SLEEP III: THE BRAIN, BODY, SLEEP CONNECTION!

Grade Level: 5

Subject Areas: Science, Math, Health,

Key Concepts: We can observe patterns of electrical activity throughout the body during sleep.

Key Cognitive Skills:
- Observation
- Data collection
- Data interpretation
- Hypothesis
- Pattern Recognition

Set up: obtain materials; copy worksheets; arrange desks for sleep lab subject.

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 activity in skeletal muscle i.e. tossing, turning and "kicking the dog off the bed"; no eye movement; a slow heartbeat, and low frequency electrical activity in the brain. Slow Wave Sleep 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

OVERVIEW

Students pretend that we are in a sleep lab. Students play the roles of a sleep subject, monitors and data collectors. An 8 hour period of sleep is simulated over about 30 minutes during which "readings" are taken from the monitors and recorded by the data collectors on the charts provided to them. The student monitors have instruments and provide us with relative electrical activity rates of the subject's brain, heart, eyes and skeletal muscles. The speed at which the instruments are played reflects the activity of the body part monitored. The roles played by the students are changed throughout the activity so that everyone collects data. At the midpoint of the simulated test period, students are asked to look at the data compiled on their charts for patterns of body part activity i.e. when there are high frequency brain waves, the eyes are moving rapidly, the heart is beating quickly and there is no activity in the skeletal muscles. During the last part of data collection students are asked to hypothesize, making predictions for activity rates for data points before the monitors are read.

GOAL

Students gain experience in scientific method with the collection and interpretation of data, which they then use to make predictions or hypothesize about the outcomes of future tests.

SPECIFIC OUTCOMES

- Electrical activity occurs throughout the body
- The average human has 4-5 periods of REM sleep over an 8 hour period of sleep.
- The dreams we remember occur during REM sleep.
- REM sleep is characterized by a pattern of high frequency electrical activity in the brain, rapid eye movement, a fast heartbeat, and skeletal muscle atonia.
- Slow Wave Sleep is characterized by a pattern of moderate activity in skeletal muscle, no eye movement; a slow heartbeat, and low frequency electrical activity in the brain.

intense dreams we often remember upon awakening. The brain, heart and eyes are very active during REM sleep, the skeletal muscles however lose their tone during this sleep stage. REM sleep lasts an average of 15 to 20 minutes, though its duration can increase toward the end of an 8 hour period of sleep. The electrical activities of the brain, heart, eyes and skeletal muscle during sleep can be observed to help us make a brain / body connection.

North Carolina Standard Course of Study for 5th grade

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.

(The activities of the brain and heart, as examined in this lesson, rely on bioelectrical activity and are usually monitored via patterns of electrical activity.)

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

Science and Technology - Students can become interested in technology as they design projects, use tools well, measure things carefully, make reasonable predictions, calculate accurately, and communicate clearly.

(Students collect data in this activity which they use to support predictions they are asked to formulate.)

MATERIALS

For each data collection group:

- Data collection board
- Glass beads

For Actors

- 3 Desks for sleep lab subject to lie across
- Cards for necks of eye, brain, heart and skeletal muscle

Instruments

- A xylophone - eyes monitor
- A drum - brain monitor
- A drum - heart monitor
- Goat toes - muscle monitor

For each student

- Observation Handout
- Conclusion Handout

PROCEDURE

Engage: (20 minutes)

- Pair off all students. Distribute data collection charts and stones to student pairs.
- Instruct students on their role as data collectors.
- The first group of monitors and the sleep subject are called to the front and receive their instruc tions.

Explore: (15 minutes)

Data run and collection.

- The guide or teacher announces the time and takes the pulse initiating the monitor cascade.
- The first couple of intervals all of the vital statistics are announced by the teacher, but later the data collectors have to listen for themselves and mark the appropriate squares with stones.
- Switches between data collectors and actors can be made every 3-4 intervals.

Explain: (5 minutes)

Midway through simulated sleep period class works on observation handout on which they are asked to write out the activity patterns they interpret from the data they've collected.

Math

• Competency Goal 3 The learner will demonstrate an understanding of patterns, relationships, and elementary algebraic representation.
• 3.03 Use patterns, relationships, and functions occurring in computation, geometry, graphs, and other applications to make generalizations and predict results.
• Competency Goal 4 The learner will demonstrate an understanding and use of graphing, probability and data analysis.
• 4.03 Systematically collect, organize, display and interpret data both orally and in writing using information from a variety of content areas.
• 4.08 Compare experimental and theoretical (expected) results for a variety of simple experiments.

(Students collect data in this activity, forming a graph, which they use to support predictions about patterns of electrical activity in the body over time.)

Health

Competency Goal 1 - The learner will direct personal health behaviors in accordance with own health status and susceptibility to major health risks.

(Students gain knowledge of the processes of the brain and body during sleep to help them make better decisions concerning the importance of sleep and the length of time necessary for adequate sleep to avoid the health risks associated sleep deprivation.)

Explain continued

• Slow wave sleep and REM sleep are identified within the collected data.
• Review concept that most dreaming occurs during REM sleep.

Expand (15 minutes)

• Continue sleep simulation and data collection with actor changes every 3 or 4 intervals.
• Teacher requests predictions for activity in different body parts for several intervals.
• Teacher questions class about average length of time between dreams according to data.

Evaluate: (5 minutes)

• Students are given a handout asking them to write down the patterns of activity, in the body parts tested, during Slow Wave Sleep and REM Sleep.
• They should also write down the average duration of Slow Wave Sleep and dreams.

Sleep stages during time intervals
9:30, 10:00, 10:30 - Slow Wave Sleep
11:00 - 1st Dream
11:30, 12:00, 12:30 - Slow Wave Sleep
1:00 - 2nd Dream
1:30, 2:00, 2:30 - Slow Wave Sleep
3:00 - 3rd Dream
3:30, 4:00, 4:30 - Slow Wave Sleep
5:00 - 4th Dream
5:30, 6:00 - Slow Wave Sleep
*Sleep experiment starts at 9:00 but it usually takes @ 20 - 30 minutes for the onset of sleep.

Instructions for data collectors.
The pulse is "taken" for each time interval and then the different monitors play. If the brain monitor is playing fast then place a stone over the high frequency waves square under the brain, if the brain monitor is playing slowly, place a stone in the low frequency box under the brain. The same goes for the eye and heart. If the muscle monitor is playing, place a stone on the square for moderate muscle activity. We only really have high activity in the muscles when we are awake and active. Each time you finish marking your data points raise your hand and keep it up so we can see when we can move on to the next interval.

Project 2061 Benchmarks for Scientific Literacy

Nature of Science
A. Scientific World View
B. Scientific Inquiry

(Students collect data in this activity which they use to support predictions they are asked to formulate.)

Nature of Mathematics
A. Patterns and Relationships
C. Mathematical Inquiry

(Students collect data in this activity, forming a graph, which they use to support predictions about patterns of electrical activity in the body over time.)

The Human Organism
C. Basic Functions

(Students are exposed to a cycle of electrical activity in the brain and throughout the body during sleep.)

Instructions for monitors and sleep subject.
Sleep subject
When your pulse is fast, your eyes are still closed, but they're moving. When your pulse is slow, your eyes are closed and not moving but your arms, legs and body are moving around

Heart
Gets hand drum and placard
A guide'll tell you the pulse. Play a fast beat for a fast pulse and slowly for a slow pulse.

Brain
Get's hand drum and placard
When the heart is beating fast the brain waves are fast so you play a fast beat, when the heart is beating slowly, the brain waves are slow, so you play slowly.

Muscle
Gets nuts on a string and placard
When the brain and heart are playing slow beats, you play fast, when they are playing fast, you don't play.

Eyes
Gets xylophone and placard
Watch the subject's eyes and play when they move, if you aren't sure, play when the brain and heart are playing fast beats.

Music Extension:
Sleep Beats Percussion Ensemble.
The electrical activity of the brain, heart, eyes and skeletal muscles are represented by different instruments in this piece. Each measure in the piece represents 15 minutes of sleep. The whole piece represents an 8 hour period of sleep with an initial measure for falling asleep and an end measure representing awakening.
North Carolina 5th Grade Music Curriculum
Goals met by extension
COMPETENCY GOAL 2: The learner will play on instruments, alone and with others, a varied repertoire of music. (National Standard 2)
2.01 Play with pitch and rhythmic accuracy.
COMPETENCY GOAL 5: The learner will read and notate music. (National Standard 5)
5.01 Read whole, half, quarter, eighth, sixteenth, and dotted note and rest durations in 2/4, 3/4, 4/4, and 6/8 meters.