Lesson: The Genius of China

Background of Lesson
Framework Connection:
Students study the technological developments of the Chinese (in comparison with similar European developments) from the Han dynasty through the Yuan to discover the effects of their civilization.

Focus Questions:
1. What were the immediate results for China of the scientific and technological accomplishments from the first to the eleventh centuries?
2. How would these inventions affect China’s future development?

Outcomes:
1. Students will examine ten selected inventions from this time period and be able to analyze and predict effects on Chinese civilization.
2. Students will construct a Chinese kite.

Target Vocabulary:
- seismograph
- magnetic compass
- lodestone
- mortar and pestle
- iron plowshares

Primary Sources:
Pictures of archeological finds.
Quotes from ancient Chinese texts, translated in English by Needham, Silverberg, and Temple.
(See bibliography.)

Visuals:
Slides or overheads of the inventions.

Lesson Procedure:
Motivation:
1. Put five large sheets of paper on the wall. Write the following titles on the papers: Cultural, Economical, Political, Educational, and Technological. Have students rotate around the room, one minute at each station, and list what they think constitutes an advanced civilization in each category.
2. Discuss the three most important elements students have placed on each chart.
3. Discuss: Is China an advanced civilization? Why? Why not?

Vocabulary Activities:
Discuss and define terms in advance with the students, adding the words to their individual learning logs or vocabulary journals. Stop the lesson whenever appropriate to discuss and define any term that presents difficulty.

**Guided Instruction:**
1. Show slides (or overheads) and discuss five inventions of the Chinese: how they worked; what they predict would be the results of these inventions; and what were the actual results of these inventions for China.
2. Each student will read the paper on ten inventions (given on the following pages).
3. With a partner each group will choose five inventions to predict the short term results on Chinese civilization.
4. Then each group will predict the long term results of these inventions for China by filling in the chart given.

**Assessment:**
Student will fill out and turn in a chart with analyses and predictions.

**Independent Work:**
Student will make a Chinese kite.

**Background Information for Inventions**

From the Shang dynasty on, the Chinese built a foundation of knowledge and inventions that could have led the country to be a technological and industrial giant, at least by the sixteenth and seventeenth centuries. Instead, European ambassadors reported: “China is a backward nation and continues to fall more and more behind the western world.”

With the invention of the spinning wheel in China in the second century C.E., the Chinese had a silk winding machine that could wind the silk directly from cocoons onto bobbins with an arrangement of spindles driven by a foot-powered belt. According to Joseph Needham, the domestication of the silkworm and the development of the silk industry had taken place much earlier, at least by the fourteenth century B.C.E. With these developments, China had a monopoly on the silk trade, and this whole silk industry encouraged the development of trade along the Silk Road through Central Asia to Syria. This opened up China to European ideas and opened up Europe to the wealth of China, both overland and over sea.

China’s invention of paper and books was accomplished at least by the Han dynasty. In China, every important scholar and official had his own library. Paper was used for clothing, wrapping lacquerware, personal hygiene, blankets, curtains, armor (that could not be pierced by strong arrows, kites (first made with silk and later covered by the cheaper paper), money, umbrellas, books, wallpaper, toilet paper (“thick, but soft and perfumed for use of the imperial family”). In the 6th century, Official Yen wrote: “Paper on which there are quotations or commentaries from the Five Classics or the names of sages, I dare not use for toilet purposes.” Europeans did not begin using paper until 1400 years later.
The earliest Chinese books were probably bamboo writing tablets from during the Han period. The Chinese were using movable type to print books on paper by the 11th century during the Song dynasty. Gutenberg did not develop his movable type until the 15th century.

The South Pointing Chariot and the magnetic compass (south pointing, also) were used from perhaps 2800 B.C.E. to the Han dynasty. The compass certainly was used by the Chinese crossing land. A book called the Kuei Ku Tzu, dated about 300 B.C.E., says: “When the people of China go out to collect jade, they carry a south pointer with them so as not to lose their way.” In the Sung dynasty there is recorded evidence of using this navigational tool on water. Chu Yu, a sung official recorded: “The ship’s pilots find the position at night by looking at the stars, in the daytime by looking at the sun, in dark weather they look at the south pointing needle.” Navigation compasses may have found their way to Europe by the 12th century, according to Needham, where they were much improved. Journeys to Africa from at least the 10th century onward, culminating with the seven voyages of Admiral Zheng He in the 15th century, used these compasses, star charts, and other navigational devices on the sea. These expeditions greatly heightened Chinese prestige in the areas visited, but were stopped by the Ming emperor who considered them superfluous and a waste of money.

In the Han dynasty, Chang Heng, a brilliant mathematician, astronomer, and geographer, is credited with inventing the first seismograph. This device could record the occurrence and direction of earthquakes from the epicenter up to 400 miles from the capital. Earth tremors would cause the silver ball to fall from the mouth of the dragon to the frog, indicating the direction. By the time of the Mongol rule in the 13th century, the principles of the seismograph had been lost. This is reported to have worked quite well, and even though the Japanese tried to duplicate this in the 1930s, they could not. The first modern seismograph of any kind was designed by De la Hautefeuille in 1703, making Chang Heng exactly 1401 years ahead of the West.

There is evidence that the Chinese knew about gunpowder from about the 4th century on. But their first uses of these ingredients were probably medicinal, mixing together saltpeter and charcoal by alchemists seeking an elixir of immortality. Later the Chinese found that mixing sulphur and charcoal together would create a beautiful flash of light and puff of smoke, so this was used in religious purposes in processions, festivals, and ceremonies. If you added one more ingredient, the salt peter, which the Arabs called “Chinese snow” they got the explosive element to their fireworks. The first time gunpowder was used in combat was about 1000, during the Sung dynasty, when China was under invasion by the Khitan barbarians. They seemed to have used some sort of crude bomb or hand grenade. By the time of the Mongols, the Chinese were using “fire arrows” with explosive devices, flame throwers, mines (both sea and land), rockets and cannons.

The men of China are great and cunning workmen, as may well be seen by the workmanship... They make and use wagons or carts with sails like boats, and with wheels so subtly made, that being in the field they go and are driven forward by the wind as if they were in the water.

The Chinese south pointing chariot was constructed by an engineer named Yen Su and had an arrangement of gears and wheel rigged to a vertical pole on which the south pointing figure was set at the beginning to point in the desired direction. Then, if the chariot moved to the east, a gear attached to its right wheel would turn a certain number of notches. This in turn would move other gears; a central horizontal wheel would cause the vertical pole to move, turning the figure. When the chariot was facing due east -- at right angles to
its original path-- the figure would be swung around crosswise, so that its arm still would point south.

Chang Heng’s seismograph is a vessel of fine cast bronze, resembling a wine-jar, and having a diameter of eight ch’ih (about 6 feet). Inside was a central column...so arranged that it would operated a closing and opening mechanism. Outside the vessel were eight dragon heads, each holding a bronze ball in its mouth, while round the base sat eight toads with their mouths open. When an earthquake occurred, the dragon mechanism of the vessel was caused to vibrate so that a ball was vomited out of a dragon mouth and caught by the toad underneath. At the same instant a sharp sound was made which caught the attention of the observers.

The Chinese method of making printed books is quite ingenious. The text is written in ink, with a brush made of very fine hair, on a sheet of paper which is inverted and pasted on a wooden tablet. When the paper has become thoroughly dry, its surface is scraped off quickly and with great skill, until nothing but a fine tissue bearing the characters remains on the wooden tablet. Then, with a steel graver, the workman cuts away the surface following the outline of the characters making them stand out. When the fire is to be started one applies a heated branding iron to the ignition chamber, and the piston rod is forced full into the cylinder-- then the man at the back is ordered to draw the piston rod fully backwards and work it back and forth as vigorously as possible. Henceforth, the oil comes out through the ignition chamber and is shot forth as a blazing flame.

In 1086, Su Sung produced a two-story tower thirty-five feet high. The heart of it was a giant clock driven by water power; water constantly flowed out of a tank always kept full, into thirty-six scoops mounted on a driving-wheel eleven feet across. An iron shaft supported on bearings was attached to this wheel; the wheel turned the shaft, which moved gears that controlled the clock. So long as the water flows at the same rate, the clock would keep reasonably accurate time. On the lower floor of the tower, puppets popped out of doors to announce the time with bells, gongs, drums, and signs.

In 1088, scientist Shen Kua wrote, “Magicians rub the point of a needle with the lodestone; then it is able to point to the south. But it always inclines slightly to the east, and does not point directly at the south. It may be made to float on the surface of water, but it is then rather unsteady. It is best to suspend it by a single cocoon fiber of new silk attached to the center of the needle by a piece of wax the size of a mustard seed -- then, hanging in a windless place, it will always point to the south.”

A traditional Chinese story declares that in the Han Dynasty a court official named Ts’ai Lun was the inventor of paper. He mashed rags, tree bark, old fishing nets, rope, and other things into a fine pulp, using a mortar and pestle, and spread it out on a frame to dry. The result, when pressed flat, was an excellent writing material less costly than silk and more convenient to handle than bamboo.

In 255 B.C.E., Mo Tzu made a wooden kite which took three years to complete. It could indeed fly, but after one day’s trial it was wrecked. Some have made flying cars with wood from the inner part of the jujube tree, using ox leather straps fastened to revolving blades so as to set the machine in motion. The kite flies higher and higher spirally, and then only needs to stretch its two wings, beating the air no more, in order to go forward by itself, because it starts gliding on the hard wind.

By the sixth century B.C.E., iron plowshares became available in China, in the form either of iron laid over wood, or of solid iron, as described in Lu Kuei-Meng’s book The Classic of the Plough. These were the first iron plows in the world. Such plows could be used in heavy soils. With a good plow, plowing becomes like running a knife
through butter, and just as a heavier knife will go through butter better, so a heavier plow will make a finer and deeper furrow with less trouble.

**Chinese Kites**

**Kite Making - Background Information**

Kite making in China goes back long before written history. Bamboo was used for the frames, with silk and later the cheaper paper being used for the coverings.

In the Han dynasty, according to Chinese legend, the people were saved from barbarian invaders by kites. Huan Theng, an advisor to the emperor, had a number of kites made with special sounding devices. When hit by the wind these sounding devices produced eerie low moans and high-pitched wails. Huan Theng had spies sent among the barbarians to spread rumors that the gods were angry with them, and they would soon be destroyed. The enemy fled in terror when they heard the kites. Kites with these sounding devices have been used by individual families flying above their homes to frighten away thieves and bandits. Today, kites may be flown above homes to frighten away evil spirits.

In about 500 C.E., Emperor Liang Moo is recorded using kites as signals to his troops to come protect the palace. Then he could allow them to disperse among the countryside and work on their farms. In times of danger he would signal his troops by flying his kites from high points throughout the area, and they would head for the palace and launch a surprise attack on the enemy from the rear.

Kites in China are used for fishing, with a long string tied to the kite’s tail. A hook with bait is attached to this string, and when the fish takes the bait, the kite is pulled in. In remote areas of China, kites with firecrackers attached are used to scare away pesky birds that would destroy the crop. Slow burning incense sets these firecrackers off at intervals.

The Chinese celebrate the Festival of Ascending on High from the first to the 9th of September. The easterly winds usually prevail during the first part of September, and students fly kites of all shapes and designs after school every day. On the 9th day, the schools declare a holiday, and kites are flown all day long. When one is finished flying his kite, he lets it go, string and all, and all of the evil, bad luck, and sickness are carried away with the kite. If you find such a kite, custom requires that you burn it.

**Materials:**

- split bamboo
  
  (I use window blinds that can be purchased at Thrift Shops or Cost Plus for a very nominal fee. One window blind has over 100 slats. I split those in half, which leaves me with over 200 pieces of bamboo about a yard long which will be plenty of material for all your kite needs. Soak bamboo in water two to three hours so splits are easy to bend.)
- rice paper
- white glue
- strong thread
- kite string
- paints (water color or poster)
- rag strips for tail (2” wide; 6” long, tied at 6 “ intervals.)
Instructions:

1. Make frame from split bamboo; lash and glue together. Let dry.
2. Lay frame on rice paper leaving 1/2” overlap; Cut with paper shears.
3. Position the frame on the paper in such a manner that the center pole is the uppermost component of the frame.
4. Apply glue to the margins of paper and fold the margins back over the bamboo, or string, portions of the frame.
5. Decorate kite cover as desired.
6. Attach tail.
7. Make bridle and attach to center pole.
8. Fly.

There are many variations of Chinese kites and students may be as creative as they wish with form and decoration. These are merely suggestions:

Redtail Hawk Kite
Fish Kite
Tree Kite
Orange Kite
Octagon Kite