The effect of fidgeting on memory retention in college students.

Jillian Alden

University of Washington, Tacoma

Abstract

While fidgeting is commonly seen as an indication of inattentiveness, previous research has shown that it has the potential to positively impact memory retention in specific groups, like those diagnosed with Attention Deficit Hyperactive Disorder (ADHD). This experiment seeks to take this previous research and apply it to one of the largest demographics of adults needing to remember information; college students. It is expected that this experiment will show a positive trend between fidgeting and memory retention in information recall, suggesting the stigma that fidgeting as a sign of inattentiveness is outdated, and classroom etiquette of sitting still should be reevaluated.

The effect of fidgeting on memory retention in college students.

Attention is undeniably a critical factor in the process of storing memories for retrieval and the natural process of selective attention in humans assists greatly with narrowing the focus of attention to a specific topic or event (Pinel & Barnes 2018). However, many individuals share the experience of mind wandering despite their conscious efforts to remain focused on a specific task or topic. The side effects of mind wandering have been studied before and have found that spontaneous body movement (fidgeting) is usually associated with instances of mind wandering (Seli et al. 2014)(Carrier, Seli & Smilek 2013).

When assessing participants on their ability to remain attentive to tasks, participants experience mind wandering on several different levels and the research done by Seli et al. (2014) showed that fidgeting typically occurred only during their deepest defined level of mind wandering. This relates the idea of fidgeting to being the effect of severe mind wandering but does not expand on why this is. However, Farley, Risko & Kingstone (2013) found that fidgeting and attention had no relationship to each other when testing the retention of lecture material, suggesting that the idea that fidgeting as a sign of inattentiveness is incorrect.

Jun, Remington, Koutstaal, and Jiang recently examined the relationship between mindfulness and vigilance decrement (the decreasing ability to focus attention on a specific task), where they found that vigilance decrement presents early during continuous performance tasks regardless of the repetitive or novel nature of the task. Boredom and mind wandering are shown to be unrelated to vigilance decrement which implies that the inability to maintain attention during prolonged tasks is not necessarily the direct result of boredom or mind wandering (Jun, Remington, Koutstall & Jiang 2019).

Several studies have also examined mind wandering and fidgeting as they relate to Attention Deficit/Hyperactive Disorder (ADHD) and specifically target possible solutions for ADHD individuals to remain on task. One such study, conducted by Hudek, Alderson, Kasper & Patros (2014), tested how working memory effected spontaneous body movement in ADHD adults compared with healthy controls. Motor activity increased in both groups during tasks that had a higher demand on working memory, although the increase in activity was significantly higher in the ADHD adults, suggesting that fidgeting as a result of higher cognitive processes is a commonality among healthy adults and ADHD adults.

Moreover, additional studies of physical activity in ADHD children suggest that they have improved cognitive control with more intense activity (Hartanto, Krafft, Iosif & Schweitzer 2016). As Yerkes & Dodson (1908) have shown previously, peak cognitive performance requires an optimal level of arousal and the study by Hartanto, Krafft, Iosif & Schweitzer indicates that in ADHD individuals the increased motor activity compensates for under arousal, thus allowing them to show higher cognitive control by reaching their optimal level of arousal.

While Soares and Storm (2019) found in their research that student use of fidget spinners during a video lecture was more likely to impair memory retention of the lecture material we propose that the use of fidget spinners rather than natural fidgeting outlets, like leg or finger tapping or pencil spinning, encourages students to pay more attention to the spinner rather than using it as engagement enhancement. We argue that fidget spinners and fidget cubes, while marketed to enhance focus and engagement, are more like a game or a toy and that this is likely the cause of the deficit in memory retention in Soares and Storm's research.

Asking the question, does natural fidgeting have an effect on students' ability to learn and retain information during a typical lecture? In this study we will examine this relationship between intentional motor activity and cognitive performance as it relates to working memory,

which we expect to see a positive trend between the amount of fidgeting and the amount of material retained.

Method

Participants

Participants will be randomly selected from a pool of volunteer students from the University of Washington Tacoma campus. Each participant will be offered extra credit that will count towards a single course during the term for participating in this study. Of this group of students, they will be divided into three sub-groups: fidgeting response, forced response, and the control group. Assignment to each sub-group is also random.

Materials

We will administer three miniature quizzes that cover key concepts of the first three quarters of the lecture that are not cumulative. Composition of these quizzes will look like 2 key concept questions, 1 mindfulness question and 1 question to measure engagement with the material. In addition, two cumulative quizzes covering the major concepts presented throughout the lecture will be administered wherein the questions of each cumulative quiz cover the same material but the questions will be reorganized and possibly reworded.

To measure the fidgeting movements of each participant, we will need at least 2 MicroMini-Motionloggers, while students will be presented with the lecture and quizzes alone, it is important to have a backup if the first one fails. The MicroMini-Motionloggers are a tool similar to a wristwatch or activity tracker, in that students will wear one on their non-dominant wrist and the device will be able to track up to 16 small, abrupt movements per second by measuring frequency, intensity and duration. These movements could include typical behaviors like tapping fingers on objects, pencil twirling, wrist rolling, or other similar movements.

We also intend to provide students with pencils and paper to take notes as they normally would throughout lecture, to keep the environment as consistent with a typical learning environment as possible.

Procedure

Students in each group will attend the same video lecture alone in a secluded room to avoid possible distractions or social pressures of being asked to participate in a group of peers. They will be presented with a pencil, paper and equipped with a MicroMini-Motionlogger, which tracks tiny movements up to 16 movements per second, to be worn on their non-dominant hand. All groups of students will be instructed to listen to the lecture and encouraged to take notes as they would in any other class. They will also be told that there will be a quiz on the presented material at the end of the class. The fidgeting response and the forced response, however, will be given additional instruction. The forced response group will be instructed not to move other than to take notes and make posture adjustments for comfort, no knee or foot tapping, no pencil spinning and no other spontaneous movements. The fidgeting control will be highly encouraged to do the opposite, to tap or spin their pencil, tapping their knees or feet in conjunction with note taking during the lecture, but are exempt from this condition during the quizzes. It is important to allow the students to disengage from the research instructions when testing their memory and self-report measures.

Three surveys will be administered throughout the video lecture, after 25%, 50% and 75% of the lecture, to determine the participants' mindfulness, engagement with the material and retention of information. These surveys are not cumulative so therefore, the first quiz will be on the first 25% of the lecture, the second quiz will be over the 26%-50% portion of the lecture, and the third will be over the 51%-75% portion of the lecture.

At the end of the lecture, one cumulative quiz with be administered to determine the overall retention of information presented during the lecture accompanied by another self-report survey to gauge the interest of the material. Students will be asked to return a week later to retake the cumulative quiz (with the questions rearranged) to test the long-term retention of the material.

Expected Results

What we expect to find is a significant difference in memory retention between the groups. The control group is expected to provide a baseline for memory retention, as those students are expected to participate in the lecture as a regular lesson, however we will be recording the differences between the amount of fidgeting that is normally present within this group, and comparing that data in several ways within this group alone, should a high amount of fidgeting be present in 50% or more of the group. By taking the average amount of fidgeting within this group and comparing it to the average amount of recording fidgeting within the other groups we will be able to compare amounts of fidgeting in each group in a multifactorial manner, with the results of memory retention of the lecture.

It is important to analyze the significance of the results not only within each group, as we are measuring multiple factors, but also between groups to calculate the differences there. It is expected that the forced response group will show a significant negative trend throughout the lecture as they will be focused on minimizing movements as much as possible, their attention will be more divided between the lecture and what sensations they experience within their body.

We expect the that the fidgeting response group will show a higher ability of retention of material compared with the forced response group, and the control group.

Discussion

This experiment is interested in testing the memory retention of college students with different expectations of personal movement. There is still stigma among intellectual communities involving fidgeting as a sign of inattentiveness and this experiment seeks to help eliminate some of this stigma by testing if fidgeting is a conduit for memory retention. Several previous studies have shown that higher levels of fidgeting in adults and children diagnosed with ADHD improved that specific population's ability to retain information (Hartanto, Krafft, Iosif & Schweitzer 2016; Hudek, Alderson, Kasper & Patros 2014). This experiment is looking to expand on that information and apply it to the general population.

Should the results of this experiment present as expected it could potentially have implications regarding the normalized etiquette of educational environments, and influence teaching styles. Delivery of information has shown to change throughout the decades, from mainly audio lecture, to including visuals, to engaging with students further and this research could improve the progression of delivering information further. It is important to note that if students of the general population show better retention of information with increased physical activity, the current idea of the ideal lecture environment may need to be reevaluated. Considering that fidgeting has historically been looked upon as a rude behavior displaying inattentiveness, this evidence could potentially show the reverse, that fidgeting is a better sign of attentiveness than is sitting still.

Possible confounds to this experiment could include participant desire to do well. While the fidgeting response group could potentially benefit from encouraged fidgeting, students could become distracted by their instructions to fidget more in their desire to comply with researcher instructions, therefore potentially skewing results. While the wording of the encouraged fidgeting will be formatted to make this more of a weighted suggestion than an instruction to try and combat this potential confound, there still could be perception of this being an instruction.

On the other hand, results could be skewed in the opposite direction if the MicroMini-Motionloggers don't detect a significant difference in fidgeting movements between the control group and the fidgeting response group, implying that instructions to fidget may not be strong enough and therefore we will be unable to determine a causal relationship between fidgeting and memory.

Overall, this experiment seeks to add to the current research in memory retention, attention, and fidgeting movements by further examining the relationship between fidgeting and memory, rather than the relationship between fidgeting and attention. Whereas with most previous research tested fidgeting as a result of inattentiveness and other current research included the manipulation of fidgeting toys, we are directly manipulating the amount of individual fidgeting between groups to test its potential causal relationship with memory and make that applicable to a large population of learners.

References

Carriere, J.S.A., Seli, P., Smilek, D. (2013) Wandering in both mind and body: Individual differences in mind wandering and inattention predict fidgeting. *Canadian Journal of Experimental Psychology vol 67* (1) 19-31. https://doi.org/10.1037/a0031438

Farley, J., Risko, E.F., Kingstone, A. (2013). Everyday attention and lecture retention: the effects of time, fidgeting, and mind wandering. *Frontiers in Psychology*, 4. https://doi.org/10.3389/fpsyg.2013.00619

Hartanto, T.A., Krafft, C.E., Iosif, A.M., Schweitzer, J.B. (2016) A trial by trial analysis reveals more intense physical activity is associated with better cognitive control performance in attention-deficit/hyperactivity disorder. *Child Neuropsychol vol 22,* (5) 618-626. https://doi.org/10.1080/09297049.2015.1044511

Hudec, K.L., Alderson, R.M., Kasper, L.J., Patros, C.H.G. (2014) Working memory contributes to elevated motor activity in adults with ADHD: An examination of the role of central executive and storage/rehearsal processes. *Journal of Attention Disorders vol 18,* (4) 357-368. https://doi.org/10.1177/1087054713497398

Jun, J., Remington, R.W., Koustaal, W., Jiang, Y.V. (2019) Characteristics of sustaining attention in a gradual-onset continuous performance task. *Journal of Experimental Psychology: Human Perception and Performance vol 45* (3) 386-401. https://dx.doi.org/10.1037/xhp0000604

Pinel, J.P.J, & Barnes, S.J. (2018) *Biopsychology* (10th ed.). Hoboken, NJ: Pearson

Seli, P., Carriere, J. S. A., Thomson, D. R., Cheyne, J. A., Ehgoetz Martens, K. A., Smilek, D. (2014) Restless mind, restless body. *American Psychological Association, vol 40* (3) 660-668. https://doi.org/10.1037/a0035260

Soares, J. S., Storm, B. C. (2019) Putting a negative spin on it: Using a fidget spinner can impair memory for a video lecture. *Applied Cognitive Psychology, vol 34* (1) 277-284. https://doi.org/10.1002/acp.3610

Yerkes, R., Dodson, J. (1908) The relation of strength of stimulus to rapidity of habit-forming. *Journal of Comparative Neurology and Psychology vol 18,* (5) 459-482

Appendix

Quiz on 1st 25% of material:

1. What is the main point the speaker is making?
2. What is the main form of communication between people?
3. Does the information presented seem relevant?
4. How likely are you to use this information in your life?

Not at all	Somewhat unlikely	Somewhat likely	Definitely

Quiz on 2nd 25% of material:

1. What is the main point the speaker is making?
2. Give one example of how language shapes and individual perception of the world.
3. Does the information presented seem relevant?
4. How likely are you to use this information in your life?

Not at all	Somewhat unlikely	Somewhat likely	Definitely

Quiz on 3rd 25% of material:

1. What is the main point the speaker is making?
2. What research does the speaker cite in their argument?
3. Does the information presented seem relevant?
4. How likely are you to use this information in your life?

Not at all	Somewhat unlikely	Somewhat likely	Definitely

Cumulative quiz 1:

1. How has human communication evolved over time?
2. Explain the cooking hypothesis.
3. What do the Spanish and German languages have in common?
4. Briefly discuss the relationship between culture and language.
5. What was the speaker's suggestion regarding languages?
6. Give an example on how other languages might describe an accident (like breaking your arm).
7. What explanation does the speaker give for the importance of understanding language(s)?
8. What was your favorite part of the lecture?

Cumulative quiz 2:

1. What do the Spanish and German languages have in common?
2. Briefly discuss the relationship between culture and language.
3. What was your favorite part of the lecture?
4. What explanation does the speaker give for the importance of understanding language(s)?
5. How has human communication evolved over time?
6. Give an example on how other languages might describe an accident (like breaking your arm).

7. Explain the cooking hypothesis.
8. What was the speaker's suggestion regarding languages?

MicroMini-Motionloggers (Ambulatory Monitoring, Inc.)