Significance of the Audience Effect on Social Facilitation

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19/11/19
Word Count: 2,195

Introduction

The aim of our investigation is to examine the extent of social facilitation within a controlled environment and determine whether the presence of a passive audience affected one's performance on a basic skills test. To test this theory, it was essential for us as researchers to be able to accurately replicate the results of the original study, however, to also apply the results to our daily lives. Social cognitive models suggest that personal, behavioral, and environmental factors all influence each other in a triadic, dynamic, and reciprocal manner. Consequently, due to the capability of one's environment to manipulate their personal behavior, social facilitation is a strong presence within our daily lives. Social facilitation, first established and defined by Norman Triplett (1898), is defined as an improvement in performance produced by the presence of others, with the contradictory effect being social inhibition. Triplett (1898) first investigated the effects of social facilitation as a laboratory experiment. He conducted a study with two conditions in which a child was assigned with the task of reeling in a fishing line as quickly as possible: a child alone and children in pairs working next to each other. Results concluded that the children performing in pairs did significantly better than those alone, providing evidence towards the existence of a co-action effect, where "bodily presence of another contestant participating simultaneously in the race serves to liberate latent energy not ordinarily available" (Triplett, 1898). Although this early research tended to focus on the co-action effect of social facilitation, later research found that the effect of social facilitation can also influence passively observed individuals; this is called the audience effect.

The study that will be replicated to examine the consequences of the audience effect was performed by Dashiell (1935), in which he performed an experiment where individuals were assigned with the task of completing a series of simple multiplication problems within a limited time. There were two groups in Dashiell's experiment which each underwent a repeated measures examination: one group who underwent the control condition first and experimental condition second, and another group who had the same tests, however in reverse order. Dashiell's results concluded that the performance of subjects on the multiplication test increased with the presence of an audience, which was measured in terms of the sheer amount of multiplication problems that could be solved correctly (Dashiell, 1935). In turn, it can be concluded that social facilitation was successfully induced as a result of the audience effect. In our replicated experiment, subjects will go through both the experimental and control condition in the form of a repeated measures design similar to the one conducted by Dashiell.

Null Hypothesis: The presence of audience members in a testing room (IV) will have no effect on the percentage of correct questions (DV) answered by subjects on a basic math skills test, compared to the percentage of correct questions without the presence of audience members.

Hypothesis: The presence of audience members in a testing room (IV) will have some effect on the percentage of correct questions (DV) answered by subjects on a basic math skills test, compared to the percentage of correct questions without the presence of audience members.

Exploration

When evaluating the best way to conduct our experiment, it was decided that it would be most effective to utilize two different experimental groups with a repeated measures design; we wanted to see specifically what influence the audience effect would have on an individual subject, in which a repeated measures design would allow for clear comparison between the performance of each subject on a skills test between the control and experimental condition, effectively controlling for knowledge differences between subjects as the subjects are being compared to themselves.

Participants were chosen through convenience sampling due to simplicity and irrelevance of specific trait characteristics; nonetheless, the participants were all volunteers from an International Baccalaureate high school, ranged from ages 14 to 17, and were gathered after a school day. There were 6 participants in each testing group for a total of 12 subjects, 3 of which were males, and all of whom went through both the control and experimental conditions due to the repeated measures design. The experimental condition consisted of participants taking the skills test with audience, in this case researcher, presence while the control condition involved the participants taking a similar test, however with the researchers outside of the testing room for the duration of the test.

Materials used included the 2 tests to be distributed for the control and experimental conditions (see Appendix 4 and 5), a timer, consent forms, and a large room with multiple tables or desks.

Refer to Appendix 3 for the full procedure and standardized scripts, however a shortened procedure to the experiment is as follows:

1. Gather 12 subjects
2. Bring subjects into room and hand out informed consent forms
3. Collect forms and read instructions
4. Read sorting script and split 12 subjects into 2 groups of 6, sorting them into Group 1 and Group 2
    a. Random assortment via slips of paper reading “1” or”2”
5. Group 1 leaves room, read testing instructions to Group 2
6. Enact control condition for Group 2 where audience leaves the room
7. Time for 2 minutes, afterwards returning to the room and collecting the test (Appendix 6)
8. Give participants a break, read second test instructions, hand out experimental condition test where audience stays in the room
9. Collect test and debrief
10. Repeat steps 6-9 with Group 1, however reverse the order of the control and experimental conditions

Due to the presence of many extraneous variables in our design, control was necessary to implement. Firstly, order effect was controlled for by having two separate groups perform the experiment; Group 1 took the test under the experimental condition first, and control group

second, whereas Group 2 had the order reversed. Order effect was necessary to control for as we suspected that having an individual take a similarly formatted test twice in a row may have sharpened their awareness of what to expect on the test, which is an extraneous variable inherent to repeated measures designs. The test format was identical between each condition, however the exact questions changed to prevent memory recall from influencing the results of the study, another extraneous variable. In the control condition where the audience was outside of the testing room, the possibility of cheating, an extraneous variable, was controlled by administering one participant to be spread as far apart as possible in a room, limiting the urge to share answers and negatively influence the results of the study. Finally, the nature of the administered test was a simple math test that controls for knowledge differences, containing questions that could be answered by an individual with basic knowledge of mathematical properties.

All standard ethical guidelines were followed during this procedure, including the distribution of consent forms (see Appendix 1 and 2), clear notice given regarding the right to withdraw from the experiment, assurance of anonymity, and a final debrief at the end of the study. Specific to our study, we noted that no subject would be humiliated or demeaned if they received a poor test score.

Analysis

As our level of measurement, ordinal-level variables were utilized (see Appendix 6). In measuring the central tendency of the percentages within both conditions, it was found that the median score in the experimental condition was a 28%, or .28, while the median score in the control condition was 40%, or .40. Interquartile range (IQR) was used as a measure of dispersion, with the IQR of the experimental condition being .22 and the IQR of the control group being .2. Using the median as a measure of central tendency and IQR as a measure of dispersion, in comparison to using mean or standard deviation, allowed for more resistance to outliers; vulnerability to outliers is a significant limitation to a small sample size (see Appendix 6). Raw data can be found in Appendix 11. Both measures supported the research hypothesis, in that the presence of audience members in a test-taking environment had a seemingly significant negative effect on the percentage of correct questions on a basic skills test.

Figure 1: Box and whisker plot for audience effect on skills test percentage

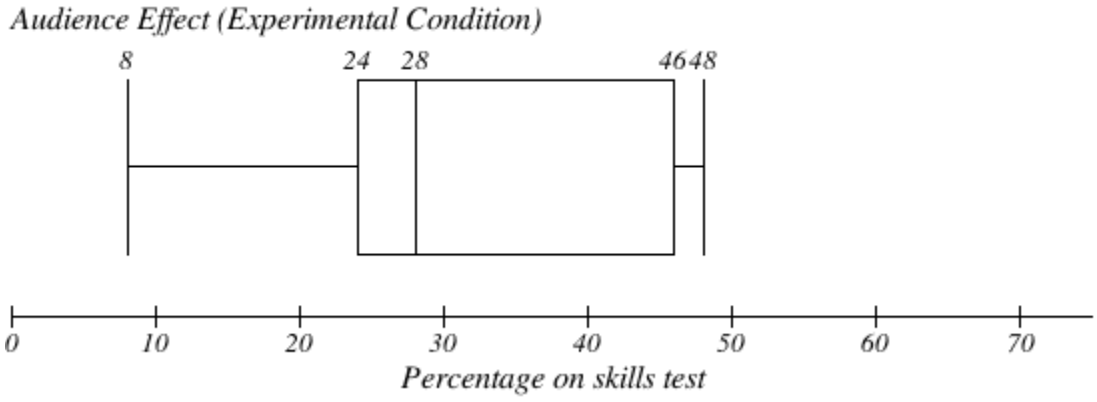
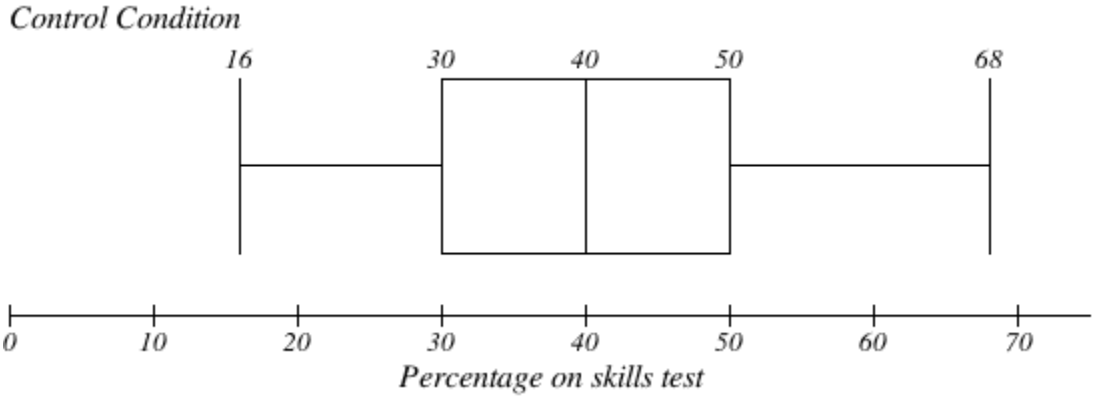


Figure 2: Box and whisker plot for no audience effect (control) on skills test percentage



An inferential statistical test was conducted to further deduce the significance of the gathered ordinal data from the experiment. As the experimental design of this study was a repeated measures design, a Wilcoxon signed-rank test was used as a nonparametric comparison between the two paired experimental and control groups. The Wilcoxon test was also chosen as the sample data did not follow a normal distribution, and therefore a paired t-test would not be possible to conduct. After the statistical calculations were performed, the calculated critical z-score value of 2.064 was found to be greater than the critical value of z at a 5% significance level for a two-tailed test, which is 1.96. Therefore, at a 5% significance level, there is a statistically significant difference between the experimental and control conditions; based on this conclusion, we can reject the null hypothesis. The specific calculations for the Wilcoxon test can be found in Appendix 7.

Evaluation

The findings from our experiment were interestingly not in line with the study we were attempting to replicate, despite being significant. Dashiell (1935) found that audience effect positively reinforced social facilitation while performing a basic multiplication task, however our results were in direct confliction of his, concluding that audience effect reinforced social inhibition during a math skills test. Despite these confounding results, the findings of our study may be explained through examining the Zajonc Theory of social facilitation.

The Zajonc Theory outlines that people “performing a simple task in which they have had plenty of prior practice were able to perform better as opposed to people performing more complex tasks” (Shrestha, 2019). This theory introduces the idea of social inhibition, where audience effect can potentially have a negative effect on subjects’ performance of tasks if the assigned task is too complex. In the case of our experiment, this is quite likely as the nature of our math skills test was not an overtly simple task. Dashiell’s study can be seen as a basic type of test, in which subjects were required to only answer various one-step multiplication problems; as

a result, social facilitation was significantly induced by the audience effect. The task within our experiment, however, is more complex than that of Dashiell's as subjects performed multi-step math problems which required more deep thought than simple multiplication would. Consequently, the Zajonc Theory effectively explains the differing results between Dashiell's study and ours, in which social inhibition was produced as a result of audience effect during a complex task like our own.

Reflecting on our study, multiple strengths and limitations must be noted and evaluated. In terms of design, the repeated measures design of our experiment was a significant strength which allowed us to effectively compare the scores of individuals when there was no audience presence to when there was audience presence. On the contrary, the math test that was assigned to subjects was evidently too complex of a task to effectively demonstrate social facilitation in the form of better performance on the test. To modify and provide support for social facilitation, a major change that could be made is lessening the difficulty of the test to a difficulty like Dashiell's, in which the math problems are one operation multiplication problems. This would be a much simpler task than having 3-4 operation math problems that require more deep thinking, which our test consisted of.

In terms of the sampling procedure, a significant strength was the usage of convenience sampling, in that for our needs, specific trait characteristics were not crucial to the results of our study**.** Despite this, the target population of high school teenagers is not representative of the general population as it is limited by age. To modify for a larger investigation, subjects could be sampled conveniently in a public space where a range of ages could be gathered to ensure that the experiment has enough variance. The experimental procedure had multiple strengths, one of which included the 3:6 audience to subject ratio during the experimental condition which assured sufficient audience effect would be experienced by the subjects. However, limitations are evident during the control condition, in that while the researchers left the room there was still a possibility that subjects could have cheated on the tests, which would have influenced the data significantly.

In conclusion, this replication successfully rejected our null hypothesis, meaning that the presence of an audience, or audience effect, did affect an individual's performance on a basic math test. However, the audience effect had a negative influence on an individual's performance on the test, and therefore our replication provided support for social inhibition, directly contradictory to the study we replicated, Dashiell (1935), due to the administered test being complex in nature. In adopting the modifications above, further research can be done to replicate the original study with stronger loyalty, likely resulting in support for the audience effect influencing social facilitation.

References

Dashiell, J. F. (1935). Experimental studies of the influence of social situations on the behavior of individual human adults. In *A Handbook of Social Psychology* (pp. 1097-1158). Worcester, MA, US: Clark University Press.

Shrestha, P. (2019, June 16). Social Facilitation Theory. Retrieved October 17, 2019, from https://www.psychestudy.com/social/social-facilitation-theory.

Triplett, N. (1898). The dynamogenic factors in pacemaking and competition. *The American journal of psychology*, 9(4), 507-533.

Appendix 1: Parental Consent Form

September 2, 2019

Dear Parents,

I am writing this letter to inform you directly about the nature of the Psych IA Experiment Day that will be taking place on Tuesday, October 1st, 2019. All Psychology students need to be there to participate as subjects (Psych I) or as experimenters & subjects (Psych II) from approximately 2:30-4:00pm. This is an IB Psychology requirement. I am asking for volunteers from NHS and Key Club to act as participants (for service hours) in the experiments as well. Ethical guidelines require that parents give consent for their minor children in order to participate in a Psychology IA. If you agree to let your child(ren) participate in Psych IA Day, please write their name(s) below and sign and date on the line. If you have any questions or would like to review the procedural or ethical guidelines, I would be happy to email them to you. Please rest assured that IB Psychology standards are even more stringent than standard ethical requirements and your student will not be in any physical or emotional distress. Thank you for your cooperation and support for this required, albeit inconvenient, IB activity.

Sincerely,

[Redacted]

Please Print Name(s) of Minor Child(ren) Who Will Participate in the Psychology IA Day below:

Student Name(s): _____

Parent Signature: _____ Date: _____

Appendix 2: Informed Consent Form

Consent form

- I have been informed about the nature of the research.
- I understand that I have the right to withdraw from the research at any time, and that any information/ data about me will remain confidential.
- My anonymity will be protected as my name will not be identifiable.
- The research will be conducted so that I will not be demeaned in any way.
- I will be debriefed at the end of the research and will have the opportunity to find out the results at a later date.

I give my informed consent to participating in this research.

Name: _____

Date: _____

Email: _____

Appendix 3: Standardized Instructions

1. Gather 12 subjects
2. Hand out consent form and collect
3. Read experimental overview script:
    a. Hello everyone, today you'll be participating in a psychology experiment. The task for you in this experiment will be to complete a basic math skills test. The test will be 25 questions long and you will have 2 minutes to complete the test. Afterwards, you will have a short break (1-2 minutes long), and then take a similar test that also has 25 questions to be completed in 2 minutes. We will then collect your 2 tests. After debriefing the first group, we will call in the second group to come follow the exact procedure. Do you guys have any questions?
4. Read sorting script:
    a. First, we need to sort everybody into 2 different groups. We have a bin here with slips that read "1" and "2," if your slip reads 1, please get up and wait patiently in the hallway, if your slip reads 2, stay in the room. Please go sit at an assigned chair so everybody is spread out along the table.
5. Sort the 12 subjects into 2 groups of 6, done by having the subjects draw slips that read 1 and 2 out of a bin
6. Take the 6 subjects with the "2" slip into the testing room, and ask the 6 subjects with the "1" slip to wait patiently and quietly outside of the testing room until called in
7. Inside of the testing room, ask subjects to sit down at designated seats which should be thoroughly spread out within the room
8. Read testing instruction script:
    a. Now we will begin handing out the math skills test. As stated before, there will be 25 questions to be completed within 2 minutes. In order to obtain the best results, please do not cooperate with other peers within the class and do not flip over the test until the timer has started. You may begin once the timer has started, good luck!
9. Hand out Form O (Control Test), and start timer after reading script
10. After reading pre-test script, leave the testing room for 2 minutes while subjects answer questions
11. Once re-entering the room, collect the tests from the subjects and place in a secure location for data collection
12. Read break script:
    a. Time. Please put your pencils down and remain silent. *Collect test* You've just completed the first math skills test. You'll have a 2-minute break to stretch before taking the second test.
13. After short break, read the second testing instruction script:
    a. You will now take a similar test to the first math test that you have taken. It will be 25 questions taken over 2 minutes. Remember to stay quiet. Good luck.

14. Administer Form X (Experimental Test), and start timer after reading script
15. Stay in the room during the 2 minute testing period, periodically walking around the room and looming over a subject while staying silent
16. After the 2 minute testing period, collect the tests from the subjects and place in secure location
17. Read debriefing script:
    a. Everyone, you have just finished completing our psychology experiment. You have just been tested on the effects of social facilitation, based off of a study by Triplett (1898) and Dashiell (1935). We tested you to determine whether the presence of audience members (us) would have any significant effect on your performance on a basic skills test. If you put your email in the consent form, we will send you the results of our study after the statistical research was conducted. Again, you have the right to withdraw if you choose to, which can be done simply by emailing any of us. You are now free to leave the room and the experiment is over, please do not inform any other groups about this information until the IA day is over. Thank you.
18. Notion for the first group to leave, and call in the group with the "1" slip
19. Repeat step 7-8 (Pre-test briefing)
20. Repeat steps 14-16 (Form X/Experimental Condition)
21. Repeat step 12
22. Repeat step 13, then steps 9-11
23. Repeat step 17

Appendix 4: Control Condition Test/Form O

Math Skills Test

Email: _____

Name: _____

Form O

1. $5(6) - 4 + 3$
2. $\frac{8-5(4)}{2}$
3. $2^3 + 4(3)$
4. $\sqrt{81} - 3$
5. $9(8) + 4 - 1$
6. $\left(\frac{7}{2}\right) - 4.5$
7. $10(3) - 8 + 6$
8. $11(5) - 6 + 3$
9. $8(9)/4$
10. $-8 + 4(7)$
11. $4(6) - 6 + 8$
12. $\frac{5+3+2(2)}{3}$
13. $12(5) + 8 - 9$
14. $\frac{13+5}{6^2}$
15. $\frac{18+5-9}{2}$
16. $5(7) - 3 + 9$
17. $4 - 9(5)$
18. $18 - 7(3) + 4$
19. $\frac{9(6)}{3}$
20. $7(6) - 5 + 4$
21. $3(9) + 3 - 4$
22. $13(2) + 8 - 5$
23. $\frac{8}{2} + 7 - 6$
24. $\frac{(100-55)2}{9}$
25. $\left(-\frac{9}{3}\right)(-6) + 5$

Appendix 5: Experimental Condition Test/Form X

Math Skills Test

Email: _____

Name: _____

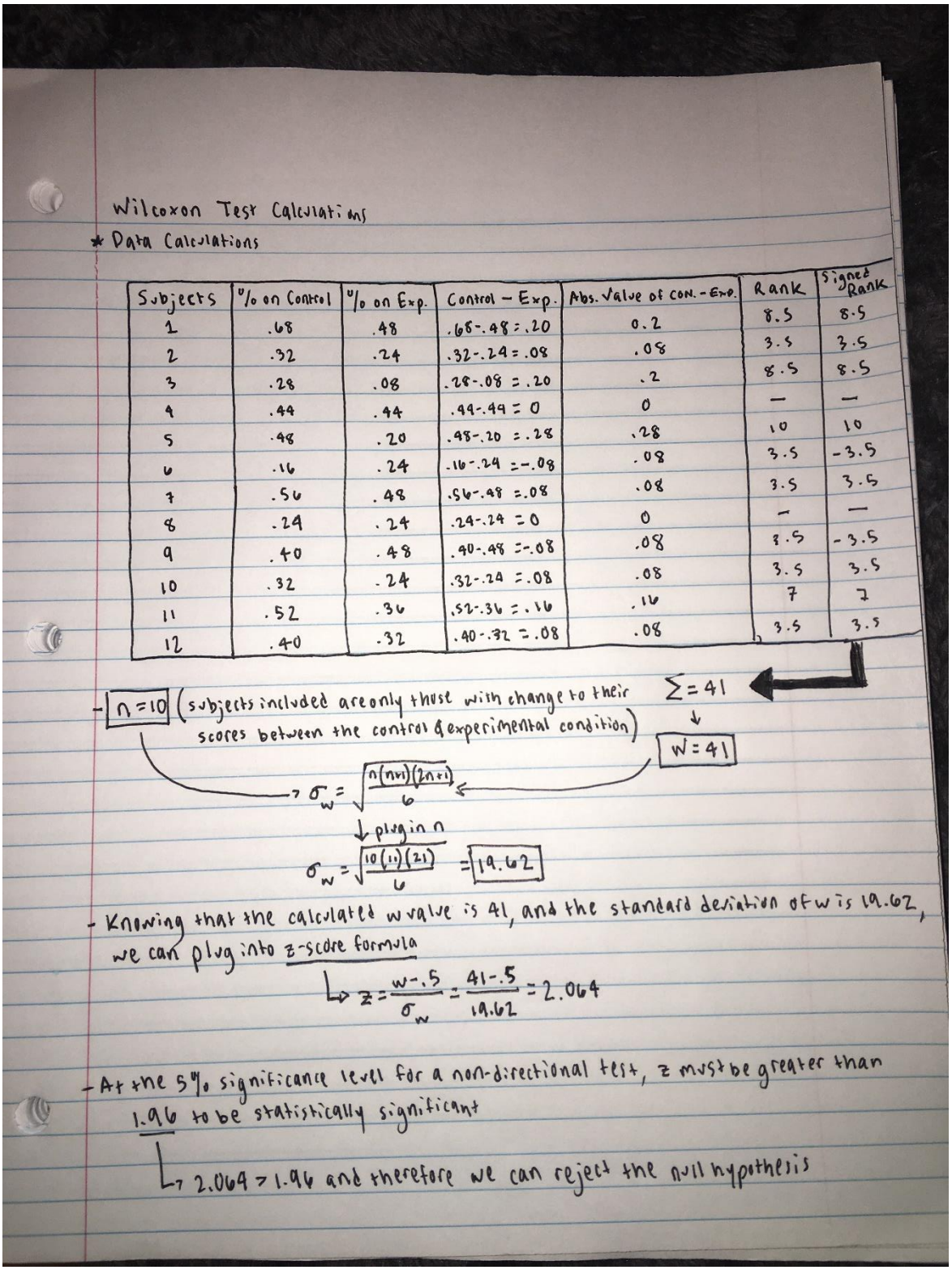
Form X

1. $6(7) - 5 + 4$
2. $\frac{9-6(5)}{3}$
3. $3^3 + 5(4)$
4. $\sqrt{121} - 4$
5. $8(7) + 5 - 2$
6. $\left(\frac{10}{4}\right) - 3.5$
7. $11(3) - 9 + 7$
8. $\frac{9(9)+3}{4}$
9. $-9 + 5(7)$
10. $-7 + 9 + 5(7)$
11. $\frac{6+3+3(3)}{3}$
12. $13(5) + 9 - 4$
13. $\frac{16(2)}{4^3}$
14. $\frac{19+6-8}{2}$
15. $6(6) - 4 + 8$
16. $8 - (7)(4)$
17. $\left(\frac{21}{3}\right)\left(\frac{64}{8}\right) - 10$
18. $20 - (8)(4) + 7$
19. $\frac{10(5)}{2}$
20. $6(5) - 6 + 5$
21. $4(9) + 4 - 3$
22. $14(2) + 4 - 7$
23. $\frac{9}{3} + 9 - 7$
24. $\frac{(90-55)2}{7}$
25. $\left(-\frac{12}{3}\right)(-7) + 4$

Appendix 6: Collected Raw Data

Subject Number	Percentage under control condition	Percentage under exp. condition
1	0.68	0.48
2	0.32	0.24
3	0.28	0.08
4	0.44	0.44
5	0.48	0.2
6	0.16	0.24
7	0.56	0.48
8	0.24	0.24
9	0.4	0.48
10	0.32	0.24
11	0.52	0.36
12	0.4	0.32

Appendix 7: Wilcoxon Test Calculations



Wilcoxon Test Calculations

* Data Calculations

Subjects	% on Control	% on Exp.	Control − Exp.	Abs. Value of Con. − Exp.	Rank	Signed Rank
1	.68	.48	.68-.48=.20	0.2	8.5	8.5
2	.32	.24	.32-.24=.08	.08	3.5	3.5
3	.28	.08	.28-.08=.20	.2	8.5	8.5
4	.44	.44	.44-.44=0	0	—	—
5	.48	.20	.48-.20=.28	.28	10	10
6	.16	.24	.16-.24=-.08	.08	3.5	-3.5
7	.56	.48	.56-.48=.08	.08	3.5	3.5
8	.24	.24	.24-.24=0	0	—	—
9	.40	.48	.40-.48=-.08	.08	8.5	-3.5
10	.32	.24	.32-.24=.08	.08	3.5	3.5
11	.52	.36	.52-.36=.16	.16	7	7
12	.40	.32	.40-.32=.08	.08	3.5	3.5

- $n=10$ (subjects included are only those with change to their scores between the control & experimental condition)

$\Sigma = 41$ → $W = 41$

$$\sigma_w = \sqrt{\frac{n(n+1)(2n+1)}{6}}$$

↓ plug in n

$$\sigma_w = \sqrt{\frac{10(11)(21)}{6}} = 19.62$$

- Knowing that the calculated w value is 41, and the standard deviation of w is 19.62, we can plug into z-score formula

$$z = \frac{w-.5}{\sigma_w} = \frac{41-.5}{19.62} = 2.064$$

- At the 5% significance level for a non-directional test, z must be greater than 1.96 to be statistically significant

→ 2.064 > 1.96 and therefore we can reject the null hypothesis