

Multitasking...Does it Work?

The Effects of Texting on Recall Ability of A.P. Statistics Students

I. INTRODUCTION

Across the globe, people experience several distractions throughout their daily routine, which could affect their performance towards their responsibilities. The efforts of these distractions and/or priorities challenge the multitasking ability of individuals. The overall principle of conducting an experiment is to test the multitasking efforts of people which will provide insight on how people respond to certain situations.

More specifically, a study performed focusing on the ability of multitasking and effective memory recall of a recorded story while some individuals text on cellular devices and others did not, allows an interpretation to be applied to everyday life. For instance, people who text while driving will fall victim to distraction; their judgment, capabilities, and overall focus will be divided while trying to complete several tasks at once. Not only is texting while driving dangerous and against the law, it hinders a person's ability to think clearly on driving only. Therefore, the experiment proposed can be related to this driving scenario. Moreover, this experiment can be performed to determine if schools are correct in not allowing students to text during class. Is texting during class a distractive agent in schools? This experiment may provide insight in order to establish a differential or concurring conclusion of texting in school. Furthermore, we believe the test subjects who text only, while listening to a recorded story, will be distracted and will perform poorly on the 10 question quiz, which was based on the story. In addition, the ability to answer questions with concise yet detailed answers will determine recall skill and hopefully an association between texting and non texting individuals.

The purpose of doing this experiment is to determine whether texting while listening to a recorded story will affect recall ability. Our overall hypothesis is that a person texting while listening to a story will be able to recall less about the story than someone who was not texting while listening to the story. We hypothesize that females will also recall more of the recorded story than the male students of the texting only population; thus, females will be better at multitasking. We hope to learn how the association between recall and texting affects the test subject (AP Statistics Students).

II. DATA PRODUCTION

We gathered quantitative data among 29 AP Statistics students. Performing two distinct experiments containing the same information given and obtained, we determined to execute an overall texting versus non-texting experiment utilizing a 2-sample t test, followed by a test focusing on gender (male versus female), within the texting only population, thus performing another 2-sample t test. We established and collaboratively designed these specific experiments to answer by either supporting or refuting our hypotheses. By following a direct procedure, we

can properly establish a consistent method limiting outside variation that may affect the test subjects.

Our data collection methods are as follows:

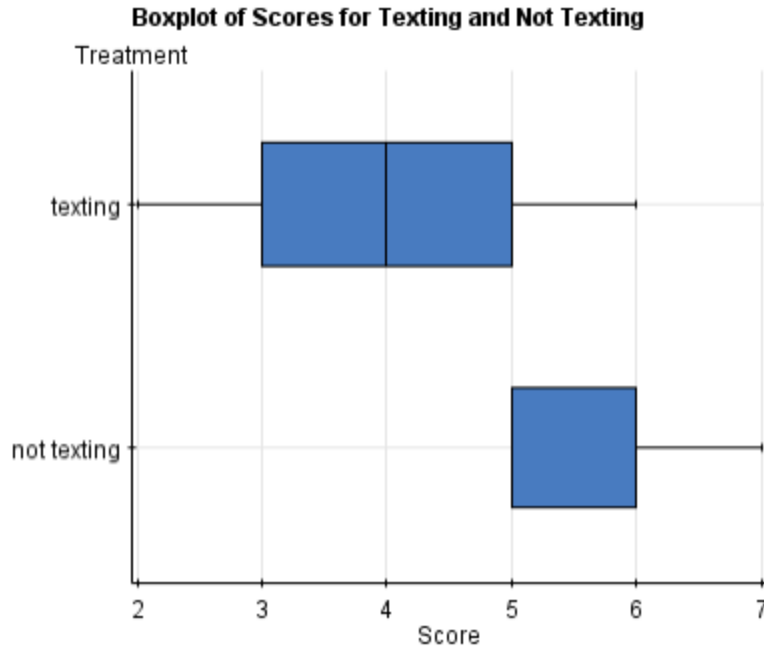
- 1) Obtain a class of AP Statistics Students.
- 2) Assign each student a number
- 3) Randomly allocate assigned number of each student to determine order of testing.
- 4) Record each student's number and order of testing.
- 5) From the list of the randomly allocated order of students, choose the first two students.
- 6) Next, flip a coin to determine who texting (Heads) or not-texting (Tails) individuals will be for the experiment within each pair.
- 7) At the time of testing, if texting individual does not have a cell phone to text, provide one.
- 8) In a quiet hallway, set students up at desks facing opposite of each other.
- 9) Place a tape player in between the seated students.
- 10) Out of the project group members, make sure one person supervises the two students, one supervises the texting of the texting student (to make sure student is not typing the story down while texting), one initiates the texting in a separate room (control), and the other guards the 10-question quiz from the test subjects until the recorded story is finished playing.
- 11) Set up tape player
 - *** Make sure tape has been rewound before hitting the play button.
- 12) Press the play button AFTER the first text has been received by the student who is texting.
- 13) Allow the pair of students to listen to a short, two-minute, creative, recorded story (control).
- 14) Following the completion of playing and listening to the recorded story, stop texting between student and project group member.
 - ***Take phone away from student who was texting.
- 15) Distribute the 10-question quiz to each student.
- 16) Allow the students 5 minutes to answer the questions to the best of their memory based on the recorded story.
- 17) Have each student to write down his/her name, period and whether he/she was texting or not.
- 18) Once time is called, collect questionnaires.
- 19) Call next pair of students to come out to the hallway for testing.
- 20) Repeat steps 5-19 until each student has been tested.
- 21) After steps 1-20 have been completed grade the questionnaires completed by the AP Statistics students.
- 22) Grade the questionnaires on a scale of 1-10 (one point for each question- ten questions total)
 - *** Allow a point to be given based on the answer sheet organized with correct answers.

23) Record scores, gender and whether the individual was texting or not in a concise data table; make boxplots to compare results.

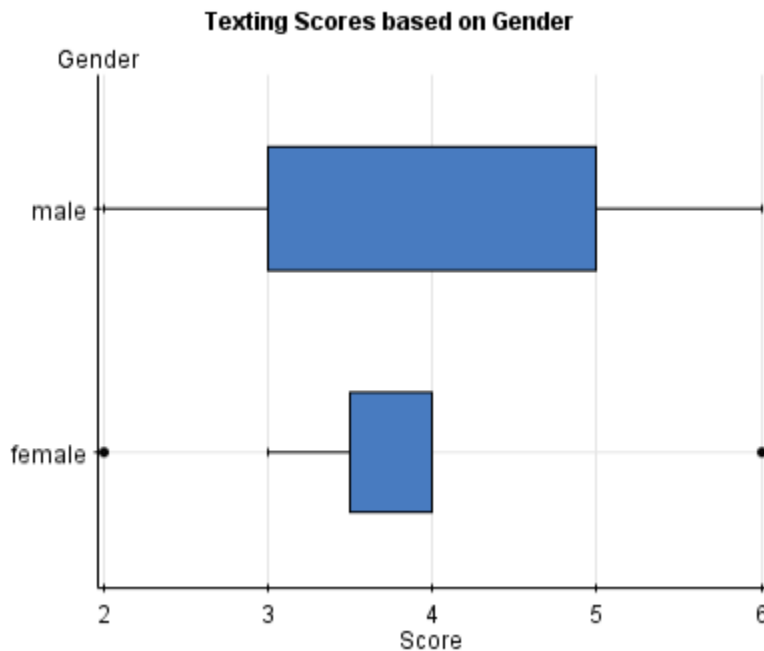
III. EXPLORATORY DATA

The data table below illustrates the association between texting and not texting students, gender of the participants and score of each from the 10-question quiz based on the recorded story.

Texting/not	Gender	Score on Quiz
not texting	male	5
not texting	male	5
not texting	male	5
not texting	female	5
not texting	female	5
not texting	male	6
not texting	male	6
not texting	male	6
not texting	female	6
not texting	female	6
not texting	female	6
not texting	female	6
not texting	male	7
not texting	female	7
texting	male	2
texting	female	2
texting	male	3
texting	male	3
texting	male	3
texting	female	3
texting	female	4
texting	female	4
texting	female	4
texting	female	4
texting	female	4
texting	male	5
texting	male	5
texting	male	6
texting	female	6



The boxplot of the non-texting scores is skewed to the right while the boxplot of the texting scores is roughly symmetric. The median of the non-texting scores is 6, which is greater than the median of the texting scores, which is 4. The range of the non-texting scores is 2, which is smaller than the range of the texting scores, which is 4.



The boxplot of the male student texters is roughly symmetric, while the boxplot of the female student texters is somewhat skewed to the left. The boxplot for the male student texters has no outliers, but the boxplot of the female student texters has two outliers. These outliers can be explained by a person's habits. The girl who scored very low might

not be able to multi-task very well in real life and the girl who scored very high might be able to multitask very well in her real life. The median of the male texters' boxplot is 4, which is about the same as the median of the female texters' boxplot, which is 4. The range of the female texters' boxplot is 4, which is about the same as the range of the male texters' boxplot, which is 4 as well.

IV. INFERENCE PROCEDURES

Texting vs. No Texting

μ_1 = average score received by students who weren't texting

μ_2 = average score received by students who were texting

$H_0: \mu_1 - \mu_2 = 0$

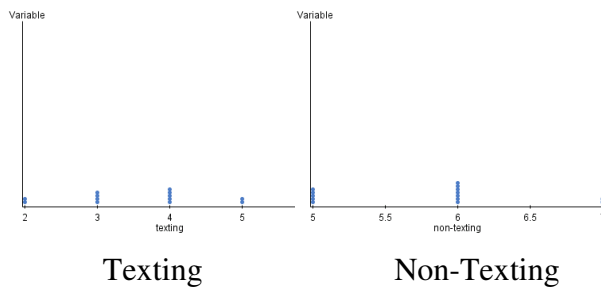
$H_a: \mu_1 - \mu_2 > 0$

R: Random allocation of students to the treatment groups

I: The score received by students in the non-texting group are plausibly independent of the score received by students in the texting group.

T: 14 and 15 < 10% of all students who text

NN:



Since both dotplots are relatively normal shaped, we will assume that the data came from a normal population. We will proceed.

~We will now perform a 2-sample t-test~

$$\bar{X}_1 = 5.786 \quad \bar{X}_2 = 3.867$$

$$S_1 = .6993 \quad S_2 = 1.246$$

$$N_1 = 14 \quad n_2 = 15$$

$$Df = 22.31 \quad \bar{X}_1 - \bar{X}_2 = 1.919$$

$$SE = \sqrt{.6993(.6993)/14 + 1.246(1.246)/15} = .3721$$

$$t_{22,31} = ((X_1 - X_2) - 0)/SE = 1.919 - 0/.3721 = 5.158$$

P-Value = .000017

Because my p-value is so low, I reject the null. I have strong evidence that the average score received by students who weren't testing is higher than the average score received by students who were texting.

Confidence Interval: Texters vs. Non-texters

Conditions met – see above

We will now perform a 2-sample t-interval

$$(X_1 - X_2) \pm t^*_{df}(SE)$$

$$1.919 \pm t^*_{22,31} (.3721) = (1.148, 2.69)$$

We are 95% confident that the true average difference in score between texting students and non-texting students is in the interval (1.148, 2.69).

Female Texters vs. Male Texters

μ_1 = average score received by female student texters

μ_2 = average score received by male student texters

$$H_0: \mu_1 - \mu_2 = 0$$

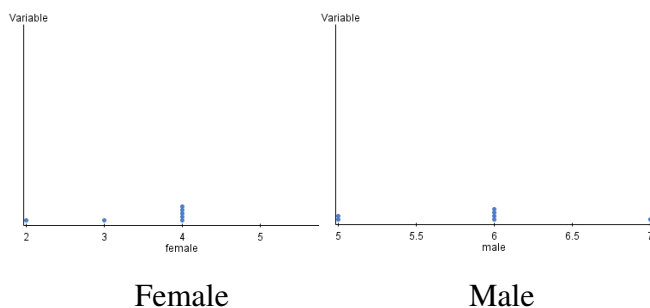
$$H_a: \mu_1 - \mu_2 > 0$$

R: Random allocation of students to this treatment group

I: The score received by female student texters is plausibly independent of the score received by male student texters.

T: 8 and 7 < 10% of all female and male student texters.

NN:



Since both dotplots look relatively normal, we believe that this data came from a normal population. We will proceed.

~We will now perform a 2-sample t-test~

$$\begin{array}{ll} \bar{X}_1 = 3.875 & \bar{X}_2 = 3.85714 \\ S_1 = 1.126 & S_2 = 1.464 \\ N_1 = 8 & n_2 = 7 \\ Df = 11.24 & \bar{X}_1 - \bar{X}_2 = .01786 \end{array}$$

$$SE = \sqrt{(1.126)(1.126)/8 + (1.464)(1.464)/7} = .682$$

$$t_{11.24} = ((X_1 - X_2) - 0)/SE = .01786 - 0/.682 = .0262$$

$$P\text{-value} = .4898$$

Because my p-value is so high, I do not reject the null. I do not have sufficient evidence that the average score received by female student texters is higher than the score received by male student texters.

Confidence interval: Female student texters vs. male student texters

Conditions met – see above

We will now perform a 2-sample t-interval

$$(\bar{X}_1 - \bar{X}_2) \pm t^*_{df} (SE)$$

$$.01786 \pm t^*_{11.24} (.682) = (-1.48, 1.51)$$

We are 95% confident that the true average difference in score between female student texters and male student texters is in the interval (-1.48, 1.51).

V. CONCLUSIONS

The p-value for the results we got for texters vs. non-texters was 0.000017. This means that assuming there is no significant difference between scores of texters and non-texters, the probability of getting results at least as extreme as ours is .0017%. Because this p-value is extremely low, we reject the initial hypothesis that there is no difference between the scores of texters vs. non-texters. Thus we can conclude that there is a significant reduction in the ability to answer questions after having listened to a speech if the test subject is texting. The confidence interval that corresponds to this test supports these results. If there was no difference between the scores, then the difference would be zero and zero would be in the interval acquired. The interval that

we got is (1.148, 2.69). Zero is not in this interval, showing that the results that we acquired are significant and that texting has an impact on a person's ability to focus and retain information.

If we were to compare the score results of males vs. females, the p-value is 0.4898. Assuming there's no significant difference between the scores of males and females, the probability of results at least as extreme as ours is 48.98%. This is a quite high p-value, so we fail to reject the initial hypothesis that the score results are independent of gender. This doesn't prove that the gender is influencing the results. Unlike the results we acquired above, these results weren't significant and this is shown further by the confidence interval. As stated above, if zero is in the interval there is the possibility that there could be no difference between the scores received. The interval that we found is (-1.48, 1.51). Zero is definitely in this interval, so there is a chance that the difference between male and female scores could be zero. This shows that the results that we acquired aren't significant.

In essence, based on our results, we can say that texting lowers the ability to answer questions that were asked about a speech that was heard whilst texting. It would be reasonable to deduce that texting lowers the concentration and ability to perceive a person's surroundings. So teachers are correct in their decision making to prohibit cell phones in class; thus, cell phones are perceived as distracting. Overall, we have come to conclude that texting while performing any activity will lead to distraction and a lack of conversation. This evidence supports our earlier claim that texting while driving is extremely dangerous because the driver is not as focused on the task at hand. If we were to do this experiment again, we feel that a greater sample size may allow us to gather more information and insight to specific associations possibly between gender and texting abilities with regard to recall of a story. Therefore, if we repeated this experiment, we would increase sample of AP Statistics Students. Another interesting aspect would be to branch out into the community to test a general population to determine if age has anything to do with recall ability while texting. This kind of test would be advantageous to determine if our hypothesis will be refuted or supported. Moreover, this addition to our original experiment would be interesting to see if there is an effect on a general population's ability to recall details while multitasking. Overall, we feel if we opened our experiment to a general population we would not only obtain more data, but we would be able to make associations to determine on a broader outlook whether multitasking is achieved, with an additive variable of age. Sources of error may include possible miscalculations during the 2-sample t-test, as well as, among the test subjects, how much the individual texted during the experiment, and how much they text in their daily lives.

We hope that this knowledge can be used in the future as an example of why texting in class and on the road can have a negative effect on a person's, especially a student's, ability to focus on the task at hand.

To the judging committee:

Below is our typed up version of our recorded story and our questionnaire for your knowledge.

Recorded Story: Experimental

“Today, my mother asked me to go to the store and purchase several items for dinner. She was making tacos, which were my favorite. In order to eat tacos, I needed to pick up tomatoes, lettuce, cheese, sour cream, guacamole, hamburger meat, paprika, basil, salt and pepper. I was on my way out the store door, when I was distracted by a mysterious ticking noise by the almonds. I went over to investigate and decided to grab a bag of almonds as a snack. I heard the ticking noise get louder as I picked up the bag. I determined that the noise had come from inside the bag. Afraid for the worst, I threw the bag onto the floor and ran. Then, the entire cast of Harry Potter jumped out of the bag! My jaw hit the floor as they started to have a magical battle across the aisles in Stop & Shop. There were gallons of milk and cartons of eggs flying all over the store. Then, all of sudden, Luke Skywalker appeared to help Harry Potter win the battle. Then, the bad guys summoned purple cows with blue and green spots to help them defeat the all mighty Luke Skywalker. Out of nowhere, Yoda came flying out of the ceiling and hits me in the head. As I fell unconsciously to the floor, I woke up. *pause* That will be the last time I fall asleep watching Harry Potter while eating Chinese food.”

Recorded Story Questionnaire:

1. What was the mother making for dinner?

2. Who bumped into the narrator?

3. Name the store where the battle took place.

4. What were the colors of the farm animal referenced?

5. What type of food was the narrator eating before she fell asleep?

6. What two movies were referenced in the story?

7. What food was the mysterious ticking noise in?

8. What was flying through the store?

9. Name three out of the four spices.

10. What was summoned?
