A Study On The Effect Of Music On Short Term Memory With The Use Of Digit Span Task Among Students

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Abstract: Short Term Memory is limited and momentary, as it only lasts for a few seconds and generally can hold 5 to 9 items if not rehearsed or actively maintained. The short term memory can hold an average of 7 items within 15 to 30 seconds. One of the Memory Span Tests used is Digit Span Test which measures the Short Term Memory with the use of numbers. There are already a lot of studies regarding Digit Span Test. However, there is not much study that focuses on the effect of music on Digit Span Test. This experimental study aimed to determine the Digit Span Scores of students of MMC-CAST. The researchers gathered 120 participants from senior high school and college department, dividing them into one control group and two experimental groups. All groups underwent Digit Span Task in both forward and backward order, wherein only the two experimental groups have rock or classical music playing in the background. The result shows that female has higher mean rank score than male eve if the Digit Span scores were combined ($p<0.05$). Additionally, both rock ($d=-0.24$) and classical music ($d=0.22$) have a small effect only on the Backward Digit Span scores of the respondents.

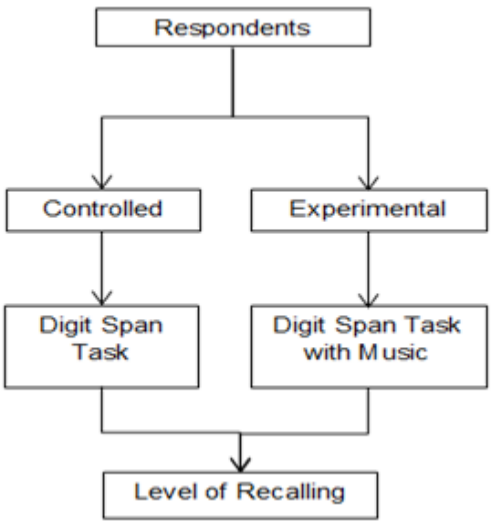
1 Introduction

Short term memory holds any information currently being used to accomplish a task, plus any information deemed important enough to be passed along from sensory memory. Information stays only a few seconds before it is displaced by new information. (Miller, 2011) Short Term Memory has three key aspects: capacity, duration, and encoding. The duration of STM seems to be between 15 and 30 seconds and the capacity about 7 items. (McLeod, 2009) Short-term memory has a limited duration of about 18 seconds if rehearsal is prevented. (McLeod, 2018)One of the Memory Span Tests used in measuring Short Term Memory is Digit Span Test. Digit Span Test is a short test that evaluates a person's cognitive status. If the test is administered forwards, it assesses both attention and short term memory. Also, it measures working memory if the backward version of the test is presented. (Heerema, 2019; Woods, et al., 2012) It encompasses several important constructs and names of tests designed to measure these constructs. First, Digit Span, along with reaction time, may be viewed as one of the two original paradigms used by experimental psychologists to investigate cognition. (Wambach, et al., 2011) This tests an individual's ability to remember a sequence of numbers that appear on the screen with one digit at a time. (Battista, 2019) Music can be an art, a source of entertainment and pleasure. It could also be a medicine and a way of meditation for the body and soul. However, music can be distracting and unbeneficial if played too loud. (Sharma, 2019) According to a study by Singh, Mohan & Kathrotia (2019), music did not affect short term memory, but if the tone played in the background expresses similar emotion as that of the face seen it may positively help in memory encoding and recalling. Mozart's music has a positive impact on brain activity and that listening to "Sonata for Two Pianos in D Major" improves mental ability. (LeMind, 2012) But this is contrasting with a study by Giannouli (2017) wherein the mentioned classical music can only improve mood but not short-term memory in healthy adults. Since there is no study about the effect of "Symphony No. 40" by Mozart and "Never Get to Me" by Deaf Election yet on recalling ability, the researchers aimed to know the effect of the two chosen music on Short Term Memory, specifically on the Digit Span scores of the participants. Rock and classical music have been selected because the two genres have distinct effects on the dependent variable. Both music were played only in 30% volume, it is 6 in a scale of 1 to 10 of how loud the music is in the designated location of the experiment.

Theoretical Framework

In 1956, a cognitive psychologist at Princeton University named George A. Miller who is known for Miller's Law provided proof for the capacity of short term memory, which is "The Magic number 7" plus or minus two, meaning people were able to hold roughly about 5 to 9 items. (Hamer, 2018)However, according to Mathy & Feldman (2011), the actual limit appears to be about 3 or 4 distinct chunks that are consistent with many recent studies, but also equivalent to about 7 uncompressed items of distinctive compressibility concerning Miller's famous magical number. This theory supports the study by determining how many digits the students can recall in a short period. Moreover, their Digit Span scores indicate their recalling ability. The researchers also observe that several students do chunking of numbers to remember the digits faster and easier.

Conceptual Framework



This conceptual framework shows that the control group will only undergo Digit Span Task while the group under experimental conditions will undergo Digit Span Task with music playing on the background. After the task, their Digit Span scores will determine their level of recalling.

Statement of the Problem

The researchers sought to answer the following questions:

1. What are the demographics of the participants?
    a. Sex (Male or Female)
    b. Academic Level
2. Is there a significant difference between the Digit Span scores of respondents based on
    a. Sex;
    b. Academic Level; and
    c. Controlled and experimental conditions
3. Is there a significant effect on the type of music used on the Digit Span score?

Significance of the Study

The study is deemed to be essential to the following stakeholders:

1. Teachers: Since teachers create test assessments for students, they can apply this study to improve their mental ability as a means to remember information in a fast and easy way.
2. Future Researchers: This study can be used by future researchers as one of their references if they want to conduct a research study about Digit Span Task, more specifically the effect of music on Digit Span Task.

2 Methodology

Research Design

Experimental research is a way of defining the effect of something on something else. To put it another way, a research begins with an idea of why something happens and manipulates at least one variable and control others, to determine the effect on some other variable. (Paltridge & Phakiti, 2015) Under experimental design are between-groups design and within-groups design. The researchers used between-groups design in which each condition tested have different respondents. (Budiu, 2018)This design was used in order to determine the differences of Digit Span scores between (A) male and female; (B) senior high and college students; and (C) controlled and experimental conditions.

Sampling Method and Sample

Convenience Sampling is a non-probability sampling in which the researcher uses the respondents that are nearest and available to participate in the research study. (Crossman, 2019) In other words, it simply includes the individuals who happen to be most accessible to the researcher. (McCombes, 2019) The advantage of this sampling method is that it is an easy way of choosing participants. However, it could be biased. (McLeod, 2019)The researchers used the mentioned sampling method by selecting the students who are only available and are willing to participate are used in the experiment. They were equally divided into three groups, one control, and two experimental groups. The control group consists of forty respondents and another forty for each of the two experimental groups, garnering a total of one hundred twenty.

Data Gathering Procedure

There are two procedures in gathering data for this study and all the procedures are held at a classroom with a maximum of ten students at a time. Everyone was asked to write their name (optional), sex (male or female), and year level (senior high or college). In the first phase, the researchers used a timed PowerPoint presentation to execute the Digit Span Task to the students. In the second phase, with the same items, they are tasked to write the numbers in reverse order. These phases are done with the control group, as well as the two experimental groups. However, in the two experimental groups, the researchers added (A) classical music and (B) rock instrumental music on the background while the students were doing the Digit Span Task.

Instrumentation

The researchers used a random number generator that mix numbers depending on quantity and repetition, forming a series of numbers and gradually increases one number after every sequence. The sequences of numbers were placed in the PowerPoint wherein the digits will appear on the screen one at a time for two seconds. In between these series of numbers, the respondents were given 10 seconds to recall and write their answers. This instrument underwent 3 subject matter experts for validity. The other instrument used are the two genres of music—rock instrumental and classical music—for the two experimental groups. The music used is “Never Get to Me” by Deaf Election and “Symphony No.40” by Mozart. These instruments were utilized to measure its effects on the short term memory of the students in terms of recalling the numbers shown on the Forward and Backward Span Task.

Data Analysis

The researchers tested the reliability of the items in the Forward Digit Span with α=0.42 and Backward Digit Span with α= 0.62. To assess the significant difference based on sex, academic level, and controlled and experimental conditions, the researchers used Non-parametric Mann-Whitney U Test since there is a large gap between the number of respondents in terms of sex, academic level, and controlled and experimental conditions. To determine the significant differences in Digit Span scores between the three groups, the researchers used One-way ANOVA. Compared Means Analysis was also used to acquire the mean and standard deviation of the results in the Forward and Backward Digit Span Task. Per testing the significant effect of type of music used on Digit Span scores, the researchers used Cohen’s d to get the level of effect.

Ethical Consideration

Considering ethical issues are major parts of conducting research. The researchers need to adhere to promote the aims of the research in sharing knowledge and preventing errors to occur, it also requires honesty and fairness among all the parties involved in the research. (Chetty, 2016)

The researchers first wrote a consent letter for the principal of Senior High School department wherein the Senior High School students were asked to be a part of the study as respondents. The gathered respondents were also informed what the research is about and its procedure, as well as their right to decline to participate or withdraw from the study once they have started. Aside from that, they were also provided the opportunity to ask questions and receive answers even after participating in the study.

3 Results And Discussion

	Senior High	College	Total
Male	32	5	37
Female	53	30	83
Total	85	35	120

Table 1 *Demographic Profile of the Students*

The table shows that 83 are female and 53 of them are from senior high school; On the other hand, 35 out of the total number of respondents consist of college students and only 5 of them are male. The large gap between the numbers in sexes and academic level is because the researchers only gathered the respondents who are available and willing to participate in the experimental study.

Test	Sex	Mean Rank	Mann-Whitney U	Sig.
Forward	Male	52.30	1839.00	0.07
	Female	64.16		
Backward	Male	53.81	1783.00	0.15
	Female	63.48		
Combined	Male	50.58	1902.50	0.04
	Female	64.92		

Table 2.1 *Difference of Digit Span scores based on sex*

In Table 2.1, a Mann-Whitney U test indicated that there is a significant difference based on sex if the Digit Span scores are combined (U=1902.50, p=0.04) as opposed to the scores of Forward Digit Span (U=1839.00, p=0.07) and Backward Digit Span (U=1783.00, p=0.15) with females having a higher mean rank than males. This shows that female can recall the sequence of digits more correctly than male. This is in line with a study by Solianik, Brazaitis, and Skurvydaz (2016) stating that women ($p<0.05$) had a significantly higher mean forward Digit Span scores than men.

Test	Academic level	Mean Rank	Mann-Whitney U	Sig.
Forward	Senior High	58.77	1634.50	0.37
	College	64.70		
Backward	Senior High	58.59	1650.00	0.33
	College	65.14		
Combined	Senior High	58.01	1699.50	0.22
	College	66.56		

Table 2.2 *Difference of Digit Span scores based on academic level*

The Mann-Whitney U test in Table 2.2 indicated that the scores for Forward Digit Span (U=1634.40, p=0.37) and Backward Digit Span (U=1650.00, p=0.33) have no significant differences based on academic level, as well as the combined Digit Span scores (U=1699.50, p=0.22). This points out that college students recalled more digits in a correct manner than those of senior high school students.

Difference based on controlled and experimental conditions	Mann-Whitney U	Sig.
Forward	1643.5	0.80
Backward	1418.5	0.30
Combined	1461.0	0.43

Table 2.3 *Difference of the Digit Span scores based on condition*

Table 2.3 depicts the scores in Forward Digit Span (U=1643.50, p=0.80), Backward Digit Span (U=1418.50, p=0.30), and Combined Digit Span (U=1461.00, p=0.43). This summarizes that the scores do not have any significant difference based on controlled and experimental conditions.

Test		Score	Interpretation
Forward		-0.23 to -1.94	Low
Mean	3.04	-1.95 to 4.13	Average
SD	1.09	4.14 to 6.31	High
Backward		-1.42 to -1.27	Low
Mean	2.63	-1.28 to 3.98	Average
SD	1.35	3.99 to 6.68	High
Combined		-0.36 to -3.65	Low
Mean	5.67	-3.66 to 7.68	Average
SD	2.01	7.69 to 11.7	High

Table 2.4.1 *Norming of scores*

This table was created to interpret the level of recall of the respondents in Forward and Backward, as well as their Digit Span scores when combined based on the conditions used.

Test	Treatment	Mean	SD	Interpretation
Forward	No music	3.03	1.03	Average
	Rock	2.98	1.19	Average
	Classical	3.13	1.09	Average
Backward	No music	2.83	1.29	Average
	Rock	2.5	1.45	Average
	Classical	2.55	1.29	Average
Combined	No music	5.85	1.89	Average
	Rock	5.48	2.19	Average
	Classical	5.68	1.97	Average

***Table 2.4**.2 Interpretation of Digit Span mean scores based on the treatment used*

Table 2.4.2 exhibits that although the interpretations are the same for both Forward and Backward Digit Span scores, it is still clear that the group without music got the highest result in Digit Span Task with the mean score of 5.85 (SD=1.89), followed by the classical music group with 5.68 (SD=1.97) and rock instrumental group with 5.48 (SD=2.19).

		df	Mean Square	F	Sig.
Forward	Between Groups	2	0.23	0.19	0.83
	Within Groups	117	1.22		
	Total	119			
Backward	Between Groups	2	1.23	0.67	0.51
	Within Groups	117	1.83		
	Total	119			
Combined	Between Groups	2	1.41	0.34	0.71
	Within Groups	117	4.08		
	Total	119			

***Table 3.1** ANOVA of Digit Span scores based on the treatment used*

The table presents that the treatment used have significantly no effect on Forward and Backward Digit Span scores even if the scores were combined (p>0.05).

Test	Treatment	Cohen's d	Interpretation
Forward	Rock	-0.04	No effect
	Classical	0.09	No effect
Backward	Rock	-0.24	Small effect
	Classical	0.22	Small effect
Combined	Rock	-0.18	No effect
	Classical	-0.09	No effect

***Table 3.2** Effect on the type of music used on Digit Span scores*

As shown in Table 3.2, both rock (d=-0.24) and classical music (d=0.22) has a small significant effect only in the Backward Digit Span score. The rest were interpreted as "no effect" for the d value is smaller than 0.2.

4 Conclusion

In conclusion, the interpretation of the respondents' Digit Span scores in both Forward and Backward shows that their level of recall is on average (Table 2.4.1). Moreover, although the combined scores from the Digit Span Tasks differed significantly between two sexes and that female can recall more digits correctly than males (Table 2.1). Thus, rock and classical music have a small effect only in the Backward Digit Span Task (Table 3.2).

Recommendation

The following are some of the recommendations of the researchers for the betterment of this delving:

1. It is recommended for the future researchers who would like to conduct a study regarding Digit Span Task to increase the number of respondents for both control and experimental groups;
2. Conduct similar experiment using other kinds of music on Digit Span Task;
3. Execute the experiment in a more standardized environment. Lessen extraneous variables as much as possible to come up with better results.

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