

Repetitive Action and Cognitive Performance

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ABSTRACT

For many High School students, repetitive actions such as chewing gum is the ideal tool to help them achieve a consistent period of clear focus and wakefulness. However, as a chewing gum enthusiast, I have recently noticed a very unexpected pattern in my concentration performance when chewing gum compared to the task performed. Due to this particular reason, a study was designed in order to determine the type of task being performed and its relationship to the effectiveness of repetitive action (this study will only examine the repetitive action of chewing) on concentration when performing different tasks (Complex task & Simple task). The research study includes a review of literature, survey, and data analysis. The review of already existing literature regarding chewing gum and cognitive performance suggests that the action of chewing can serve as a distraction in specific environments (such as during an exam) and participants of the [Tucha and Simpson study](#) only showed more sustained attention 30 minutes into the study, with the prior time suffering from less sustained attention than usual. The survey data suggests a pattern between sustained attention in relation to the task performed. While chewing gum, the subject's performance worsens while conducting a complex task (tasks requiring critical thinking skills), such as completing exams, solving puzzles, and memorizing specific details, but improves while conducting repetitive or hands-on tasks, such as exercising, copying, and coloring. The pattern may also exist between high accuracy tasks and low accuracy tasks, therefore accuracy may also be a distinguishing factor for chewing gum's cognitive influence.

Review of Literature

In a fast-paced modern society, many often succumb to stress, anxiety, and pressure from work or school, and in order to deal with those stress and depressing thoughts, we utilize stress-relieving stimulants to keep us moving. One such popular stress-reliever, chewing gum, has become one of the most often used products for concentration, staying awake during working hours, and also reducing anxiety levels. However, the effects of the gum aren't entirely true as many believed. Much research has been done to test the actual effect of chewing gum and its influence on things such as concentration, mood, memory, and sustained attention.

In a study done on the effect of chewing gum on cognitive performance, mood, and other performances by Andrew P. Allen and Andrew P. Smith (*Chewing Gum: Cognitive Performance, Mood, Well-Being, and Associated Physiology 2015*), researchers found out that, contrary to my initial hypothesis upon seeing the abstract of the research, people who chew gums seems to only benefit from its effect on concentration, alertness, and reaction time, but no decrease in Anxiety level as well as low performance on specific cognitive tasks such as focused attention, and no improvement on memory, the study concluded that gum seems to only have a positive effect on certain cognitive tasks and negative effects on others as well as no influence on mood whatsoever. In order to test this theory, Tucha and Simpson (*The role of time on task performance in modifying the effects of gum chewing on attention 2011*) took a closer look at the effect of gums (specifically sugar-free spearmint gum) on task performance under a prolonged condition, the experiment was conducted to determine and compare the effect of gums on sustained attention within a 30 minute task period, and as a result of the study, researchers found out that there is a negative effect on the sustain attention of users early into the 30 minute period but attention became more sustained in later stages of the 30 minute period. However, the result of gum's effect on sustained attention is still up to debate whether it is positive, negative,

both, or neither, as pointed out by a summary study done by Yoshiyuki Hirano and Minoru Onozuka (chewing and attention: A Positive Effect on Sustained attention) however, only 64 % of the total 22 articles recorded on the table from this study shows a positive effect of chewing gum on sustained attention and memory and the other 23% shows both positive and negative effect, as well as 9 % showing no difference and 5 % showing an only negative effect, although the majority of the studies proves the gum’s effect to be positive, the number is still only a little over half sitting at a mere 64%, this means that only a little over half of the people using chewing as a tool for sustain attention would see its effect.

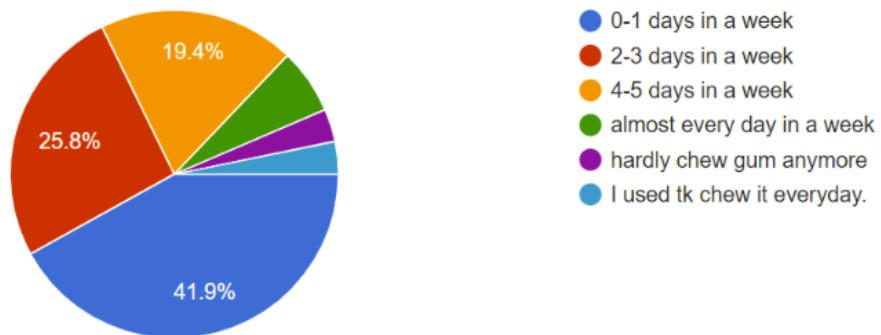
One factor that is not considered in detail during Yoshiyuki Hirano and Minoru Onozuka’s article experiment was the role in which the flavor of the gum would play in the study, out of the 22 articles which were analyzed and recorded, there are 6 which contained spearmint/mint-flavored gum. And of the results of these 6 experiments, 4 positively affected the users of flavored gum. This led to the question of whether or not the flavor of the gum would play a role in the user’s cognitive performance, in a study conducted by Andrew J. Johnson and Christopher Miles(*Chewing gum and context-dependent memory: The independent roles of chewing gum and mint flavor*) on the independent roles of chewing gum and its mint flavor they examined the participant’s long term memory in association with chewing and the minty flavor of the gums by having participants chew on gums and then asking them to memorize 20 words on a list, participants were later asked the recall the words and data were recorded, however, the result of this result only cast further doubts on any relationship if at all there is between simply chewing gum and its minty flavor.

Methods

An anonymous survey is conducted on a sample group of 31 highschool students from Albert G. Lane Technical High School through Google forms. The form is published online and through social media platforms (SnapChat & Instagram). The form consists of 8 questions regarding the frequency of gum use, purpose of gum use, self reporting of the effects of gum, and thought experiment.

How often do you chew gum in a week?

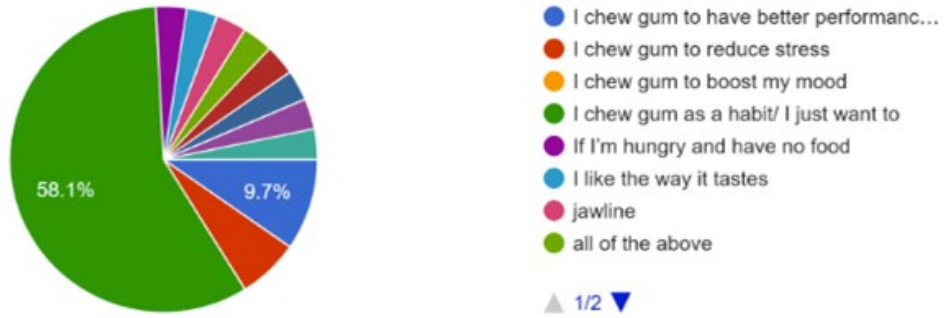
31 responses



1.

Why do you chew gum?

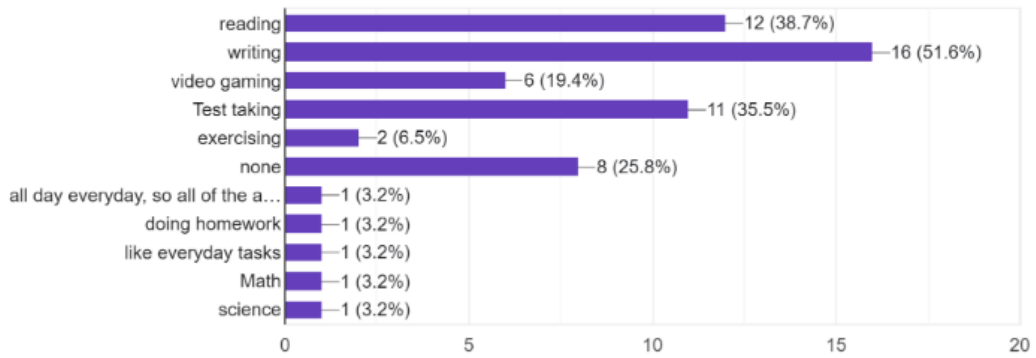
31 responses



2.

If you chew gum for at least once a week, which of the following activities do you engage in while chewing gum?

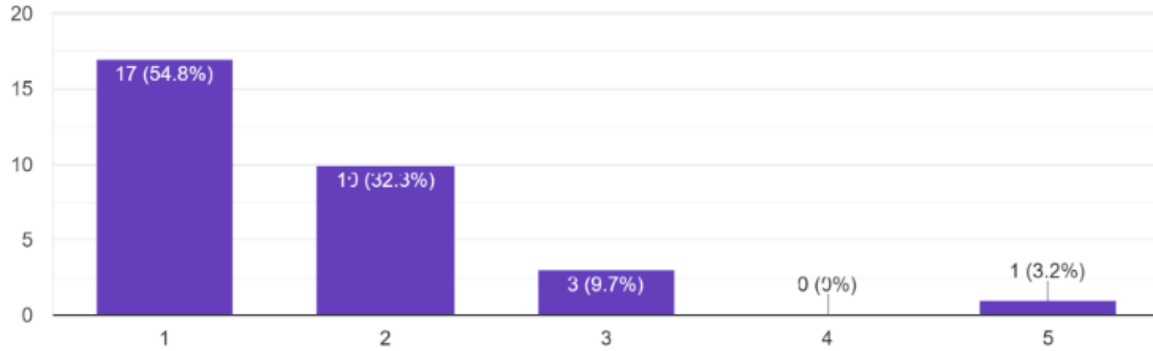
31 responses



3.

Imagine if you are reading a comic or manga, how much will you be distracted by chewing gum at the same time.

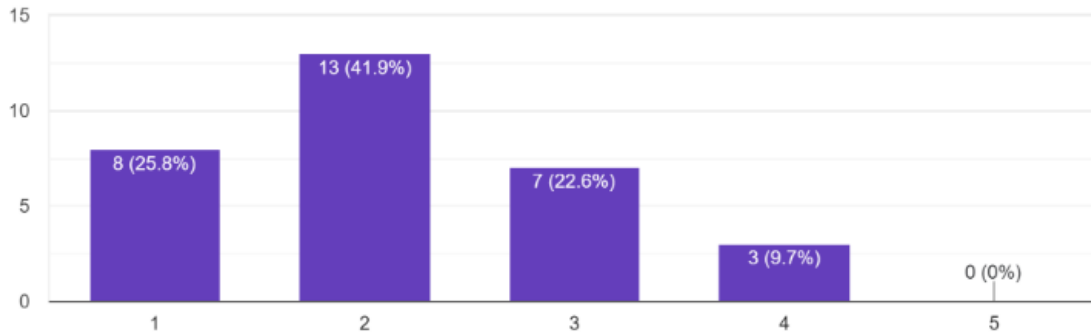
31 responses



4.

Imagine if you are reading a research article for school, how much will you be distracted by chewing gum at the same time.

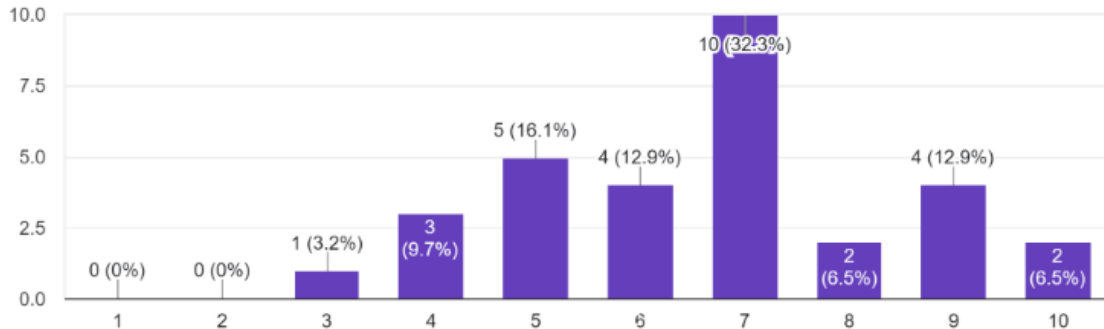
31 responses



5.

Imagine if you are taking a SAT/PSAT type reading question (reading a passage and then answering the multiple choice questions) while ch... represents that the performance stays the same)

31 responses



6.

Figure 4, Figure 5: 1 being the lowest distraction value, and 5 being the highest distraction value.

Figure 4 shows a *mean* distraction value of 1.645 with a distraction value *standard deviation* of 0.8997. Also a *median* of 1, *Q3* at 2, *Q1* at 1, and an *Interquartile Range (IQR)* of 1. The graph has an *outlier* at 5.

Calculation was done by plugging in 31 data values, each representing a response and their corresponding value, into a TI 84 calculator.

Calculation for mean, standard deviation, median, Q3, Q1:

Stat →Edit→L1 for the 31 responses →Stat→CALC→1-VAR Stats→List: L1→Calculate.

Calculation for IQR: $Q3 - Q1$.

Calculation for outlier:

Lower bound: $Q1 - (1.5 \times IQR)$

Upper bound: $Q3 + (1.5 \times IQR)$

Figure 5 shows a *mean* distraction value of 2.161 with a distraction value *standard deviation* of 0.09192. Also a *median* of 2, *Q3* at 3, *Q1* at 1, and *IQR* of 2. The graph has no outliers.

Calculation was done with the same method as Figure 4 using a TI 84 calculator.

Figure 6 Question: Imagine if you are taking a SAT/PSAT type reading question (reading a passage and then answering the multiple-choice questions) while chewing gum, How much better or worse do you think you will perform in comparison to taking the same test without gum. (1 represents significantly worse performance and 10 represents significantly better performance, 5 represents that the performance stays the same).

Figure 6 shows a *mean* performance value of 6.645 with a performance value *standard deviation* of 1.7879. Also, a *median* of 7, *Q3* at 8, *Q1* at 5, and *IQR* of 3. The graph has no outlier.

Calculation for mean, standard deviation, median, Q3, Q1:

Stat →Edit→L1 for the 31 responses →Stat→CALC→1-VAR Stats→List: L1→Calculate.

Calculation for IQR: $Q3 - Q1$.

Calculation for outlier:

Lower bound: $Q1 - (1.5 \times IQR)$

Upper bound: $Q3 + (1.5 \times IQR)$

Results

There is a slight increase in the distraction value when the participants engage in a complex task while chewing gum (represented by Figure 5) when compared with when participants engage in a simple task while chewing gum (represented by Figure 4) according to self-reporting: *mean of figure 5* – *median of figure 4* = $2.161 - 1 = 1.161$

*The median of Figure 4 was used for this calculation due to the skewness of the graph caused by an outlier at 5.

Figure 6 shows a overall performance boost when the participants are completing a complex task while chewing gum according to self-reporting: Mean performance value: 6.645 (5 being that performance stays the same)

Limitations

Due to the Covid pandemic as well as other financial and time limitations, the study could not have been done through experiments, and instead through survey formats. This format imposed a number of limitations on the study, including the interpretation between the cause and effect, where self-reporting surveys failed to limit other factors that could influence the study, such as gum flavor as well as false reporting due to memory. The survey format will also not be sufficient to indicate any cause and effect outside of the possible correlation between the types of task completed by the participant and chewing gum.

Conclusion

Despite the limitations on the study, the research results still suggest a correlation between performance under repetitive action and the types of task performed. Although a more precise experiment will need to be conducted, the results of this study can change the conventional view on chewing gum and its effects on performance. The study also suggests that under the influence of repetitive action such as chewing, there can be negative effects on performance related to critical thinking.

References

- Tucha and Simpson (*The role of time on task performance in modifying the effects of gum chewing on attention* 2011) <https://pubmed.ncbi.nlm.nih.gov/21192998/>
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