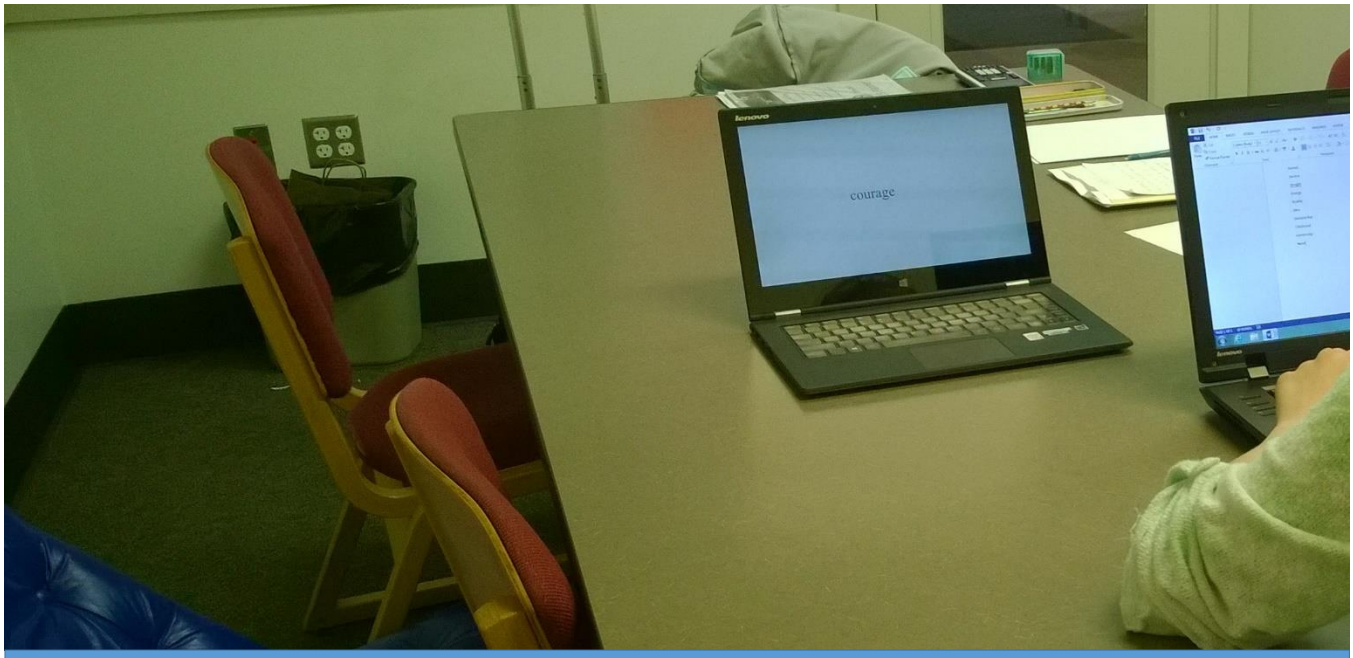
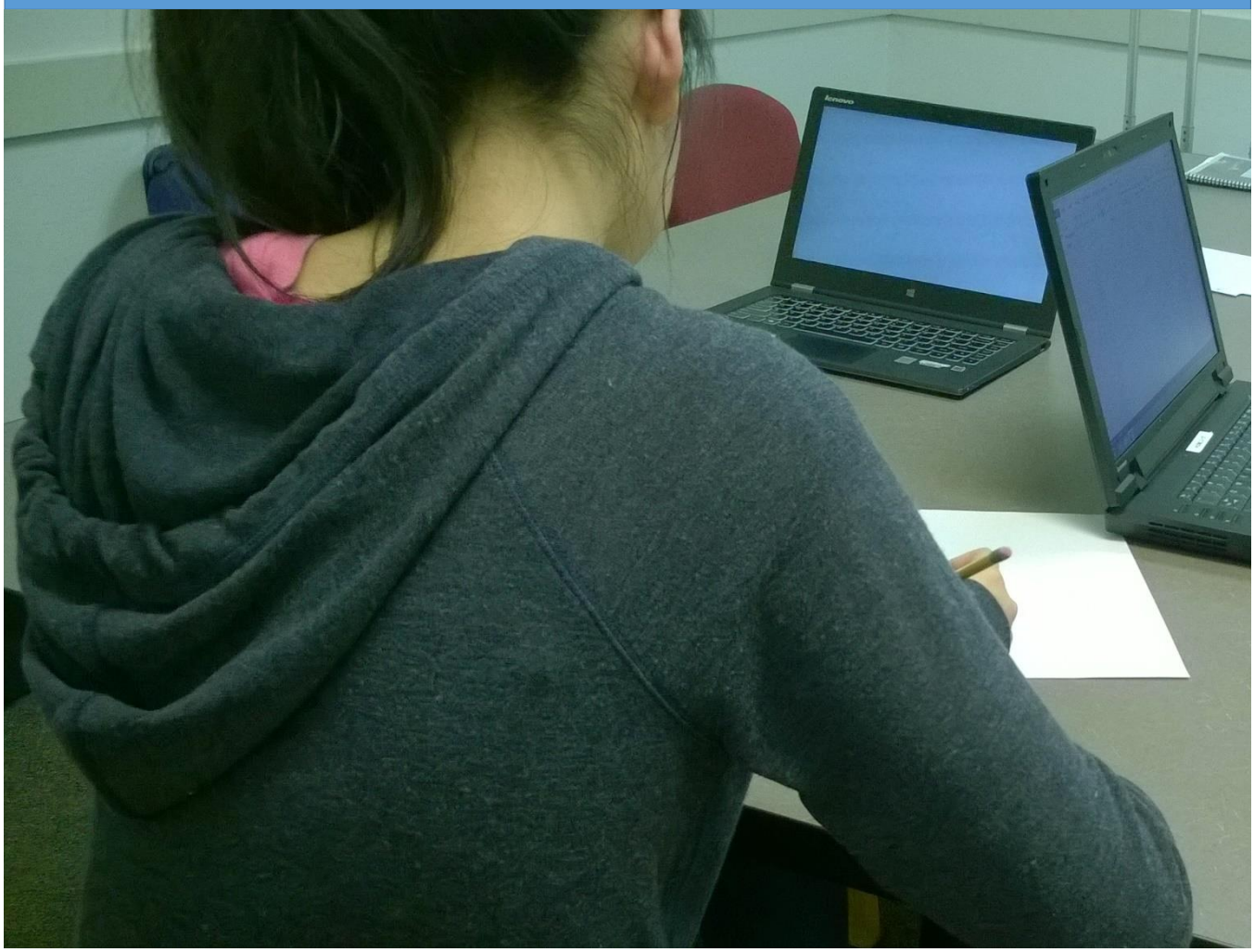


Effects of Note-taking Method on Short-term Memorization

By: Michelle Lin and Nelson Ngouenet



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Introduction:

Computers are slowly overtaking handwritten notes in the classroom. With such devices becoming cheaper and cheaper, schools are beginning to switch over to a Bring Your Own Device (BYOD) system. Many are also exploring the pros and cons of using a device to take notes versus using hand-written notes. One example of a school who will be switching to BYOD is Overlake High School, our population of interest. There have been many studies done on the effect of computers in traditional classroom settings. One of such studies is Lin Lin and Chris Bigenho's study "Note-Taking and Memory in Different Media Environments" which explores the effect of different note-taking strategies on memorization with distractions. Their results suggested that taking notes by hand was favorable in some classroom settings while taking notes on the computer was favorable in others. We would like to expand on this by looking specifically at the difference in memorization ability, if any, based on note-taking strategy. Our question of interest is: Is there a difference between student's ability to memorize from handwritten notes versus typed notes?

Data Collection:

Our study is based on data gathered from an experiment. A random number generator was used to determine note-taking method; 0 for handwritten, and 1 for typed. Students who typed were given a library computer with the internet connection cut and a word document open, while students who took notes by hand were given a sheet of lined paper. Each volunteer was randomly assigned a treatment and then taken into a study room alone, where we read them a set of pre-written instructions (see Appendix IV). They were then presented 20 words on a PowerPoint (see Appendix I) and given 5 second intervals in-between each word to copy them down either on a sheet of lined paper or on a blank Word document. Afterwards, a blank slide was shown, the device/sheet was taken away and they were given a sheet of blank paper and asked to write down the words they remembered in 3 minutes. Our

data came from the number of words they answered correctly (see Appendix II). The words were chosen from a site with a list of 176 abstract words. We numbered them and then used a random number generator (TI-Nspire cx number generator) to pick out 20 of those words. Different forms of the same word still counted towards the subject's word count, and words that were not in the set did not count against them.

Hypothesis:

$$\mu_1 = true\ mean\ number\ of\ words\ memorized\ by\ handwriting\ by\ students\ like\ these$$

$$\mu_2 = true\ mean\ number\ of\ words\ memorized\ by\ typing\ by\ students\ like\ these$$

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

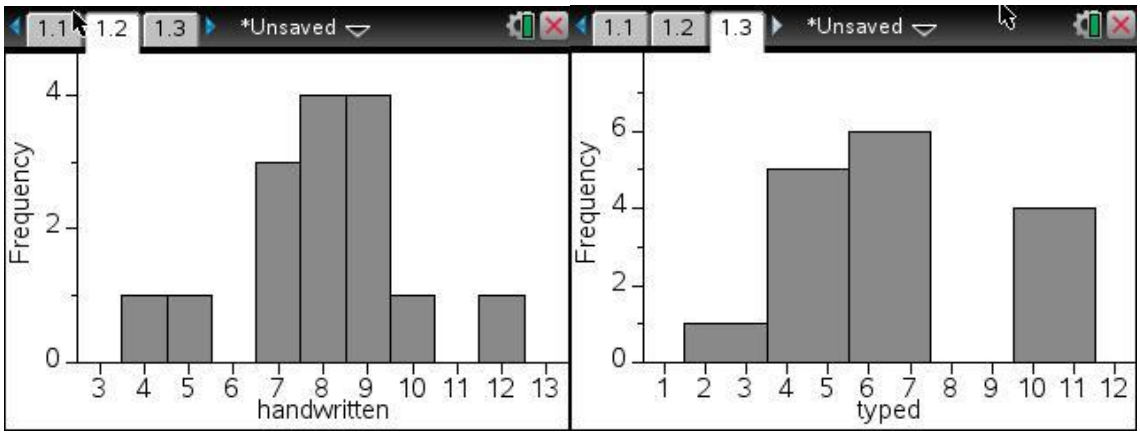
$$H_a: \mu_1 - \mu_2 \neq 0$$

Conditions for a 2 sample t-test for $\boldsymbol{\mu_1 - \mu_2}$ at $\boldsymbol{\alpha = .05}$:

Random: Since this procedure consisted of an experiment, random sampling was not used. This process was replaced by the process of random assignment through the application of the TI-Nspire random number generator. If 1 was generated the volunteer went through the typing memorization and if 0 was chosen they went through the handwritten memorization testing.

Independent: Each subject was tested separately in an enclosed environment. The two sample groups were independent. We had two samples, the first with a size of 15 and the second with a size of 16 and we know that there are more than $15 \times 10 = 150$ students and $16 \times 10 = 160$ students at Overlake (527 students), we are not in violation of the 10% condition in either of the samples.

Normal: Since the sample sizes were smaller than 30, the Central Limit Theorem does not ensure normality. T-tests are robust if the sample sizes are 15 or larger and show no outliers or skewing. Since both of our samples had sizes of 15 and 16, we then used histograms to check for normality. The histograms are below:



Since both histograms look approximately normal and outliers do not seem to be present, it can be assumed that both distributions are approximately normal. This directly translates to the target distribution $\mu_1 - \mu_2$ as both μ_1 and μ_2 are approx. normal, so the difference will also be approx. normal.

Calculations:

Summary Statistics found in Appendix III

$$df = 14$$

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{(8 - 6.5625) - 0}{\sqrt{\frac{(1.9272482233189)^2}{15} + \frac{(2.7560539423845)^2}{16}}}$$

$$t = 1.69134$$

$$p - value = 0.113$$

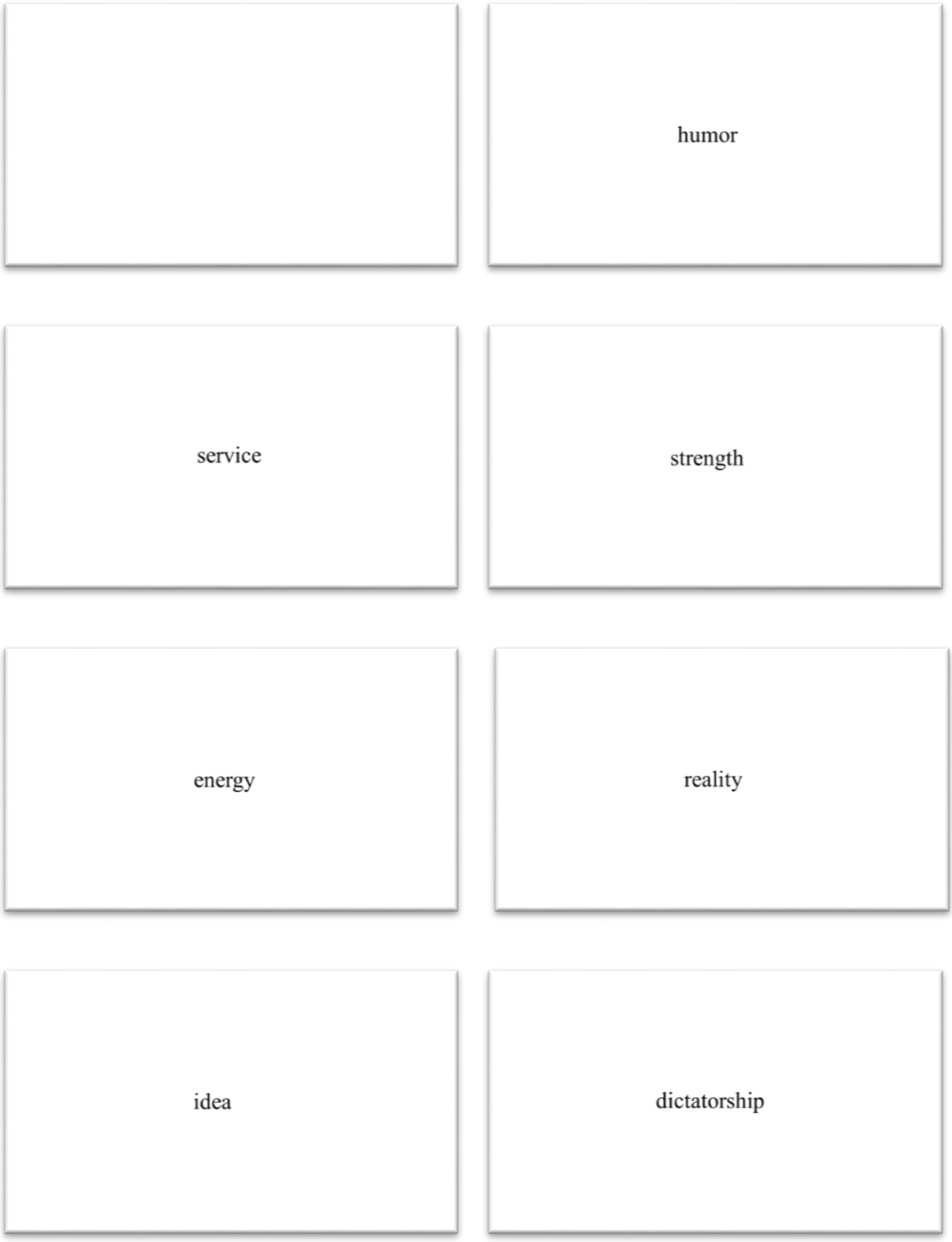
Conclusion:

Since $0.113 > 0.05$, we fail to reject the null hypothesis. We have no evidence of a difference between typing and handwriting notes. In other words, the note-taking method seems to have no effect on short-term memorization of words.

Reflection:

There were several ways in which this study could have been improved. One example is that some volunteers asked questions while others stayed quiet, which may have given them an advantage over others. Also, since the instructions were spoken, the tone or speed of the speech may have affected their understanding. Besides that, we could not get all the volunteers tested at the same time or in the same location, which could potentially have some effect on the results. Since Overlake only has a population of 527 students, we could only take a small sample, which may have affected our results as well. Perhaps, with a larger sample, the results would be significant. If we were to repeat this experiment, we would use larger sample sizes for each sample. We could also expand the experiment to see whether different sexes memorized better with typing or hand writing their notes. We can also see whether amount of words in the list given makes a difference. Along with this we can see if increasing or decreasing the amount of time given to copy down each word makes a difference for in short term memory. Although our experiment was insignificant, many possibilities for further study are yet to be explored.

Appendix I:



childhood

generosity

need

courage

patience

adventure

maturity

envy

adoration	tolerance
sophistication	elegance
redemption	Please give all notes to your proctor
	Thank you for participating! 

Appendix II:

Number of Words Remembered	
Handwritten notes	**Typed notes**
9	5
9	11
5	5
4	6
10	11
8	7
8	10
9	11
8	4
7	2
7	6
7	6
9	6
12	6
8	4
	5

Appendix III:

	One-Variable Statistics	
Title	Handwritten Data (1)	Typed Data (2)
$\bar{x}$	8	6.5625
$Sum\ of\ X$	120	105
$Sum\ of\ X^2$	1012	803
$S_X := S_n - X$	1.9272482233189	2.7560539423845
$\sigma_X := \sigma_n X$	1.8618986725025	2.6685377550261
n	15	16
$MinX$	4	2
$Q1\ X$	7	5
$Median\ X$	8	6
$Q3\ X$	9	8.5
$Max\ X$	12	11
$SSX := \sum(x - \bar{x})^2$	52	113.9375

Appendix IV:

Hello, and thank you for participating in this study. I will be your proctor today. First, I will show you some words one by one as you copy them down on your device/paper. You will have 5 seconds per word. Afterwards you will be tested on the words. You are allowed to take whatever notes will help you remember. Are you ready?

Citations:

Lin, Lin, and Chris Bigenho. "Note-Taking and Memory in Different Media Environments." Routledge 28.3 (2011): 200-16. Web. 28 May 2015.