Does meditation have a positive impact on the brain?

As we get older, the thickness of our cerebral cortex typically decreases due to a natural loss of neurons. Researchers are considering ways to prevent this loss and even reverse the trend.

In 2005, Lazar and her colleagues investigated whether practising meditation over many years can lead to physical changes in the brain.

In this study, a total of 35 participants—20 with extensive meditation experience and 15 with no meditation experience—were tested. The participants were all physically and psychologically healthy and each group (meditation and non-meditation) were evenly represented in terms of sex (65 per cent male), age, race and years of education.

The participants underwent MRI scans and the thickness of parts of their cerebral cortex (cortical thickness) was measured.

As predicted, the results showed that, in the group of meditators, brain regions associated with meditation, including the prefrontal cortex, were thicker. These brain regions are associated with attention, perception, cognition and emotion. The most pronounced differences between the meditators and non-meditators were found in the older participants, suggesting that meditation might offset age-related cortical thinning.

In the second part of the study, the meditators were also asked about the extent of their meditation experience. A positive correlation was found between cortical thickness and meditation experience.

This initial leading study provides evidence for structural changes to the brain being associated with meditation experience and contributes to our understanding of brain plasticity.


Questions

Answer the following questions with reference to this research.

1. What was the aim of this experiment?
2. What was the research hypothesis for this study?
3. List the details of the participants (number and any other important details).
4. The participants were divided into two groups: meditators and non-meditators.
   a. Were the participants randomly divided into two groups? Why/why not?
   b. What participant characteristics were evenly represented in both groups?
   c. Why was it important to have an even representation of certain characteristics in both groups?
5. What is meditation?
6. What is cortical thickness? What tends to happen to cortical thickness as we age?
The ‘flowerpot’ technique

In 1967, Jouvet published a study that highlighted the importance of REM sleep. He created a situation, known as the ‘flowerpot’ technique, in which he deprived cats of REM sleep. The upside-down flowerpot was just large enough to hold a cat and was placed in a pool of water.

The cat was able to sleep on top of the flowerpot during NREM sleep. When the cat entered REM sleep, however, the loss of muscle tone caused it to fall into the water and so wake up. The cat would then return to the flowerpot. Therefore, the cat was able to get some sleep but was unable to experience REM sleep.

Jouvet found that cats deprived of REM sleep eventually died. He concluded that extreme and continuous deprivation of REM sleep has serious behavioural and physical consequences.

Research Investigation

In this research investigation, you will make your own change blindness test: a ‘flicker’ test to see if the use of a blank screen between visual scenes affects the ability to detect a change in the scenes.

This design-your-own experiment requires a digital camera, a tripod (or something similar to keep the camera in the same position) and access to a computer.

1. Working in small groups, create a scene that you can manipulate. For example, you may want to create a scene where people swap places between photos, build a city with blocks and have one building disappearing, or have items on a desk and then change an item to a different colour.

2. Take photographs of both scenes from exactly the same position (best to use a tripod).

3. Load photographs onto a program such as PowerPoint.

4. Create the experimental condition:
   a. Insert a blank screen between the two photographs.
   b. Use advance slide option. Set animation for automatic advance after 0.01 (even 0.005 or less if possible).

5. Create the control condition:
   a. Do not insert a blank screen between the two photographs.
   b. Use advance slide option. Set animation for automatic advance after 0.01 (even 0.005 or less if possible).

6. Plan how you will carry out your experiment.
   a. Decide on the experimental research design (independent groups or repeated measures).
   b. Decide on how to select your participants (convenience sampling, random sampling or stratified sampling).
   c. Think about the ethical considerations. For example, how are you going to get informed consent?
   d. Create standardised instructions. What do you need to tell participants before they start the experiment? How will you ask for their results? What will you say once they have finished the experiment?

7. Carry out your experiment, testing at least five participants.

8. Formally write up this research investigation following the criteria outlined in ‘Report writing for VCE’ on pages 35–6. Questions to consider:
   a. What was the aim of your experiment?
   b. What was the research hypothesis?
   c. What were the operational independent and dependent variables?
   d. What type of experimental research design was used?
   e. How were participants selected? Outline one advantage and one limitation of using this selection method.
   f. Why is the use of standardised instructions important?
   g. What were your results?
   h. To what extent was your research hypothesis supported? Did this support previous ‘flicker technique’ research such as Rensik, O’Regan and Clark (1997)?
   i. Were there any extraneous or potentially confounding variables?

Extend yourself

You may want to design your own experiment using your change blindness photos. For example, you could investigate:
   a. the effect of age on change blindness
   b. ‘mud splashes’ versus blank screens on change blindness
   c. length of time spent viewing the visual scenes
   d. length of time spent viewing the blank screen.

Assessment criteria can be found on page 232.
ANOTATED FOLIO OF PRACTICAL ACTIVITIES

Guided by your teacher, select a range of activities within the mind, brain and body chapters to present for assessment.

The activities do not need to be formally written up but must be presented in the manner as per instructions within the text and/or your teacher. For example, a folio may include:

- one research investigation per chapter
- responses to the test items at the end of one or more chapters
- written responses to the Review items in one or more chapters within this area of study.

MEDIA RESPONSE

Write a response to a media clip that relates to a topic of your choice within the mind, brain and body area of study. The media clip could be sourced from a film, television show, cartoon, newspaper article, book, website, painting, photograph, song, documentary, advertisement, magazine or podcast.

Critique the media clip in terms of its portrayal of a mind, brain and body topic (is it appropriate and correct?).

1. Give a brief description of the media clip.
2. Which topics of Mind, Brain and Body are covered in the media clip?
3. Which theories, issues and studies are related to the media clip?
4. Do you think the media clip portrays the mind, brain and body topic accurately? Explain with reference to the relevant knowledge and understanding.
5. Do you think the media clip might contribute to any misconceptions or negative stereotypes within our society? Explain your answer.
6. How has this media clip contributed/not contributed to your knowledge and understanding of this area of study?

ORAL PRESENTATION

Select one of the following topics and present it as a PowerPoint presentation or podcast, using two or more data types, such as still images, moving images, written text or sound. You may also embed short video clips that are relevant to this topic. The presentation should be 3–5 minutes long.

- Create an advertising campaign targeted to teenagers that promotes the value of sleep and ‘busts’ the myths that surround sleep.
- Create an advertising campaign that highlights the issues of drink-driving or driving when sleepy. In your campaign, relate the material to the characteristics of states of consciousness and, if applicable, the need for sleep.
- Pick one of the following and use studies to explain how it affects cognitive processes and what it reveals about consciousness:
  - Broca’s aphasia
  - Wernicke’s aphasia
  - spatial neglect
  - split-brain studies
  - motion after-effects
  - change blindness
  - synesthesia.

VISUAL PRESENTATION

Create a concept map, graphic organiser or poster on one of the following:

- You are a sleep researcher investigating the effects of sunlight on sleep. You are monitoring a scientist working in a small hut in Antarctica for an entire year.
  - What effects do you expect hours of sunlight will have on the scientist’s behaviour?
  - What are the effects of sleep deprivation?
- In your visual presentation, highlight how you plan to carry out this research. How will you monitor sleeping behaviour? How will you know if the scientist is awake or asleep? When they are asleep, how will you know which stage of sleep they are experiencing?
You are a secondary school teacher and plan to introduce a meditation exercise at the start of each lesson.

What is meditation and what form of meditation will you use?

Explain the benefits of meditation with reference to the characteristics of altered states of consciousness.

Outline some methods used to study consciousness that could be used in this situation.

Imagine you want to conduct psychological research related to sleep on the Big Brother housemates. Choose one housemate and write them a brief letter explaining the nature of your sleep research, the ethical principles that would apply, and their rights as a participant in your research.

Pretend you are a neuroscientist. Create a visual representation of the brain. Highlight the different sections of the brain and the main functions that were mentioned in the mind, brain and body area of study. Discuss the different brain research methods that you could use to study the brain.

**ESSAY**

Write an 800 word essay on one of the following topics. In your essay, refer to the relevant theories and studies to support your statements.

- Is sleep a waste of time?
- With reference to various parts of the brain, what is meant by the term ‘location of function’?
- How can the brain be studied? Include the methods mentioned in the mind, brain and body area of study.

**DEBATE**

Choose one of the following topics for your debate. Draw on the relevant theories and studies to support your argument. Obtain additional information through further reading and research for your presentation.

- Total sleep deprivation is a form of torture that should be banned.
- Secondary school should start later in the morning.
- The purpose of sleep is to survive.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Screen in bedroom</th>
<th>Mean sleep time (hours)</th>
<th>Participant</th>
<th>Screen in bedroom</th>
<th>Mean sleep time (hours)</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes</td>
<td>10.1</td>
<td>K</td>
<td>No</td>
<td>10.0</td>
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<tr>
<td>B</td>
<td>No</td>
<td>10.0</td>
<td>L</td>
<td>Yes</td>
<td>6.4</td>
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<tr>
<td>C</td>
<td>No</td>
<td>12.5</td>
<td>M</td>
<td>No</td>
<td>8.4</td>
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<td>D</td>
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<td>9.2</td>
<td>N</td>
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<td>10.4</td>
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<td>E</td>
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<td>7.6</td>
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<td>Yes</td>
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<td>F</td>
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<td>9.8</td>
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<td>G</td>
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<td>J</td>
<td>Yes</td>
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<td>No</td>
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</table>
DATA ANALYSIS

A sleep study used 20 participants—10 aged 10 years old and 10 aged 17 years old. The researchers made a note of those who had a ‘screen’ (e.g. TV, computer, mobile phone) in their bedroom. The total sleep time over a week was measured and the means were put in the table on page 231.

1 Calculate the mean sleep time for:
   a all the 10-year-old participants
   b all the 17-year-old participants
   c the participants with screens in their rooms for each age group
   d the participants without screens in their rooms for each age group.

2 Compare the data of the 10-year-old participants with the data of the 17-year-old participants. Is there a difference?

3 Compare the data of the participants with screens in their bedrooms to the data of the participants without screen for each age group. Is there a difference?

4 Participant B represents the typical sleep time for someone aged 10 years. How do the other 10-year-old participants total sleep times compare with this figure?

5 How much sleep is recommended for a teenager? How do the 17-year-old participants’ sleep times compare with this amount?

6 Describe the typical sleep pattern for a teenager. How does this compare to a child and an adult?

7 Why do sleep experts recommend not having screens in your bedroom? Is this reason supported by the data in the study?

8 Consider the amount of sleep that participants E and L are getting. In what way do you think this could be affecting their school work and relationships with their friends?

ASSESSMENT RUBRIC

<table>
<thead>
<tr>
<th>Criterion</th>
<th>4 marks</th>
<th>3 marks</th>
<th>2 marks</th>
<th>1 mark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Communication</strong></td>
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<tr>
<td>writing to the needs of the audience</td>
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<td>persuading effectively reading independently</td>
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<td>listening and understanding</td>
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<td><strong>2 Planning and organisation</strong></td>
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<td>collecting, analysing and organising information</td>
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<tr>
<td>planning the use of resources</td>
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<td>time management</td>
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<tr>
<td><strong>3 Presentation of task</strong></td>
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<td>use of technology to organise data</td>
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<tr>
<td>use of technology to present data</td>
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<td>speaking clearly and directly</td>
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<td>visual presentations are clear</td>
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<td>explained written work</td>
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<tr>
<td>follows the conventions of formal writing</td>
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</table>
### 4 Research
A comprehensive range of relevant and appropriate resources have been used effectively to address the requirements of the task, and sources have been correctly cited.

A range of relevant and appropriate resources have been used to address the requirements of the task, and sources have been correctly cited.

Use of some relevant sources to address the requirements of the task, with some attempt to cite sources.

Limited use and citation of sources.

### 5 Understanding
- **of the task**
- **of the concepts to addressed in the task**

Clear and complex understanding of the task, and of the concepts that are relevant to the task.

Clear understanding of the task and the concepts that are relevant to the task.

Some understanding of the task and the concepts that are relevant to the task.

Partial understanding of the task and limited understanding of the concepts that are relevant to the task.

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N.B. For all criteria, 0 marks are awarded for ‘not shown’.

* Teachers must indicate to their students which aspects of each criterion are applicable to the relevant assessment task that has been set for their class.
WHAT MAKES US REMEMBER SOME THINGS AND FORGET OTHERS? HOW DO WE REMEMBER? DO WE EVER REALLY FORGET? FRIEDRICH NIETZSCHE SAID: ‘THE EXISTENCE OF FORGETTING HAS NEVER BEEN PROVED: WE ONLY KNOW THAT SOME THINGS DON’T COME TO MIND WHEN WE WANT THEM.’ PERHAPS HE WAS POINTING OUT A FUNDAMENTAL TRUTH—IT CERTAINLY WOULD BE HARD TO PROVE.

In this unit, we examine the biochemical and psychological mechanisms of memory formation and the ways in which a person’s abilities in the memory processes vary across the lifespan. Different models of memory are compared, contrasted and coordinated and studies of forgetting are examined.

Finally, we consider ways in which memory can be improved and conversely we study some aspects of eyewitness testimony to examine how memories may be reconstructed, manipulated and distorted.

OUTCOME

On completion of this unit, the student should be able to compare theories that explain the neural basis of memory and factors that affect its retention, and evaluate the effectiveness of techniques for improving and manipulating memory (VCE Study Design, 2009).

MEMORY ... IS THE DIARY THAT WE ALL CARRY ABOUT WITH US.

Oscar Wilde