Brainwave Activity

Grade Level: 5-6

Classroom Time: 45 minutes

Materials:
- Mindflex game
- Electroencephalography handout

Objectives:
1. Students will become familiar with electroencephalography.
2. Students will use brainwaves to control the Mindflex ball.

Teacher’s introduction to the material:
Whenever you concentrate, you generate brainwave activity. Mindflex uses a variation of Electroencephalography (EEG) technology to "read" the intensity of these brainwaves via sensors positioned on the forehead and ear. These sensors don’t generate or interfere with brainwaves, they only “read” what is already there. The headset transmits a signal to a fan within the console. This fan controls ball levitation. Your brainwaves, in turn, control the power of the fan. The more effectively you concentrate, the stronger the fan blows and the higher the ball floats. Relaxing your mind relaxes the fan’s airflow, which lowers the ball.

Instruction:
1. Have students read the EEG information handout.
2. Have students complete the worksheet.
3. Ask students to discuss how EEG testing is used by doctors.
4. Use the Mindflex game to reinforce content knowledge.

Skills: Concentration, Reading comprehension

Vocabulary: Brainwave, Concentrate, Cognitive, Electrode, Electroencephalography, Neural Oscillation, Synchronized

**Electroencephalography**

Brain cells communicate by producing tiny electrical impulses or neural oscillations, commonly called brain waves. Neural oscillations are observed throughout the human central nervous system and can be measured by electroencephalography (EEG). Using an EEG machine attached to the scalp by fine electrodes neural oscillations are measured and displayed by their **frequency**, **amplitude** and **phase**. Frequency is how often they occur; amplitude is the magnitude or amount of change and phase is the shape of the brainwave. The recording machine converts the electrical signals into a series of wavy lines that are drawn onto a moving piece of graph paper. Neural oscillations and their synchronization have been linked to many cognitive (mental) functions such as information transfer, perception, motor control and memory. Neural oscillations that occur at the same time or the same rate are synchronized.

EEG testing is used to detect abnormalities in the electrical activity of the brain. Specifically, EEG tests are used to diagnose the following:
- seizure disorders (such as epilepsy or convulsions),
- structural brain abnormality (such as a brain tumor or brain abscess),
- head injury, encephalitis (inflammation of the brain),
- hemorrhage (abnormal bleeding caused by a ruptured blood vessel),
- cerebral infarct (brain tissue that is dead because of a blockage of the blood supply), and
- sleep disorders (any condition that interferes with sleep).

An EEG is performed by an EEG technician. The technician either measures the scalp and marks the spots where small discs (electrodes) will be placed or fits the head with a special cap containing between 16 and 25 of these discs. The electrodes conduct the electrical current from the patient to the recording machine. They only record activity and do not produce any sensation. The test causes no discomfort. The patient needs to lie still with eyes closed because any movement can affect results. The patient may also be asked to do certain things during the EEG recording, such as breathing deeply and rapidly for several minutes or looking at a bright flickering light.

**Mindflex**

Whenever you concentrate, you generate brainwave activity. Mindflex uses a variation of **Electroencephalography** (EEG) technology to "read" the intensity of these brainwaves via sensors positioned on your forehead and ear. The headset transmits a signal to a fan within the console. This fan controls ball levitation. Your brainwaves, in turn, control the power of the fan. The more effectively you **concentrate**, the stronger the fan blows and the higher the ball floats. To **concentrate** you focus all of your thoughts or mental activity on one subject or activity. Relaxing your mind relaxes the fan’s airflow, which lowers the ball.
Event-Related Brain Potentials (ERPs)

The horizontal axis is one second.
The vertical axis is 50 µv (unit of electric potential).
There are 5 event-related brain potentials recorded: aroused, relaxed, sleepy, asleep, and deep sleep.

Which has the lowest frequency? ________________________________

Which has the most amplitude? ________________________________

Which do you think has the most interesting phase? ________________________________

Study the EEG report and describe which event had the most brain activity.

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