

Short-Term Memory Comparison Of Students Of Faculty Of Medicine Pelita Harapan University Batch 2015 Between The Handwriting And Typing Method

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Abstract

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Introduction : A lot of research has been done to determine if handwriting or typing note influenced short-term memory, however, the results obtained are still controversial. Therefore this study is structured to see the effect of note taking methods by handwriting and typing on short-term memory.

Aim : The aims of this study were to increase the performance of students in Faculty of Medicine Pelita Harapan University as well as providing the right and effective method of taking notes.

Method : Experimental study design was chosen in this study. Study population is students of faculty of medicine Pelita Harapan University batch 2015. 40 samples will be divide randomly into two, one group will take a note by handwriting and another by typing. Each group is required to watch a video about 15 minutes long. The results were analyzed statistically using T-test.

Result : The average of new information that can be remembered by group that take a note by handwriting significantly ($p < 0,05$) higher than group than take a note by typing with a p-value of 0,009.

Conclusion : Take a note by handwriting allows people to remember more new information than typing.

Introduction

There are different stages of memory formation called, sensory memory, short-term memory, and long-term memory. Perception of stimuli (new information) is encoded to sensory memory, and then stored as short-term memory in prefrontal cortex.¹ Short-term memory is a process of temporarily storing new information, and only remembered as long as we focus on it.²

As the technology develops, many students take notes using electronic devices.³ Whilst handwriting consists of more complex motor skills, typing consists of repetitive movements, but doesn't have specific motor movements. There for, short-term memories formation might be worse than handwriting, but the results obtained from previos studies are still controversial.^{4,5,6}

The aims of this study were to increase the performance of students in Faculty of Medicine Pelita Harapan University as well as providing the right and effective method of taking notes.

Material And Method

This experimental study had been conducted in students of faculty of medicine Pelita Harapan University batch 2015 between January 2018 and march 2018. Informed consent had been conducted from all of the students.

Inclusion Criteria

Students of faculty of medicine Pelita Harapan University batch 2015 who are cooperative, right-handed, and don't have knowledge about the videos used in this research.

Exclusion Criteria

Students of faculty of medicine Pelita Harapan University batch 2015 who are not cooperative, left-handed, and taking drugs with side effects that affect concentration.

Randomisation

40 students of faculty of medicine Pelita Harapan University batch 2015 were divided into two groups by computer generated randomization.

Design Of The Study

In this experimental study, samples had been divided into two groups (handwriting and typing group). Both group had done pre-test and post-test. The results were compared against their short term memory.

Statistical Analysis

Statistical analysis was performed by using SPSS 22 version and Microsoft Office Excel 2011 version. Shapiro-Wilk test were used to compare the data. Independent T-test were used for bivariate statistical

analysis of data : mean±standart deviation was used for numeric variables. When $p < 0.05$ accepted as statistically significant.

Result And Discussion

40 students out of 199 were randomly chosen to participate in this study. The 40 students then randomly assigned to the handwriting (n = 20) and typing (n = 20) group. Each group were divided into 3 small groups with different video. Handwriting group : video1 (n = 6), video2 (n = 7), video 3 (n = 7). Typing group : video1 (n = 7), video2 (n = 7), video 3 (n = 6).

Samples characteristics : male (17.5%) vs female (82.5%), age 20 - <21 (72,5%), 21 - <22 (17,5%), 22 - <23 (5%), 18 - <19 (2,5%), and 19 - <20 (2,5%). Average amount of new information remembered in handwriting group : video1 6,83 (56,49%), video2 5,43 (45,22%) and video3 6,86 (57,29%) (mean 6.53 (53.08%)). Typing group : video1 5,1 (42,86%), video2 5 (41,67%) and video3 5,5 (45,83%) (mean 5.20 (43.42%)).

Table 1. Sample characteristics based on new information that can be remembered

Variable	n	Persent	New Information Obtained		
			Mean ± SD	Minimal (%)	Maximal (%)
Note Taking Method					
Handwriting	20	50%	6,35 ± 1,348	33,33	75
Typing	20	50%	5,20 ± 1,281	16,67	58,33

Table 2. Comparison of the Average Amount of New Information that Can be Remember Between Method of Taking Notes by Handwriting and Typing

Note Taking Method	Mean	SD	P value
1 Writing	6,35	1,348	0,009
2 Typing	5,20	1,281	

Table 3. Table 2x2 Method of Taking Notes by Handwriting and Typing

Method	The amount of new information that can be remembered		
	≤ 5	> 5	Total
Typing	11	9	20
Handwriting	5	15	20
Total	16	24	40

The handwriting group remembered more new information compared to typing group with $p = 0,009$ or $p < 0,05$, with Odd ratio 3,68 and Relative risk 2.2

Discussion

Reaserch Subjects Overview

The research subjects were 40 students from batch 2015, which the age range is not too wide (18-22 years old) and the activities carried out daily are not too different. 18 to early 20 is the peak age where someone is best at remembering various information in a short time.⁷ This condition affects the amount of new information that can be remembered between handwriting and typing. If the age difference is too far, then the results may not be representative, because there is a decline in cognitive function and memory in adulthood (over 25 years).⁷

Researchers use videos of approximately 15 minutes, on the grounds that glucocorticoids are produced approximately 10 minutes after someone learns something new. Glucocorticoids are secreted by the adrenal cortex when a person faces a stressful situation. This hormone will enter the brain and bind to the adrenal steroid receptors (glucocorticoid receptors), then, transcription of many genes occurs resulting in protein synthesis. This protein helps memory formation.⁸

Comparison of Short-Term Memory Between the Handwriting and Typing Method independent T-test (table 2.) shows that the handwriting group $M = 6,35$ ($SD = 1,348$) statistically significant to remembered more new information compared to typing group $M = 5,2$ ($SD = 1,281$) with $p = 0,009$ or $p < 0,05$.

In addition, the results are also supported by the value of odd ratio and relative risk. The handwriting group remembered more new information compared to typing group with $p = 0,009$ or $p < 0,05$ means there were statistically significant difference. Odd ratio 3,68 (odd ratio >1) can be interpreted as there is an association between the method of note taking with the amount of new information that can be remembered. Based on these results, typing has a greater chance to make someone remember less new information than handwriting. Relative risk 2.2 means taking notes by typing have 2.2 times greater risk to remember less than 5 information compared to handwriting.

Like our study, Timothy J. Smoker, Carrie E. Murphy & Alison K. Rockwell (2009) stated that people who take notes by handwriting are better at remembering short-term information compared to people who take notes by typing.⁶

Short-term memory formation involves several components. New information (stimuli) detected by sensory neuron. Whilst information deemed as important is passed through the connecting neuron to be forwarded to short-term memory in the prefrontal cortex, information that considered insignificant will be lost. Short-term memory will be sent to the hippocampus and stored as long-term memory. Besides being stored in the cerebral cortex, long-term memory is also stored in various locations throughout the nervous system and even throughout the body because receptors in the brain are also found in all cells of the body.⁹

Handwriting movements when taking notes helps to form memory in the sensorimotor parts of the brain and the memory is also stored along the nervous system in the muscles of the fingers to become motor memory.⁹ Using motor skills to remember information makes the information more memorable than just listening.¹

Handwriting allows a person to remember more new information, possibly due to making someone more familiar with words that are important to remember and induced formation of more complex memories. Whereas typing consist of repetitive movements but don't have specific movements and more using visual abilities than motor skills.⁵

Comparison of Short-Term Memory Between the Handwriting and Typing Method on Magnetic Resonance Imaging (MRI)

According to previous research using MRI, handwriting activated many parts of the brain. Such as involvement of the inferior frontal gyrus (IFG), anterior cingulate cortex (ACC), and fusiform gyrus (FG). Whereas, typing involves fewer parts of the brain, specifically the posterior parietal cortex (PPC) and FG.¹⁰

IFG plays a role in language processing. At the posterior part there is a dominant broca area for understanding language and the ability to speak. The ACC part is connected to the prefrontal cortex, parietal cortex, and also related to the motor and visual system. ACC is activated when someone does something that requires concentration and high attention. In addition, ACC also plays an important role in decision-making, emotions, and empathy. FG is significantly active to recognize and distinguish faces (visual), colors and words. PPC is known to

be involved in the ability to receive various inputs (information) from the sensory area and unite the information to be understood.¹⁰

These data indicate that handwriting, activated parts of the brain that process motor, visual, language, and parts of the brain that help to recognize words. Meanwhile, by typing the dominant part of the brain that is activated is the part that processes the sensory stimulus and visual area.

Therefore, the short-term memory produced by handwriting is more complex

than typing.

Conclusion

Take a note by handwriting allows people to remember more new information than typing and the difference is statistically significant.

Recomendation

Glucocorticoid levels in the blood need to be measure before and after watching the video to get more accurate results. Also, long-term memory test need to be done one week after watching the video.

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