

A Science Teacher Looks at Social Studies

by S. Maxwell Hines

Social studies teachers tend to present Enlightenment philosophers as abstract thinkers or curious eccentrics whose ideas only incidentally had real world application. The most famous images are probably Isaac Newton sitting under an apple tree pondering gravity and Ben Franklin flying a kite during a lightening storm. Dava Sobel's book about the struggle to develop an accurate way of measuring longitude while at sea presents a very different picture. In this story, the Enlightenment is part and parcel of efforts to answer practical questions in an era of European global expansion through trade, conquest and colonization.

Using the astrolabe and the stars to measure latitude, distances north or south of the equator, was a relatively simple operation for the natural philosophers and intrepid mariners of the sixteenth century. However, they had no instruments for measuring longitude, distances east or west of a point, which was a big problem. When a ship's captain's estimate of longitude was off by a small amount, ships grounded on unexpected rocks and entire cargoes and crews were lost. Some ship's captains tried to avoid this fate by traveling east and west along a narrow band of well-plotted latitude, but this left them vulnerable to attack by pirates and enemy navies.

Goods acquired in East Asia and the 'New World' directly translated into wealth for European merchants and the nations under whose protection they ships sailed, so their loss at sea represented major economic catastrophes. Because of this, the problem of calculating longitude was of monumental import to European nation's during this period of increasing global interaction. The need to solve this problem was so significant that European nations offered huge rewards to the scientist who could discover a practical method to accurately discern longitude while at sea.

The beauty of Sobel's book is in how she places human faces on the struggle to solve the problem of longitude. She painstakingly describes the life and times of the men who competed to solve this problem and for the reward, either by inventing a new measuring device or by mapping the heavens. We learn about the English clockmaker and non-scientist, John Harrison, who campaigned for forty years as a 'scientific outsider' to have his invention of a dual clock, substantiated by a skeptical scientific community. Harrison's clock was a complicated device that accurately measured distance by allowing mariners to compare the time of the rising and setting of the sun at sea with known times at home.

This book, which is eminently readable, offers social studies teachers and high school students a unique insight into the process of scientific discovery that lay people often miss. It helps students understand that scientific discoveries are often born out of practical human need, that they are generally predicated on previous findings, and that at first glance, they frequently appear to have little to do with the research question at hand. Scientific efforts that seem esoteric may eventually be used to develop practical solutions to problems that we have not yet even considered. The search for longitude netted a number of ancillary scientific discoveries, not the least of which were accurate calculations of the speed of light, the weight of the earth, and the distance of the earth from the stars.

Learning Activity: Scientific and Technological Achievements in Global History, 1050-1775

1050	Astrolabe arrives in Europe from the East
1151	China uses gunpowder as weapon
1400's	Italians use perspective in painting
1445-1450	Gutenberg printing press and Bible in Germany
1510	Leonardo da Vinci of Italy designs horizontal water wheel
1512	Copernicus argues earth and planets revolve around the sun
1665	Isaac Newton invents differential calculus; experiments on gravitation
1717	Lady Mary Wortley Montagu introduces inoculation against small pox into England
1733	English patent of flying shuttle loom
1764-1775	James Watt of England develops the steam engine
1775	Captain James Cook successfully field-tests John Harrison's devise for measuring longitude at sea

- Which scientific or technological developments do you consider most important in this period (select between one and three)? Why do you make these choices?