Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Lesson objective	Introduction	Main activity	Reflection	Success criteria
How exercise helps your cognition? LO: To understand the concept of cognition To understand how brain work To understand how exercise can improve cognition	Watch animated video: "What is cognition? Was there anything that surprised you in this video? How would you try to explain what the cognition is? Watch a video "How brain work" Go over power point slides	Go over power point, completing set activities as they follow. Sentences completing game Complete the neuron figure with appropriate terms (myelin sheath, axon, nucleus, neuronal body, dendrites, synapses)	Children to create their own mind map about brain	I can identify the different regions of the brain I can identify their function I can understand how cognitive functions are processed in the brain I can recognize neurons and glial cells and how they differentiate I can understand influence of exercise on cognitive health I can explain why exercise is important for my cognitive health
Memory and exercise LO: To understand the concept of memory formation in the brain To understand how exercise influence your memory	Explain to children in which regions in the brain memory is created Explain to children how exercise can improve memory Go over power point slides Watch a video: "Inside Alzheimer's disease" Explain to children how exercise can reduce risks for Alzheimer's disease	Go over power point Watch a video: "Inside Alzheimer's disease" and answer on the questions that follow Watch a video with exercises to solve (to remember as much things as possible) and follow the instructions After 5-10 minutes extensive training in the class (jumping, running, jogging… You must sweat and your heartbeat must be faster) repeat the exercise	Children to create a poster promoting the benefits of exercise on memory. What strategies can we use to be more in control of our memory?	I can infer what the memory is I can understand influence of exercise on memory and learning I can identify ways to improve memory I can explain why this is important for my wellbeing I can create a workout class

		Compare results before and after physical exercise Does your memory improved? Children to create a workout class in pairs. They should make a week plan for exercising and to find out which exercise is the best for them		

Power point Example

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BRAIN HEALTH QUIZ



1. **Average daily blood pressure:**

a) Normal or low blood pressure (below or around 120/80)
b) Mildly elevated high blood pressure (around 130/85)
c) High blood pressure (around 140/90)
d) Very high blood pressure (above 160/100)

2. **Diabetes**

a) No diabetes
b) Diet-controlled diabetes
c) Mild to moderate diabetes, on medications
d) Severe diabetes, poorly controlled

3. **Diet**

a) Eat fruits and vegetables 5x/day, with a balanced diet of meats, carbohydrates, bread and fish (2-3 servings a week)
b) Eat fruits and vegetables once or twice a day, with a fairly good, balanced diet
c) Occasional fruits and vegetables, no particular attention to diet
d) No fruits and vegetables, fast-food hamburgers more than 2-3 times a week

4. **Brain stimulation**

a) Interested in solving problems, crossword puzzles and Sudoku puzzles, playing card games, fixing things around the house, other brain-teasing activities
b) Occasional brain-stimulating activities

c) Do not enjoy problems or puzzles of any kind
d) Avoid active thinking as much as possible, let other people figure things out

5. Stress and anxiety

a) No stress, feeling happy and in control of life, have a positive attitude
b) Occasional stressful situations, such as dealing with deadlines weekly
c) Frequent stress and anxiety most days of the week, rarely relax
d) Running around all the time, always feeling behind, constantly feel worried, stressed and anxious

6. Cholesterol

a) Normal cholesterol profile (LDL < 100, HDL > 40), controlled with diet and exercise
b) Mildly elevated cholesterol, on medications
c) High cholesterol (total cholesterol > 200), on medications, but not under control yet
d) High cholesterol, not on medications

7. Weight

a) Thin to normal
b) Mildly overweight
c) Overweight (with abdominal size of > 40 inches for men and > 35 for women)
d) Obese

8. Smoking
   a) Never smoked
   b) Quit, with occasional smoking in bars and restaurants
   c) Smoke up to one pack per week
   d) Smoke one pack per day or more

9. Leisure activities

a) Enjoy hobbies (gardening, dancing, movies, day trips, fishing, crochet, etc...), keep busy with them once a week
b) Occasional hobbies, about once or twice per month
c) No regular leisure activities, may travel once or twice a year
d) No hobbies, no leisure activities, watch non-educational programs on TV more than 3-4 hours a day (for example reality shows)

10. Exercise

a) Walk or engage in some form of exercise once or twice a week, for more than 30-45 minutes, at least four days a week
b) Walk or engage in some forms of exercise once or twice a week, for at least 30 minutes each time
c) Do not participate in any regular exercise program, may take a long walk occasionally
d) No exercise ever, sedentary (couch-potato) lifestyle

Exercise is a powerful tool for enhancing mental performance and cognitive health. Whether you want to improve your memory, enhance your problem solving abilities, reduce your risk of Parkinson's or Alzheimer's, or bend metal and shoot lasers with your mind – exercise has an important role to play in all but two of those activities.

The primary functional units of the brain are neurons, which communicate with each other through projections called axons at junctions known as synapses. When a neuron reaches a certain threshold of excitation, it triggers an action potential which travels down its axon to its synapse with another neuron. At each synapse, chemicals called neurotransmitters are released and depending on the transmitter and the receptors on the post-synaptic neuron, these produce either an excitatory or inhibitory response. Your brain is composed of many bilions of neurons and about the same number of their supporting glial cells. There are five types of glial cells: astrocytes, oligodendrocytes, microglia, scwann cells and satellite cells. Exercise has been shown to upregulate two types of glial cells worth particular consideration: astrocytes and oligodendrocytes. Astrocytes help give structure to the brain, provide vascular support and play a critical role in the management and flow of cerebral spinal fluid. These are fundamental activities for the brain and undoubtedly necessary for managing neurogenesis and other cerebral changes. Oligodendrocytes, on the other hand, are a glial cell type critically important in the regulation of neuronal myelin – that is, for the sheath that covers the axons, the neuronal projections. As enhanced myelination has been shown to improve transmission, exercise's ability to enhance the production of oligodendrocytes is significant.

Many of the central functions of memory depend on the region of the brain known as the hippocampus and on processes of plasticity– the brain's ability to dynamically alter neurons and the connections between them. Without a functioning hippocampus, the process of memory encoding ceases to work, typically producing a state of amnesia. At the same time, improving the functioning of the hippocampus seems to be a reliable method of improving memory. Exercise has shown favorable benefits in the regulation of stress (and in particular the management of corticosteroid processes – e.g. cortisol) and may also favorably affect hippocampal memory systems through this process. Indirectly, by managing stress, exercise may also help enhance memory through a brain region known as amygdala. This is a region of the brain heavily involved in emotion. Increased activation in the amygdala has been shown to modulate the memory and enhance the process of memory formation.

More specific to the process of memory formation and the underlying neuronal structure, exercise has been shown to increase levels of hippocampal neurotrophins. Neurotrophins are a class of growth factors centrally important in the development and health of neurons. In particular, increases in a neurotrophin called brain derived neurotrophic factor (BDNF) have been linked to neurogenesis (the creation of new neurons) and improved synaptic plasticity, producing substantial improvements in memory. In turn, exercise has been shown to up-regulate levels of hippocampal BDNF- and much of its favorable impact on memory appears to stem from this process. Similar to BDNF, insulin like growth factor 1 (IGF1) is another compound which has been shown to enhance neurogenesis and plasticity processes and it is similarly upregulated through exercise.

Not only does exercise lead to favorable increases in these compounds, but it can also help regulate hormones which indirectly support them. That is, exercise has been shown to help maintain levels of testosterone and estrogen, which have also been shown to help favorably regulate levels of neurotrophins and neurogenesis. Taken together, the neuronal and synaptic plasticity promoted by these compounds ultimately work to facilitate some of the basic processes of memory and learning.