

SLEEP II: SLEEP GRAPHING!

OVERVIEW

Brain wave cycling during sleep is simulated with drum beats played over 5 second intervals. Each 5 second interval represents 15 minutes of sleep so 8 hours of sleep can be "played" in 160 seconds. Students record the relative speed of the beats (fast or slow) for each interval, discovering that there are 5 short periods of high frequency brain activity, separated by long periods of low frequency brain activity. Students are also given brain wave frequency in Hertz, collected at 15 minute intervals over an 8 hour period of sleep. The students are asked to graph this quantitative data.

GOAL

Students gain experience in qualitative and quantitative data collection, presentation and interpretation as they examine the cycling of electrical activity in the brain during sleep.

SPECIFIC OUTCOMES

- Observation skills
- Students gain experience with qualitative data collection and interpretation.
- Students gain experience in graphing quantitative data.
- Students understand the cycling of electrical activity in the brain during sleep.
- Students learn that frequency is measured in Hertz, which is cycles per second.

MATERIALS

For instructor:

drum
brain wave poster
poster graph
tape with tone every 5 seconds (optional)

For each student

drum frequency data sheet
sleep lab data sheet
labeled graph paper
conclusions handout

Grade Level: 5

Subject Areas: Science, Math,

Key Concepts: Electrical activity cycles in our brains during sleep. Measurements of this activity are in the form of wave patterns which can be described both quantitatively and qualitatively.

Key Cognitive Skills: Observation
Comprehension

Comparison

Analysis

Set up: obtain materials; copy worksheets

Background Information

During sleep human beings cycle between a sleep stage known as "Slow Wave Sleep" and a stage known as Rapid Eye Movement or REM sleep. Over an 8 hour period of sleep, the average human cycles through these stages 4 to 5 times. Slow Wave Sleep is characterized by low frequency electrical activity in the brain, and lasts an average of 90 minutes, but toward the end of an 8 hour period of sleep, the duration of this stage often decreases. REM sleep is the period of sleep during which we have the long intense dreams we often remember upon awakening. It is characterized by high frequency electrical activity in the brain. REM sleep lasts an average of 15 to 20 minutes, though its duration can increase

Background Information (cont'd)

toward the end of an 8 hour period of sleep.

North Carolina Standard Course of Study

Science

- Goal - The goal for fifth grade is to investigate energy interactions.
- Competency Goal 2 The learner will build an understanding of forms and sources of energy.

(Brain waves are discussed in this lesson as a measure of the electrical activity in the brain.)

- Science as Inquiry - Students must actively participate in science investigations, and use the cognitive and manipulative skills associated with the formation of scientific explanations.

(Students collect and analyze data on frequency of events over time and create graphic representations of that data.)

Math

Major Concepts

- Addition, subtraction, and multiplication of fractions
- Computational Skills to Maintain
- Add and subtract multi-digit numbers
- Divide using single digit divisors

PROCEDURE

Engage: (10 minutes)

- Show poster of brain waves.
- Play patterns to represent waves while awake and waves while alert. Point out the 2 different wave patterns apparent while asleep, point out the similarity between the alert pattern and one of the sleep patterns.
- Ask students to think about what their similarity may signify.
- Review concept of frequency as events over a period of time and explain that brain waves and other frequencies are measured in hertz which is cycles per second.
- Show a cycle as a complete wave from 0 to 0.

Explore: (15 minutes)

- Hand out qualitative data sheet.
- Draw example of sample line on board
- Explain to class that while patterns are being played a bell will ring every 5 seconds and they are to write F in the blank if the pattern is fast and S if it is slow.
- Emphasize that there will be no medium speed beats.
- Play 3 sample intervals and explain when students are to mark their sheets.
- Play sleep patterns on drum with 15 min sleep intervals represented by 5 second intervals.
- Ring bell with foot every 5 seconds as signal for students to mark their data sheets or have recording with a sound every 5 seconds for cue to students.

Explain: (10 minutes)

- Discuss results of data collection.
- Have students write on sheet what they think is happening during the fast waves.
- Confirm the idea that they are dreaming during that period.
- Have the students count how many fast wave periods they have.
- Guide discussion toward idea that during the first fast wave period they are awake.
- Ask, "from this data, how many dreams occurred during that period of sleep?"
- Review concept of qualitative vs. quantitative data guiding discussion to idea that the data we just collected is qualitative.

(Students are asked to determine frequency, involving addition of the events divided by the number of seconds over which the events occur. Some of the graphic representations reinforce addition of fractions of units.)

Project 2061

Benchmarks for Scientific Literacy

- Grade5

Nature of Science

A. Scientific World View

B. Scientific Inquiry

(Students collect and analyze data on frequency of events over time and create graphic representations of that data.)

Nature of Mathematics

A. Patterns and Relationships

C. Mathematical Inquiry

(Students are asked to determine frequency, involving addition of the events divided by the number of seconds over which the events occur. Some of the graphic representations reinforce addition of fractions of units.)

The Human Organism

C. Basic Functions

(Students learn that different states of consciousness correspond to different patterns of electrical activity in the brain.)

Expand: (20 minutes)

- Pass out "sleep lab" data and labeled graph paper.
- Point out that with this data we are looking at the frequency hertz, numbers, ask students whether this data is qualitative or quantitative.
- Have student come to the front and graph the first couple of data points on laminated graph paper poster.
- Students complete graphing data on their sheets individually.
- Discuss results of graphing, pointing out the 5 peaks of high frequency activity that represent dreaming.

Evaluate: (5 minutes)

On a handout students should be able to state how many dreams the average person has per night, the duration of the period between dreams and the corresponding relative electrical activity rates in the brain.