

TEACHING GUIDE for CALLIOPE: *Made in China: A History of Firsts*

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PART ONE: WARM-UP

- 1) Explain to students that they will be learning about inventions and discoveries in China throughout its history. Ask students to find out which inventions they will be learning about. Have them skim the table of contents and examine the illustrations. They should write down as many inventions as they can infer from a brief look at the magazine.
- 2) As a class, look at the list of inventions students came up with. Discuss briefly: What do you think the inventions have to do with life today? Ask students to keep this question in mind as they read.
- 3) Have students select and read an article he or she finds appealing. Utilize discussion questions included in this guide below if you like. Ask students to introduce their invention to the class and explain its importance to life in China at the time and to our lives today.
- 4) As a class, create an illustrated time line of inventions and discoveries. Using the online references below, add to the time line major periods or events in Chinese history that give a clue about what Chinese civilization was like during the time of the invention.

References:

"Time line of Chinese History" Asia for Educators, Columbia University
<http://afe.easia.columbia.edu/>

(Click anywhere on the time line on the homepage and follow the link to the "Time line for Chinese History.")

"The China History Time line" Freer Sackler Gallery
<http://www.asia.si.edu/collections/chineseHome.htm#>

PART TWO: READING COMPREHENSION QUESTIONS

"China at the Forefront" (p. 2)

What does the author say about how ideas, technology, and products flow from one place to another? What are some examples of products and technology that flowed from China to the West? From the West to the East?

What kinds of technology is China known for today?

What is supporting the growth of technology in China today?

What questions do you have about China's history of inventions or its advances in technology today?

"Metallurgy in Ancient China" (p. 4)

What does the term “metallurgy” refer to?

What is bronze made of? Where did these metals come from?

Describe the process of casting bronze.

What did you learn about ancient China from this reading?

“Iron Makes a Difference” (p. 7)

The author refers to the production of iron as the second metallurgical revolution? What was the first and when did it occur?

Where does iron come from? What was iron used for in ancient China?

What kinds of materials did iron replace?

The author says that iron had certain advantages over bronze. Can you think of what some of these might be? How can you find out?

“Ringing the Bells” (p. 8)

Name a few instruments discovered in Neolithic sites. What were they made out of?

What role did music play in ancient China?

In what important ways do Chinese bronze bells differ from the bells we ring today?

The author says a fifth-century set of bells was tuned to a chromatic scale. What is a chromatic scale? Why is this fact important?

“Predicting Earthquakes” (p. 11)

Describe Zhang Heng’s invention and explain how it works. What contemporary technology has replaced this early invention?

Why was it particularly important for an emperor to know when and where an earthquake struck?

What other inventions have you read about that helped the emperor appease Heaven?

What do you think it meant to be a good ruler in imperial China? Investigate: Find an example of an emperor who was considered to be a good ruler. Explain why.

“On Books Baked in Ovens and Counting with Chopsticks” (p. 14)

Write your age in signs used by ancient Mesopotamians. Write a family member’s age.
(Hint: < = 10, Y = 1.)

How would you write the length of your school day using the revised ancient system?
(Hint: Count by 60s.)

In China’s counting rod system, what did vertical lines represent? Horizontal?

Draw a grid and label boxes where you would write the unit, tens, hundreds, and thousands.

Draw these three numbers: 5, 600, 50,000.

Investigate some early applications of mathematics in China. What was the counting rod system used for?

“One Potter + Clay + Fire = Porcelain” (p. 20)

How is porcelain made? How did it differ from earlier types of ceramics?

When was porcelain invented in China? How long did it take for porcelain production to be “invented” in other parts of the world? Why do you think it took so long for porcelain production to begin in other parts of the world?

What technological challenges did porcelain potters face?

“Chinese Junks” (p. 26)

A Chinese junk may look somewhat like a fish, but the author says that the junk’s structure and function is more like what creature?

What are common nautical devices used today that were invented by Chinese long ago? What are the functions of these devices?

Give one example of an innovation that made ships or seafaring more efficient.

Why do you think seafaring was important for the Chinese empire?

“Zheng He’s Voyages” (p. 29)

What was the purpose of Zheng He’s voyages?

What are some important questions historians and scientific specialists still have about Zheng He’s voyages?

“Fire Power” (p. 32)

Who was Sunzi? What advice did he give about using fire to attack the enemy?

What did Mozi believe? What advice did he give about defending cities against attack?

What conditions led to the invention of gunpowder? What do you think is the most useful application of gunpowder?

“Seeing Stars” (p. 36)

What impact did people in ancient China believe the stars had on Chinese civilization?

Describe some early discoveries in astronomy.

What is the armillary sphere? How does it work?

“To Fly on Silken Wings” (p. 38)

What were some practical applications of kites?

What science did Chinese engineers discover by working with kites?

Explore the Web or library for traditional Chinese kite designs. Find an example of a design or symbol that is meaningful in Chinese culture.

“Balloons, Parachutes, and More” (p. 40)

Describe the different means of flight devised by Chinese inventors. What do you know about how the inventions worked? Where could you find more information?

This article (along with other articles in this issue) tell you that these inventions were discovered in Europe and elsewhere long after they were invented in China. What are some possible reasons inventions appeared later in Europe?

“Can We Tame the Flooding River” (p. 42)

What important concept did Yu's methods of flood control reflect?

The Dujiangyan Irrigation System has been designated as a World Heritage Site by the the United Nations Educational, Scientific, and Cultural Organization (UNESCO). UNESCO “seeks to encourage the identification, protection, and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity.” UNESCO does this by recognizing places as World Heritage sites to be preserved for all the world's people to appreciate. Why do you think Dujiangyan is a World Heritage site?

Find out more about this special designation and see why Dujiangyan qualifies by searching the World Heritage official site: http://whc.unesco.org/pg.cfm?cid=31&id_site=1001.

“Biorice: Food of the Future” (p. 48)

What does it mean to “map a genome”? Why is this “map” useful?

What problem do scientists anticipate regarding food production?

What group(s) opposes biorice? What are some reasons why?

Why is it significant that scientists are typically very young?

PART THREE: ACTIVITIES FOR LEARNING ABOUT CHINESE HISTORY AND CULTURE

Chose one or more of the following activities to help students delve deeper into Chinese history and culture.

Activity: A Virtual Tour of Chinese Bronzes

1) Of all Bronze Age civilizations, the Shang dynasty probably had the most advanced bronze-casting techniques. In Shang China, bronze was considered to be very beautiful. Have students explore ancient Chinese bronzes by visiting online museum collections from around the world. Alternatively, select a few images to share with students in class. Be sure to enlarge images so that students can see the decorative details clearly.

References:

Chinese Bronzes of the Shang and Zhou Periods, Asia Society
http://www.asiasocietymuseum.com/region_results.asp?RegionID=4&CountryID=12&ChapterID=22

National Palace Museum, Taipei, Taiwan
http://www.npm.gov.tw/en/collection/selections_01.htm?catno=19&pageno=2

Minneapolis Institute of Arts

<http://www.artsmia.org/art-of-asia/explore/explore-collection-chinese-bronzes.cfm>

Shanghai Museum

<http://www.shanghaimuseum.net/en/collection/qingtong/1.htm>

2) Ask students to make observations about the Shang and Zhou period vessels. Focus on form first: What shapes do you see? Are lines straight or curved? Do designs fill the surface? Are designs symmetrical or no? What is being depicted? Do you see familiar motifs? Do you find designs appealing? Why or why not?

The article mentions the *taotie* as a common decoration. The *taotie* depicts the face of an imaginary beast with eyes, horns, jaw, and sometimes a paw with a claw. Ask students: Can you find the *taotie*? What perspective of the animal do you see? (Although the face appears to stare straight out at the viewer, the *taotie* is actually depicted as mirror-image profiles. Each half was carved separately, by hand, in a clay casting mould.)

Focus on function: What might the vessel be used for? Who would use such a vessel? How could you find out if you are correct?

3) Have students sketch a few vessels and their motifs to refer back to later.

4) Discuss: What do your observations about the form and function of the vessels tell you about Chinese civilization at that time? Why do historians and anthropologists consider the bronze vessels an important discovery?

5) Compare observations and sketches with a different type of bronzes discovered in China in 1986. The Sichuan bronzes, now displayed at the Sanxingdui Museum in China's Sichuan province, represent a discovery that has radically changed historians' picture of Chinese civilization. Ask students to find out why.

Have students view the Sichuan bronzes from the museum Web sites below and go through the observations questions again. What are some key similarities and differences? Why do you think the discovery of these bronzes changed our understanding of ancient Chinese civilization?

Read about why this discovery is revolutionary and what questions remain unanswered (see the Seattle Weekly article). Debrief the article with students and discuss: How can we change our time line to reflect this new discovery?

References:

Sanxingdui Museum Sichuan, China

<http://www.sxd.cn/maine.asp>

Seattle Art Museum

<http://seattleartmuseum.org/Learn/SchoolTeacher/teacher.asp>.

Scroll to "Treasures from a Lost Civilization: Ancient Art from Sichuan" and click on "transparencies."

Seattle Weekly article on Sichuan Bronzes, "The Mysterious West: New Discoveries Poke a Hole in Imperial Chinese "History"

<http://www.seattleweekly.com/arts/0118/arts-downey.php>

Activity: What's Chinese about Traditional Chinese Music?

1) Music was an important part of court culture, and later, daily life in traditional China. As a class, listen to the sound recording of ancient bells (featured along with the wooden flute and zither) from the Web site below. Discuss with students:

What do you notice? What is the tempo like? What is the mood of the music? How does it make you feel? What does the narrator of "Sacred Sounds" tell you about music in ancient China? When was music played? What was the purpose?

Reference:

"Sacred Sounds: The Bells of Ancient China" from the Minneapolis Institute of Arts
http://www.artsmia.org/index.php?section_id=2&exh_id=2309&IM=2&start=1

2) Few instruments heard in traditional Chinese music are indigenous to China. Many traditional instruments were introduced to China from other parts of Asia via the Silk Road, a trade route that transmitted goods and ideas across Asia. Have students select a Chinese traditional instrument to listen to at the Web site below. Ask them to research the instrument's history and share it with the class.

Reference:

National Geography World Music [lute (*pipa*), Chinese violin (*erhu*), zither (*qin*)]
http://worldmusic.nationalgeographic.com/worldmusic/view/page.basic/genre/content.genre/chinese_traditional_709

3) For a contemporary connection, ask students to investigate an example of contemporary music that is influenced by traditional Chinese sounds and instruments. Examples include the music of classical composer Chen Yi; the popular music group, 12 Girls Band; and Yo Yo Ma's Silk Road Project. Review questions from the first part of the activity with contemporary pieces and compare responses.

Activity: Philosophy and Science in China

1) Many of the articles tell us that philosophical and religious beliefs (as reflected in the folk, Daoist, Buddhist, and Confucian traditions) influenced innovations in science and technology. In fact, Chinese philosophical traditions reflect many different ways of looking at the natural world. Read the statements below, and discuss the similarities and differences in the world views they reflect.

"The emperor was regarded as the Son of Heaven. He was appointed by Heaven to maintain order in society that reflected the natural, hierarchical order of the cosmos. Natural disasters expressed Heaven's displeasure with the emperor's rule and needed to be controlled at all costs."

"Daoists believe that change is the inevitable, natural state of the universe. One substance can transform into another."

"Traditional Chinese medicine traces problems in the human body to imbalances of the polar opposite qualities yin and yang. A patient might be plagued with an imbalance of cold and heat, for example."

2) Discuss with students: What role did philosophical beliefs play in the discoveries and inventions you read about? (See articles on bronzes, stars, earthquakes, kites, astronomy, and floods, etc.) What other clues about Chinese traditional beliefs did you find in the readings? Based on what you read, do you think traditional beliefs supported or blocked innovations in science and technology? How so?

3) Connect the discussion to current events: How do you think beliefs influence innovations in science and technology today? What controversial application of science is discussed in the magazine? What examples of controversial applications of science and technology in our world can you think of?

Have students do some research to find two or more articles that represent different points of view about an issue in which science and values conflict. Students should write a brief essay about their findings that describes the arguments made by each side, the evidence given, and his or her opinion about which position is most persuasive.

Activity: Flows of Goods and Ideas

1) As students learned in the articles, inventions and discoveries are sometimes “invented” and “discovered” years or even centuries later elsewhere around the world. However, early on in China’s history there were mechanisms to transport some goods and ideas from China to other parts of the world and vice versa. Present to students the topics below about flows of goods and ideas, then and now. Invite them to select one topic to research in small groups and present to the class.

Topic One: Flows of Goods. How were goods manufactured and traded in imperial China? What about today? You read references to the Silk Road and to China’s export trade in porcelain, silk, and tea. Find out more about the export trade in traditional China. What techniques did Chinese workers use to produce large quantities for export? Where did the goods go? How did they get there? What challenges existed? Compare with China’s export trade today. What parallels do you notice, and what significant differences are there?

Topic Two: Flows of Ideas. Long ago Sir Francis Bacon said that knowledge is power. The articles mention a few instances in which knowledge of science and technology was not shared initially but kept secret (think of the article on porcelain and the one about biorice). Why would this knowledge be kept secret? What are some impacts of keeping technological knowledge a secret? How do we attempt to protect new ideas and inventions today? Investigate international intellectual property issues.

PART FOUR: CULMINATING “SCIENCE FAIR” ACTIVITY

Hold a science fair featuring inventions and technologies from a particular period in Chinese history. Science fair contestants should research a technology or invention of their choosing, and design a poster, brochure, model, or other visual project to explain the technology, why it made a difference to Chinese civilization at the time, and why it is important for the world today. Invite another class to visit and vote for the technology that had the greatest impact. Debrief by discussing the conditions that supported technological innovation during this period in Chinese history.