Summer 2015

Using a BCI to Assess Attention During an Online Lecture

Ethan Hanner
Winthrop University, hannerm2@winthrop.edu

Follow this and additional works at: https://digitalcommons.winthrop.edu/mcnair_sre

Recommended Citation

Hanner, Ethan, "Using a BCI to Assess Attention During an Online Lecture" (2015). *Summer Research Experience Poster Presentations.*
6.
https://digitalcommons.winthrop.edu/mcnair_sre/6

Using a BCI to Assess Attention During an Online Lecture

Ethan Hanner and Dr. Marguerite Doman, *Winthrop University*

INTRODUCTION

Previous research has identified a positive correlation between motivation and academic achievement (Bruinsma 2004). The ARCS Model of Instructional Design (Keller 1987) identifies four major conditions for motivation: Attention, Relevance, Confidence, and Satisfaction. Attention may be thought of as the precursor to learning; if a student is not paying attention to the material being presented, learning cannot take place. Getting attention can be trivial, but sustaining attention is difficult.

WUtopia! is an online learning platform developed at Winthrop University designed to improve student learning outcomes. The platform delivers video lectures alongside questions addressing key concepts. The questions are tied to particular timestamps in the video. Previous research demonstrated that students who use the platform perform better on post-lecture quizzes than students who only view the lecture (Grossoehme et al). **We hypothesize that the Wutopia! platform more effectively engages the student's attention, thereby increasing motivation to learn and leading to better performance on the quiz.**

Past research on attention largely relies on participants' self-reported measures of how attentive they perceived themselves to be during a task. A more reliable, objective measure is needed to enable researchers to compare the effectiveness of different approaches to instruction at engaging learners.

METHODS

Participants
Participants for the study were recruited through a mixture of email, flyers, and social media.

Materials
The NeuroSky MindWave, a non-invasive brain computer interface based on EEG technology, was used to collect information on participants' attention levels while viewing the lecture video. The MindWave consists of a single dry electrode placed directly on the user's forehead. Once per second, it reports an Attention value between 0 and 100.
A survey adapted from Rebolledo-Mendez et al. (2009) asked participants to respond with the degree to which they felt select criteria for ADHD from the DSM-V applied to their behavior during the activity.

Procedures
Participants (*n = 13*) were randomly assigned to either the intervention (*n = 7*) or non-intervention (*n = 6*) group. The intervention group watched the lecture alongside questions tied to particular timestamps in the video. The non-intervention group viewed the lecture by itself. After the lecture, both groups completed the attention survey and a quiz on the material presented.
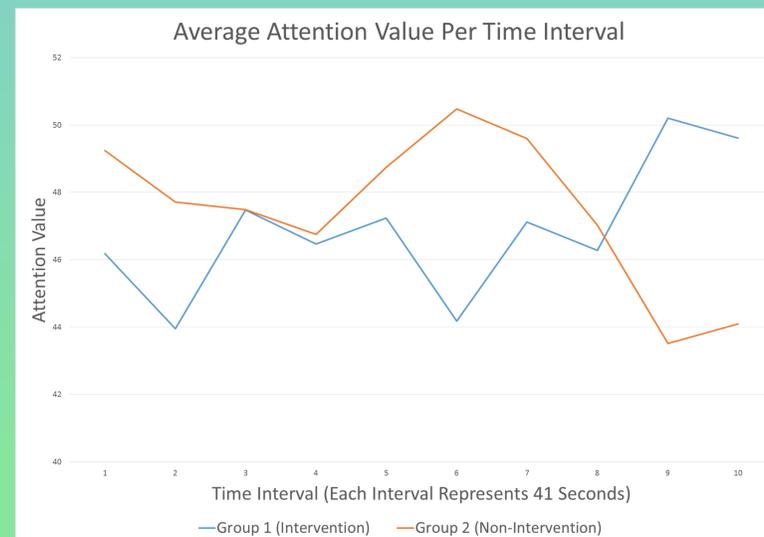

Figure 1. Screenshot of the WUtopia! Interface for the intervention group

Figure 2. The NeuroSky MindWave Mobile device

Figure 3. Graph showing the comparison of average attention levels during each interval for Group 1 versus Group 2

RESULTS

MindWave Mobile Recordings
For each participant, we examined their attention values during the first 6 minutes and 50 seconds that they viewed the lecture video. This time span was broken down into intervals of 41 seconds, and the average attention during that interval was calculated. The chart in Figure 3 shows the average attention value for all the participants in each group for each interval.

The results for intervals 1 through 8 are opposite of what we expected; the average attention levels were higher for Group 2 versus Group 1. Starting at interval 6, the average attention value for Group 1 began to drop until finally in intervals 9 and 10 the values for Group 2 were higher. At all points during the time span examined, average attention values for both groups were in the range of 43 – 51, which indicates an "average" level of attention according to the documentation for the MindWave.

Attention Survey
The survey asked participants to rate the frequency with which they experienced criteria for ADHD during the video on a scale from 1 to 5, with 1 meaning "all the time" and 5 meaning "never". The average of all these ratings for each participant was calculated to give an overall score. Again these results were opposite of what we expected. For group 1, the average score was 3.51 while for group 2 the average score was 4.14.

DISCUSSION

Although the preliminary results indicate that attention levels are higher for participants in the non-intervention group, the average values for each time interval did not vary by more than 7 points on a 100 point scale. The time span examined in this study was relatively short, at less than 7 minutes. More significant differences may emerge if we examine a longer time span, as this would more effectively measure sustained attention. Already the data suggests that for the non-intervention group, attention tended to drop at later intervals, while attention tended to rise for the intervention group. The intervention may be sustaining attention more effectively than viewing the lecture by itself.

One possible explanation for the lower attention values in the intervention group may be that their attention is divided between the video and the questions. However, many participants in the intervention group noted after the quiz that the presence of questions during the lecture helped them to stay on task.

Selected References
Bruinsma, M. Motivation, cognitive processing and achievement in higher education. Learning and Instruction, 14 (2004), 549-568.
Grossoehme, N., Doman, M., and Moore, A. Effectiveness of Coordinating Artifacts in an Online Tutoring System. Unpublished manuscript.
Rebolledo-Mendez, G., Dunwell, I., Martinez-Miron, E. A., Vargas-Cerdan, M. D., de Freitas, S., Liarokapis, F., and Garcia- Gaona, A. R. Assessing NeuroSky's Usability to Detect Attention Levels in an Assessment Exercise. in Human-Computer Interaction. New Trends, (San Diego, USA, 2009), Springer Berlin Heidelberg, 149-158.