Early Ways of Telling Time

Background Information

One of the oldest and simplest ways of telling time is by looking at the position of the sun. Over time, early people realized that when the sun appeared, the light part of the day started, and when the sun disappeared, the dark part started. When the sun is low on the eastern horizon, people know that the time of day is **sunrise**, when daylight is just beginning. When the sun is low on the western horizon, people know that the time of day is **sunset**, when daylight is just ending. When the sun is at its highest point in the sky, people know that the time of day is **noon**, or midday, when daylight is about half over.

Since early times, humans have wanted more detailed information about the passage of time than sunrise, midday, and sunset provide. Much of the information early humans wanted about time involved meeting common needs, such as when was a good time to go hunting.

About 3000 BCE, early Egyptians told time by the shadow cast by the sun on an unmoving object. They used an **obelisk**, a vertical structure with four sides, as a shadow clock, placing it in the sun so that it could cast a shadow. The shadow showed the position of the sun throughout the day. By 300 BCE, people in Babylonia had started using a **sundial**, a flat circle on which a 12-hour clock face, or dial, had been written. Adapting methods used by the early Egyptians, Babylonians attached a **gnomon**, a vertical marker, to the middle of the dial. The gnomon cast a shadow on the dial as the sun's position changed throughout the daylight hours. Where the shadow fell on the dial showed the time of day.

A sundial

In addition to using the position of the sun to tell time, people learned to use the position of the moon, planets, and stars. However, on overcast days and nights people found it difficult or impossible to tell time and began to invent tools for tracking time. The early Greeks and Egyptians designed a **water clock** (also called a **clepsydra**) that used the flow of water to measure time. In a very early version, water flowed through a small opening in one container into another bowl-shaped container below it. Both containers were usually made of stone or heavy pottery. Horizontal lines were drawn on the bowl-shaped container. The water reaching each line showed that a certain amount of time had passed.

An hourglass timer

Another method of telling time at night was used in ancient China and involved tying knots at regular intervals on a thick rope, then burning the rope. People could tell how much time had passed by looking at how many knots had been burned. Once candles had been invented, people used them not only to provide light but also to tell time at night. First, thick candles were burned to see how long they could last. Then, notches were made in candles of similar thickness, each notch representing a period of time. A person could tell how much time had passed by looking at how many notches had been burned since a notched candle was lit.

As economic activities became more complex, people began to think of ways of telling time that were more accurate, lasted longer, were more easily carried than sundials, sand timers, and water clocks, and could be used at any time of the day or night. The hourglass, which was in use in Europe by the 11th century, could be used at any time and was one of the first timekeepers (also called timepieces), tools designed to tell time that were not dependent on the sun. The hourglass consisted of two upright containers joined with a narrow opening. The first containers were probably made of pottery, and the later ones of glass. One container contained sand or some other material, such as water, that shifted easily. To start the process the hourglass was turned upside down so that the sand or water poured into the bottom container.

The units of time measured varied by how large the hourglass was, the size of the opening for the sand to run through and how long it took the sand to fill the bottom hourglass. A small hourglass could be used for measuring minutes, or a large one for measuring an hour or more. The larger the hourglass, the heavier it became and the more difficult it was to make it measure time accurately. However, by the 11th and 12th centuries, hourglasses were one of the most portable and accurate ways of telling time. For those reasons, hourglasses were often used as timekeepers on ships, which needed accurate measurements of time to determine longitude, imaginary lines or meridians that run from the North Pole to the South Pole on the earth's surface.

ACTIVITY 2

Making a Water Clock to Tell Time Without Sunlight

Purpose

To investigate an early way of telling time in the dark (i.e., without sunlight or a watch).

Material

Glass jar.

Paper cup that fits about halfway into each jar.

Straight pin.

Strip of paper marked with five horizontal lines 1 inch (2.5 cm) apart.

Transparent tape.

Pitcher of water.

Clock.

World History journals and pencils.

Presentation

- Most Montessori teachers present this concept in Year 4.
- Announce that the students will have an opportunity to investigate one way early people told time without using sunlight.

Discussion

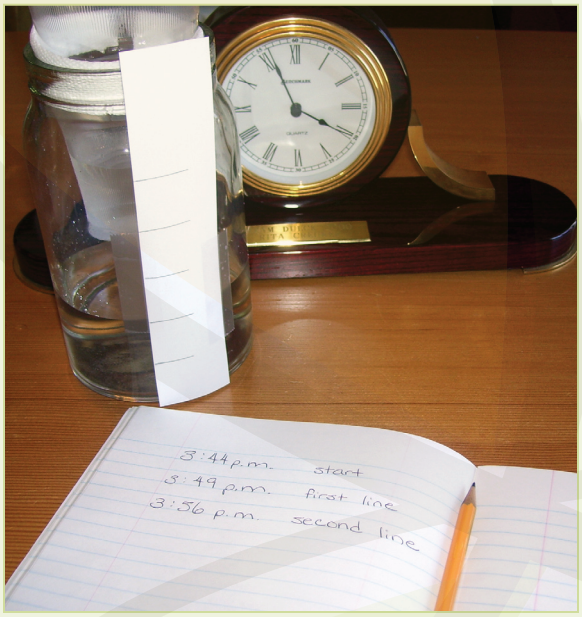
- Discuss the challenges early peoples might have had telling time without sunlight.

- Define and discuss water clocks and hourglasses as examples of how early people could tell time without sunlight, also as ways people could measure short periods of time.

Demonstrating a Water Clock

- Demonstrate the materials for making a water clock.
- Tape the strip of paper vertically to the side of the jar, making sure that the bottom of the strip is at the bottom of the jar.
- Use the pin to make a hole in the center of the paper cup.
- Place the paper cup so that it fits about halfway in the top of the jar.
- Record the time on the classroom clock, then use the pitcher to fill the cup with water.

- When the water reaches the first horizontal line on the strip of paper, record the time on the classroom clock. Repeat as the water rises and reaches the remaining lines on the paper strip. Point out that the time it takes the water to reach the top line is the longest time the students can measure with this water clock. In a similar fashion, an egg timer measures time for just two minutes.



Making Water Clocks

- Ask the students to make their own water clocks and use them to time three different tasks or events (e.g., boiling an egg, eating lunch, walking around the school once).
- Ask the students to use their journals to write about the usefulness and accuracy of their water clocks in timing the three tasks or events.

Extensions

- Make another kind of water clock. Nail two boards into an L-shape. Take six paper cups and use a pin to place a hole in the bottom center of five of the cups. Using tacks, attach the cups in a vertical row on the upright board, placing the cup without the hole on the bottom. Fill the top cup with water. To see how much time the water clock can measure, record on a clock how long it takes the water to move from the top cup to the bottom. Finish by writing a short report about how this water clock could be used.
- Find two examples of water clocks used in early history. Provide a brief description and an illustration (drawing or photograph).
- Find an example of an hourglass timer that is in use today. Write a report explaining how the timer works and ways it can be used (egg timer, timer for board games).
- Make a sand timer that measures an exact length of time, such as 10 minutes or 30 minutes. Report on the challenges involved in making a timer that can measure exact lengths of time.
- Research early clocks that used motion to measure time (e.g., perpetual motion clocks, rolling ball clocks). Describe two examples and explain why they are not practical for everyday use.