by people all over the world. Over the years, people of all cultures have observed astronomical events, recorded them, analyzed and classified them as predictable and unpredictable, and they have passed this knowledge on to their successors. An approach to multicultural astronomy education should not only focus on differences between cultures, but should include a discussion of similarities. These ideas can give students insight into the important historical role astronomy has played in helping people to organize their lives and in supporting our understanding of the environment. This insight will also help students to recognize and reflect on the relevance that astronomy has had in their own lives.

Moreover, students of various cultural backgrounds will be able to contribute to discussions in astronomy by sharing and reflecting on how the development of their own cultural traditions in setting their calendars, for instance, was influenced by their ancestors' observations of the sky.

To demonstrate the activities involved in the science of astronomy and provide models of people engaging in the practice of astronomy

No matter what reasons different people may have had for carrying out their observations of the universe, their actions have given rise to the science of astronomy. It is a science quite different from the experimental science that students usually encounter in our schools which is associated with the traditional scientific method. The science of astronomy focuses on observation and it may appeal to those students who have become disinterested in some aspects of experimental school science. Multicultural astronomy provides students with examples of how people of the past and present practiced the science of astronomy by: making observations; keeping detailed records of observations; interpreting observations; transmitting these observations to others and using them for practical purposes. Such examples can serve as models for students to carry out their own astronomy investigations.

To have students visualize the appearance of astronomical phenomena from different perspectives.

Since the appearance of the sky is dependent on the observer's position on Earth, many of the differences between various cultures' representations of the sky can be attributed to these differing perspectives. The study of these various perspectives can provide a context for students to engage in abstract visualizations that can help support their understanding of some basic astronomy concepts such as: the cause of seasons and Moon phases; the position and motion of constellations and the changing position of the Sun during the day and year. Moreover, this multi-perspective approach to studying astronomy concepts provides an alternative way for dealing with those conceptually difficult topics as students will be required to apply their understanding across a variety of different contexts. Research in the study of conceptual change in science education suggests that having students apply new knowledge across a variety of contexts contributes to conceptual change process and can be a useful way of remediating misconceptions. Getting students to visualize the sky from different frames of reference as they are learning astronomy concepts is particularly challenging because it requires some agility with spatial thinking and a deep understanding of the concept. A multicultural approach supports this type of learning.

To engage students to think critically about how our understanding of astronomy has evolved over the years.

By providing students with examples of people engaging in the science of astronomy, all over the world, and at different times in history, provides a context for learning. Instead of just transmitting facts about how the universe works, stories and artifacts that provide evidence of how others have studied the universe can help to ground this knowledge and promote a critical approach to learning astronomy. A critical approach may involve investigating the evolution of astronomical thinking. How have observations of the same phenomenon been interpreted by different people, in different places over time? How has our understanding of astronomy evolved as a result of technology? These are only a few broad questions that multicultural astronomy can address.

Using the Rising and Setting of Constellations to Determine Seasons

Students need to understand that based on their different values, traditions, needs and positions on Earth (latitude), different cultures will have different ways of interpreting and using the same astronomical phenomena. For example, since the Earth revolves around the Sun, different constellations are visible in the night sky during the year. The conspicuous appearance of the Pleiades at certain times of the year, has led to its associations with seasonal change. Many cultures organized agricultural activities around the appearance of this star cluster. For the Onondaga Indians of upstate New York, the Pleiades signal when it is safe to grow food. The Pleiades reach their highest point in the early evening sky by mid February. This is the prime of winter and food is scarce for these people. They watch this group of stars carefully and wait for them to signal when it is time to plant seeds again. This time is signaled by the gradual disappearance of the star cluster in the evenings as it sets in the west in the months following February.

The Pleiades are the basis of the calendar for the Barsana Indians of Colombia. Instead of bringing cold dry weather, the appearance of the Pleiades signals the beginning of their rainy season. However, like the Onondaga Indians, this is also a time of scarcity of food. At this latitude, the Pleiades highest point, observed in the early evening, also occurs during January and February; this signals the beginning of the planting season and summer. By April, the Pleiades move west and gradually become less apparent in the evenings. This time marks the rainy season where food supplies become depleted.

At far northern latitudes, the Pleiades never set, so it cannot be used for calendar-keeping in the same way it can be in the temperate and tropical climate zones. It may be interesting to see if students can predict and explain which months or seasons are associated with the Pleiades, across different countries around the world. Here are several concepts that a discussion of the Pleiades might cover: the appearance of stars in different parts of the sky throughout the year; the apparent path of the Sun throughout the year, which in turn could form the basis for discussing the seasons); and the reversal of the seasonal cycle of between the northern and southern hemispheres.

The elaborate structure of the early Egyptian society was based on the ability to predict when the annual rising or flooding of the Nile would occur since this event left much of their land in the valley covered with water. This was followed by periods of planting, growth and harvesting. Records dating from the 3rd millennium BC have shown that the Egyptian calendar was divided into three seasons that reflected the structure of their society- flooding, planting, and the harvest. While each of these seasons were roughly four lunar months in length, with each lunar month being approximately twenty-nine and a half days, this posed a problem for predicting precisely when the Nile would flood. This year of twelve lunar months would fall short of the average rising of the river from one year to the next and fell eleven days short of a solar year (the time it takes for the Earth to make one complete revolution around the Sun). To solve this problem, the Egyptians used the helical rising of the star Sirius to help in the prediction of the river flooding. A helical rising is the period of time when the star is briefly seen in the eastern sky before dawn and is no longer hidden from the glare of the Sun. The Egyptians gradually realized that, in this 12 lunar-month year, the rising of Sirius varied from year to year by 11 days. Whenever it rose late in the 12th month an extra month was added to ensure that it would rise again in the twelfth month in the following year. This rather arbitrary system of calendar keeping did not suit the needs of this highly organized society! Eventually this problem gave rise to the 365 day calendar.

Just as the appearance of the Pleiades and Sirius at a certain time of night has been correlated with the seasons, the orientation of a constellation such as the Big or Little Dipper at certain times of the night, has also been correlated with seasonal change.

Students can verify some of these observations using star charts, planispheres, celestial globes, planetarium software, or by visiting a real planetarium. Planetarium programs which allow students to observe pictures of the night sky from any place on Earth, can be particularly useful in facilitating the visualization and investigation of these patterns while studying multicultural astronomy.

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