# Differences in neural correlates of attention in undergraduates across classroom activities

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## Introduction

- Attentional skills are important for academic success[1,2] and evidence shows that **students tend to show greater attentional engagement during active learning tasks than passive types of academic activities** [3].
- Typically, student's attentional behaviors are measured by observational ratings through teacher or parent reports. **Observational ratings can be biased and do not always correlate with lab-based measures of the same skills**[4].
- With advancements in electroencephalography (EEG) technology, researchers can examine the neural correlates of student's attention in the classroom, **EEG could potentially offer a more ecologically valid measure of attentional behaviors in the classroom.**
- Using EEG, researchers have found that **lower alpha-range (8-12Hz) oscillations recorded over the visual cortex (alpha power) are associated with higher attentional engagement**[5,6].
- **In this pilot study,** we utilized portable EEG in a mock classroom experiment to examine undergraduate student's attentional engagement as measured by alpha power during different types of academic activities.

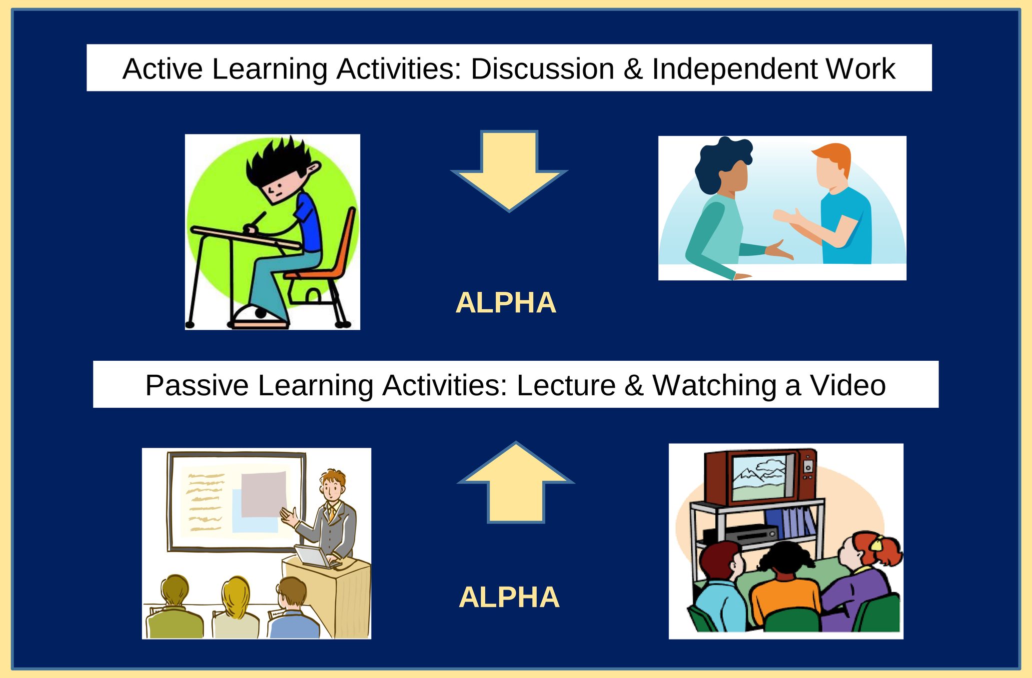
## Hypotheses

**Aim 1:** To examine the feasibility of assessing the neural correlates of attention using portable EEG while students participate in academic activities.

**Hypothesis 1:** We anticipate that it will be feasible to collect EEG data during academic activities.

**Aim 2:** To examine the differences in alpha power as a function of the type of academic task they are engaged in.

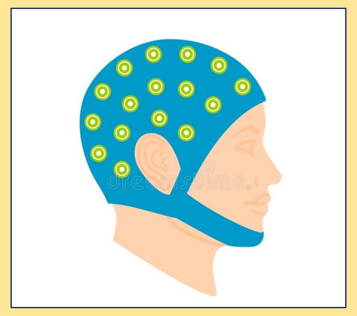
**Hypothesis 2:** We predict that students will show greater attentional engagement measured by lower alpha power during active types of academic activities (partner discussion and independent work) than passive types of academic activities (listening to a lecture and watching a video).

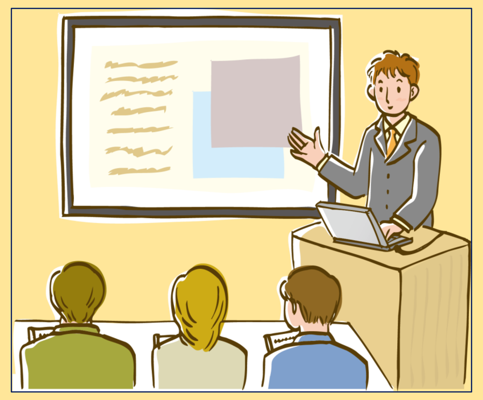


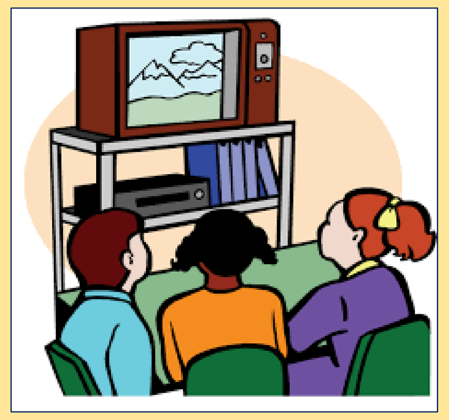

## Method

**Participants:**
- 18 undergraduates
- *M*age= 20.47 years, *N* male= 4
- Participants were recruited from the undergraduate Psychology major subject pool.

As a group, 6-9 undergraduate students participated in different types of academic activities on neuromyths (e.g. You only use 10% of your brain) and educational neuroscience in a mock classroom setting. Instructor-lead activities included: listening to a lecture, watching a video, discussing with a partner, and taking a written test. **Three students were randomly selected to be capped with the portable EEG electrodes throughout the mock classroom procedure.**







## Analysis

Data from thirteen participants are included in the analysis. Statistical analyses were conducted on normalized mean power values in the 7.5–12.5Hz frequency band alpha range oscillation at occipital scalp sites, Pz, POz, O1 and O2.

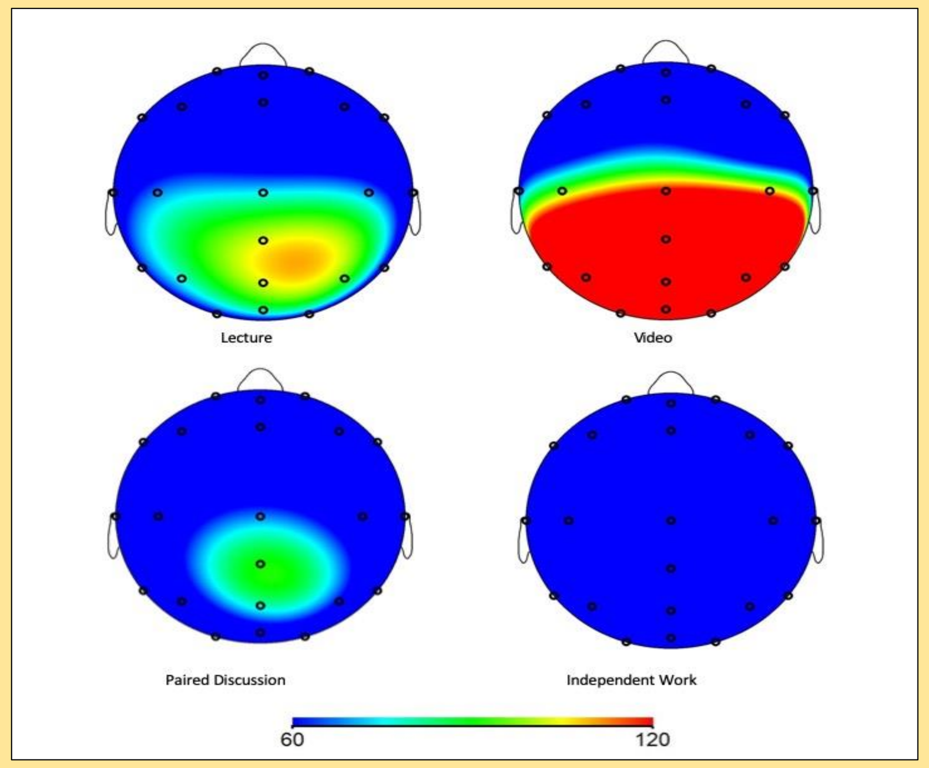



**Figure 1. Occipital Alpha Power Change in Four Activities**

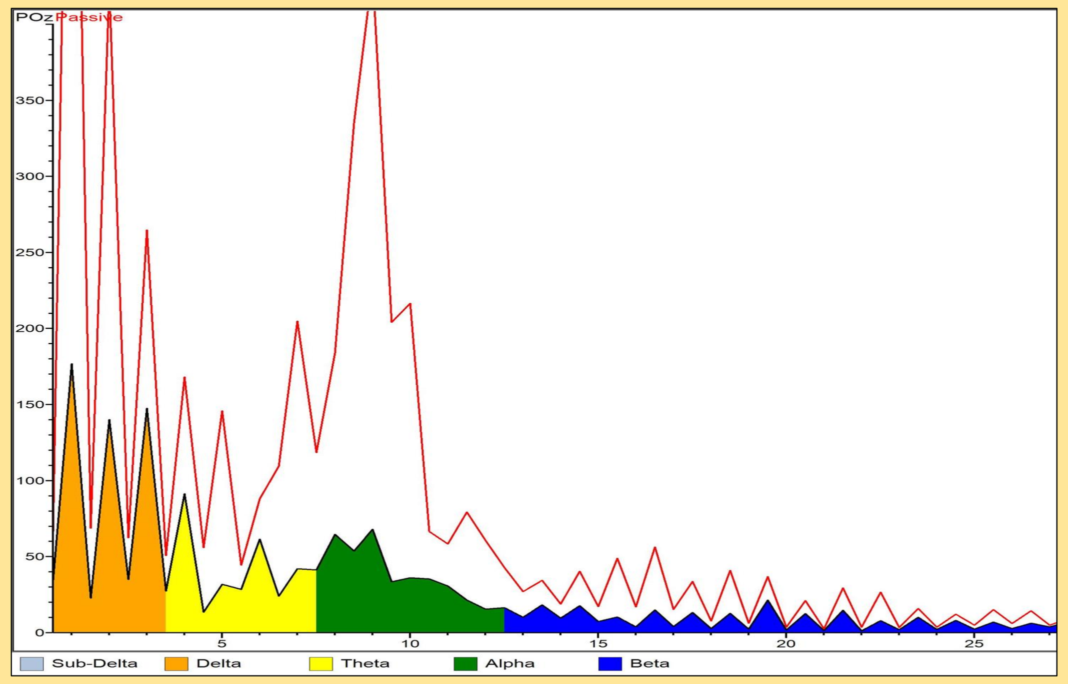
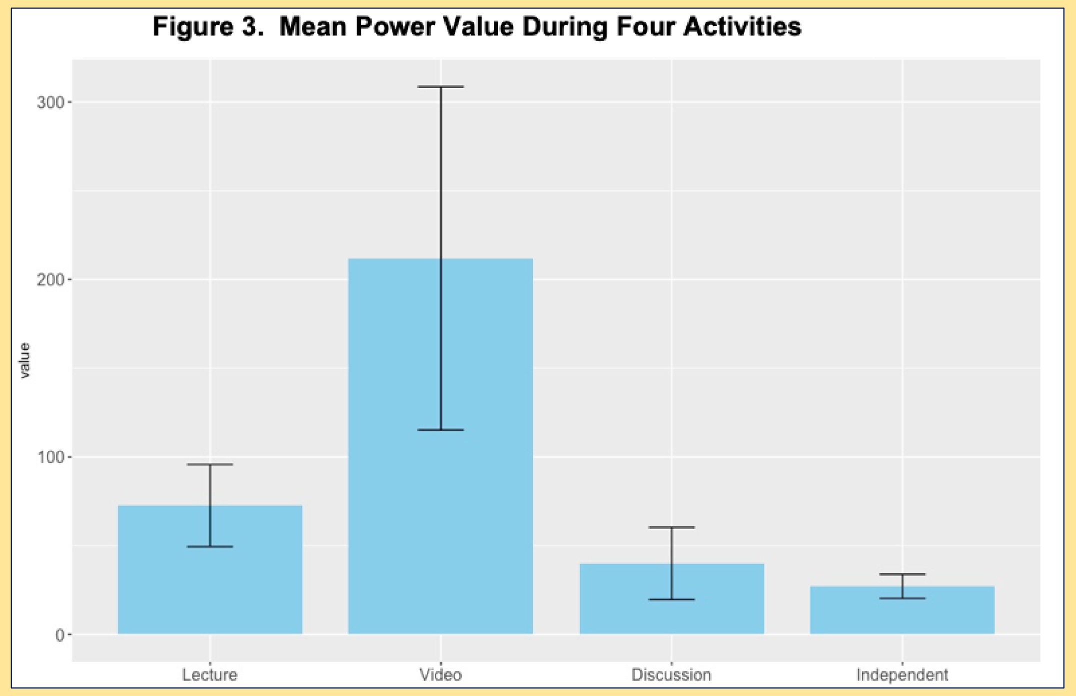



**Figure 2. Spectral Power Values at POz**. Colored blocks represent average alpha power during active learning activities (discussion and independent work); the red line represents average alpha power during passive activities.

**Figure 3. Mean Power Value During Four Activities**




## Results

- Preliminary **analyses showed significantly higher alpha power during lecture and video viewing than during discussion and independent work, t(35)= -2.81, p< 0.01, suggesting that participants demonstrated higher attentional engagement in more active academic activities** (partner discussion and independent work) than during passive instructions.
- In addition, **results from planned contrasts revealed that alpha power during video time was significantly higher than during lecture time, t(35) = -2.68, p = 0.01**, while no difference was found between alpha power in discussion and independent work, t(35) = 0.35, p> 0.5.

## Discussion

- **These results support our hypothesis that students are less attentive during passive academic activities such as listening to lectures and watching videos, and corroborates previous studies of student attentional engagement and active vs passive learning.**
- In addition, **no difference in alpha power was seen between independent work and discussion**, while students are significantly less engaged in the video watching than in the lecture. **This could be partially attributed to the interactive nature of the lecture, which allowed for questions and participation from students.**
- Further studies should expand upon this research to examine if students' attentional engagement in academic activities is linked to their learning outcomes.
- **Interestingly, as shown in Figure. 3 there was greater variability of alpha power during video watching than during other activities, which may portray that students have individual differences and preferences in their attentional engagement.**
- We hope to further examine individual differences in attentional engagement to learn more about the educational practices that promote learning.

## Future Directions

- **EEG may be a particularly useful tool for examining children's attention-related behaviors in the classroom**, as it can be challenging to reliably observe attention through behavior alone.
- **Future research should consider additional contextual factors that may promote or challenge student attentional engagement in classrooms.** For example, a recent EEG study that measured students alpha power during different types of instruction found that students paid greater attention to the lecture when they liked the instructor (based on a student-teacher closeness scale)[6].
- **Individual differences in students attention should also be examined.** This work can be especially valuable when working with populations that have experienced adversity or studentsp with learning disabilities, as current evidence demonstrates that they may need different forms of instructional support in the classroom.

**References**
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