Book Review

Longitude
By Dava Sobel
c. 1995 by Penguin Books

Reviewed By Susan Palmer Slattery

The *Writing Across the Curriculum* program stresses applications that include reading and writing in all subject areas. Mathematics and science disciplines have been blessed with the popular acceptance of histories and biographies about these disciplines, such as *A Beautiful Mind,* and *A Brief History of Time.* Instructors can use books like these to provide reading and writing opportunities that connect with the classroom topics and lead to extension projects. The geometry or trigonometry teacher has a perfect opportunity to achieve these goals with *Longitude.*

For a ship at sea, latitude could be determined using a map depicting the constellations and certain key stars. Due to the rotation of the earth, the movement of stars through the night sky could be observed to follow known paths "above" certain latitudes, with variations due to seasonal changes given by nautical charts. During the early days of ocean travel, knowing one's latitude enabled mariners to sail out of sight of land and, if the winds held, they could be assured of reaching land at some point. Ships could travel along coastlines to reach those latitudes with favorable wind patterns for ocean crossings. This practice, however, encouraged piracy as ships carried goods along well-known routes between the Old and New Worlds.

When the winds became variable, or ships were blown off course, knowing one's longitude became vitally important. Latitude could tell a ship's captain where they would make landfall but it was longitude that could tell him how far the ship was from that land. The limited provisions on board made this piece of information the difference between life and death: dehydration, starvation, scurvy, and running aground in unfamiliar waters were the fears faced by a crew whose captain who couldn't determine where the closest land was located. Thousands of deaths and the loss of numerous ships caused the British Government to pass the Longitude Act of 1714, in which a prize of £20,000 would be paid to the person(s) who could provide a solution to the longitude problem.

Astronomers believed that, like latitude, the determination of longitude would be accomplished using the stars. Processes were developed, requiring complex calculations taking many hours and extremely accurate sightings of stars, planets or moons, taken from the deck of a rolling ship. These were deemed impractical, and improvements were sought to simplify the processes.

Theoretically at least, a solution was known to exist, requiring only an accurate clock on board the ship in addition to the maps and charts available to a ship's captain. At any latitude, a point on the earth travels through 360^o in 24 hours, or 15^o per hour. Prior to a ship's departure, an accurate clock could be set to local time at a point of known longitude. Then, every day during the journey, the time, as given by the clock, could be observed at noon (ship's time). If, for example, the clock, having been set at port, said that it was one o'clock in the afternoon when the sun reached its highest point (noon) above the ship, the captain would know that the ship was one hour, or 15^o, west of the known point. Using the detailed maps of the day, the captain could convert that 15^o to miles. During the 1700's, however, time was kept on pendulum clocks that were not very accurate, even without being subjected to the movement or temperature changes of the ship at sea, so this method was dismissed as impossible.

While astronomers continued to map the skies in pursuit of the £20,000, John Harrison, a self-taught clockmaker, dedicated himself to inventing the time-piece necessary to collect the prize.

In *Longitude,* Dava Sobel chronicles the trials faced by Harrison as he spent most of his adult life creating what we now know as the chronometer. Harrison was eventually awarded the prize money, but in a web of political intrigue, was denied the fame of having solved the problem. In this respect, *Longitude* is the biography of a man dedicated to a cause. However, the large amount of background information that is included to help the reader understand the challenge would cause one to view it as a scientific history

of a famous problem. In either case, *Longitude* is an enjoyable book that educates.

Assigning this book as part of a course is easy. Students will appreciate its brevity (only 175 pages), its thorough explanations and its colorful characters. Instructors can easily connect the material to coursework as many classic scientific and mathematical problems are mentioned. Extension projects could include learning about astronomy and mapping the stars, the development of satellites and how modern navigation systems work, understanding the geometry of the sphere with distances measured in degrees-minutes-seconds, and mastering calculations involving bearing, heading or triangulation.

See NOVA's "Lost at Sea: In Search of Longitude" for a video presentation based on the book.

Also by Dava Sobel: "Galileo's Daughter," a biography of Galileo through the words of his daughter, with whom he maintained a voluminous correspondence.

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