Exploring World History Along the Silk Route:

A Social Studies Investigation Through Mathematics

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The study of world history provides a natural opportunity to integrate social studies and mathematics. Map skills, the study of cultures, and looking at modes of travel are all social studies concepts that are natural venues for exploring mathematics. In this article, we discuss how the use of the book, *The Silk Route: 7,000 Miles of History* (John S. Major, 1995), serves as the context for this integration. The activities are appropriate for upper elementary or middle grades students; they are also easily adaptable for use with other levels.

Summary of the Book

The Silk Route: 7,000 Miles of History takes the reader on a caravan trip from central China to Tyre and then onto Byzantium in the year 700 AD. This is a period of great changes in world history. The silk route described here illustrates contact between various cultures because of the desire for trade. In addition to material goods being traded the author points out that various religions were also being exchanged and their influences felt across the world. The author's concluding paragraph provides a wonderful overview on the process of trade.

> The garments worn by the wealthy people of Byzantium are made of silk cloth brought from China, more than 6,000 miles away. Few people in Byzantium have more than a vague idea of where China is or what its people are like, just as few Chinese know anything about the Eastern Roman Empire. Yet Chinese silk is sold in Byzantium, and Byzantine gold coins circulate in the markets of China. The two empires are linked together by trade, thanks to the brave and enterprising merchants of the Silk Route. (p. 28 - 29)

<u>Exploring Map Skills</u>

The ability to read and use maps is an important area within the social studies curriculum. Working with maps provides a mathematical opportunity to discuss the use of legends or keys and to discuss the difference in distance as the "crow flies" versus distance along a road.

The very beginning of the *The Silk Route* features a map of the Silk Route. This map is a simple form that is not cluttered with extra information that would be provided in most general maps of the region. The route winds from city to city like a red and gold snake. In finding the distance between cities, students might be tempted simply to count the number of red and gold segments on the route. However, on a closer inspection they will find that the segments are not of equal size across the entire map; thus, they need to use the distance key provided. It is interesting to note that distance is provided in both kilometers and miles.

After reading *The Silk Route* to a class, the teacher might challenge students to check the distance from Chang'an in China to Byzantium. If students are going to check the claim of the author then they need to be sure to use the miles key. (Note: the scale is 500 miles per inch.)

Upper elementary students could place a string on the map to closely follow the silk route indicated on the map, measure the length of the string, and then multiply their length in inches by 500 miles per inch. Such an activity is great for small groups because it helps to have several fingers to place the string on the route on the map. (We found the total distance to be about 7700 miles.)

Students may also want to find the distance between each of the cities mentioned in the story.

From	To	Distance between the cities in inches	Distance in miles	
Answers:				
Chang'an	Dunhuang	_____	_____	(1300)[1200]
Dunhuang	Kashgar	_____	_____	(1500)
[1300]				
Kashgar	Tashkent	_____	_____	(800) [700]
Tashkent	Herat	_____	_____	(900) [800]
Herat	Baghdad	_____	_____	(1300)
[1100]				
Baghdad	Damascus	_____	_____	(400) [400]
Damascus	Tyre	_____	_____	(200) [200]
Tyre	Byzantium	_____	_____	(1400)
[1400]				
	TOTAL	_____	_____	(8000)
[7000]				

(Note: the distance between cities varies depending on the measured distance along the route on the map or the straight-line distance between the mentioned cities. Our estimates for actual map or curved paths are indicated in parentheses and the corresponding straight-line distances are enclosed in brackets. Which do you suppose the author used? How can you support that claim?)

<u>Modes and Speed of Travel</u>

Considering the differences in modes and speeds of travel provides another opportunity to integrate discussion of cultural differences and history and computational work in mathematics. The following activities suggest some ways to integrate social studies and mathematics. These activities are appropriate for upper elementary or middle grades students, depending on their mathematical background; teachers can easily adapt activities by modifying the numbers used.

At the end of the story, the author provided additional information about the places and modes of travel. He indicated that a caravan might travel as few as 10 miles per day or as many as 50 miles per day, depending on the terrain and weather conditions.

Example 1. Suppose you are a private Chinese merchant who is making the trip as far as Kashgar. It is important to get to Kashgar and back as far as Dunhuang before the summer heat makes crossing the Taklamakan Desert too dangerous. To be safe you decide that the trip must be completed by June 1. If the reliable guides claim that you can average 30 miles per day, when would be the latest that you could leave Chang'an with confidence that you would make it according to your ideal time schedule? (Answer: 143 days before June 1)

Explain how you decided on the date on which to leave with the caravan.

Example 2. Suppose that you are traveling west with a load of fine silk. At Dunhuang, your caravan guide informs you that you must pack at least 8 liters of water per day for the trip across the desert. Your camel can carry an additional 70 kilograms.

Will you have to get an additional camel to transport the needed water? Explain your answer.

(Answer: YES!! – at 1500 miles a rate of 30 miles per day means 50 days. 50 days x 8 liters is 400 liters of water. Each liter weighs one kilogram so that's 400 kilograms -- a lot more than the 70 your camel could carry. To convert kilograms to pounds multiply by 2.2 to get 880 pounds of water.)

Example 3. After carefully listening to stories from older merchants you have determined that the value of fine silk increases by 50% for each 1000 miles it is moved to the west. Further you determine that fine rugs from Baghdad increase the same amount for each 1000 miles they are transported to the east. You determine to make the trip from Chang'an to Baghdad with a load of silk. After arriving in Baghdad you plan to trade the silk for Persian rugs, which you will sell back in China. If you leave with $1000 worth of silk, what value should you have upon trading in Baghdad? (Answer: about $11,000) Now, if all of that money is put back into Persian rugs that are transported back to Chang'an what will be the value of the rugs at the end of the trip? (Answer: about $125,300)
[Hint: use the miles between cities figured earlier (about 6000 miles).]

Example 4. A rival merchant from Chang'an also has plans to trade silk for Persian rugs, but the rival is only going as far as Kashgar. There the rival will sell the silk and buy the rugs for later sale in Chang'an. The rival will not make as much money, but believes that he can make two such trips while you make only one. If the rival

actually can make the two trips to your longer one, who will have the greater profit from the business (assume the expenses of caravan travel are the same for your one trip and for the rival's two trips)?

(Answer: Rival will make about $18,000 for the two trips; you make $125,000 if the bandits don't get you or your stuff!)

<u>Changes Over Time</u>

Students often fail to realize that cities may change names over time, depending on various historical actions such as war and occupation by other countries. Exploring such changes provides another opportunity to integrate mathematics and social studies, along with technology through exploration via reference books or the Internet.

For the next exercise students investigate which cities mentioned in the Silk Route have had name changes since 700 AD. For example, Byzantium changed to Constantinople and is now Istanbul. However, Damascus, Baghdad, Tyre and Dunhung are still called by the same names. What kind of reference book could be investigated to check on city names?

Example 5. Using a current map, plot a route that passes through the cities mentioned in the story from Chang'an (now Xi'an) to Tyre. Then approximate how long it would take to travel that route by truck if the driver actually drives for 10 hours per day and can average 50 miles per hour (assume that there are no problems passing from one country to another). (Answer: 12 days) How much would it cost if you hire a truck driver at a rate of 55 cents per mile? The driver pays for the fuel at a rate of 75 cents per liter. If the truck can average 8 miles per liter of fuel how much will the driver make for the entire trip? (Answer: about $2700, using 6000 miles for the trip.)

Example 6.   If the truck driver had to have his/her passport stamped at each border crossing how many times would the truck driver have had his/her passport stamped?

Conclusion

The ideas discussed here are just a few of the ideas that can tie mathematics with a story of early commerce between two major civilizations, Chinese and Persian of the late first millennium, that are not often featured in the social studies curriculum. The focus here was on mathematical tasks, but we believe that teachers who read *The Silk Route* will find a treasure of other possible activities and investigations that are appropriate for the students that they teach.

References

Major, John S. *The Silk Route: 7,000 Miles of History*. (1995) Harper Collins Publishers.