Working memory capacity of grade 11 learners

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ABSTRACT

This study attempts to assess the working memory capacity of the 153 Grade 11 students of Mayapyap National High School, Cabanatuan City which in terms of their Operation Span Task, Reading Span Task and Verbal Span Task. Further, the study determines the significant relationship between the respondents' profile variables and their working memory capacity. The study used frequency counts, percentages and rankings to describe the profile of the respondents. On the other hand, the use of Likert scale was used to describe the working memory capacity of the respondents. The study found out that majority of the respondents is females and 17 years old. Moreover, most of them are "very satisfactory" in terms of their Operation Span Task and Verbal Span Task, while "outstanding" in terms of their Reading Span Task. On the study's result, sex is positively correlated to Operation, Reading and Verbal Span Tasks. It is then recommended that the learners may have trainings on working memory tasks to strengthen/improve their Working Memory Capacity.

Keywords: working memory capacity, operation span task, reading span task, verbal span task

1. INTRODUCTION

Effective language processing and learning largely depends on how well working memory performs [1].

Over the last 40 years, the concept of Working Memory (WM) has been increasingly widely used, extending from its origin in cognitive psychology to many areas of cognitive science and neuroscience, and been applied within areas ranging from education, through psychiatry to palaeoanthropology [2].

Working Memory is considered to be a specialized component of memory that is responsible for the temporary storage and manipulation of information necessary to accomplish a cognitive task [3]. It involves the ability to remember something and to perform an activity using this memory. This skill allows learners to maintain information in mind so that

it can be used for learning, reasoning, or producing a result. It processes all encountered stimuli, delegates it to the different parts of the brain that can take action, allows them to block out unnecessary information and keeps them updated on what is happening – and keeps learners focused on what matters [4].

As an important concept of cognitive psychology, WM has a great influence on many aspects of language learning including vocabulary acquisition, language understanding, language performance, reading comprehension and so on - which is regarded to make the learners learn and process the language easier and faster [5].

On the other hand, WM is limited in capacity [6]. A learner can only keep something "*active*" for a very short time without conscious attention [7]. The nature of how a person learns and processes language depends on it, which means that learners cannot store and manipulate endless amounts of information [8]. It is this which so limits working memory capacity.

Therefore, the types of thinking and remembering tasks to be given to the learners' specifically in language learning and processing will be constrained by working memory resources. It also limits, to some degree, the types of things learners can handle concurrently [9].

The teachers and learners may have made considerable investments of time and put a lot of effort in teaching and learning and not seeing much improvement on their learners' abilities

because the learners may have reached the limits of their working memory.

In this regard, the researcher was driven to have clearer picture of her learners' capacity to hold information in connection with language processing and learning. Once the researcher knew where the limits were, a guide was used for giving effective instructions for the educational system's betterment. Hence, the researcher aimed to assess and describe the working memory capacity of Grade 11 Learners of Mayapyap National High School. Specifically, it sought to answer the following: (1) How may the profile of the respondents be described in terms of their sex and age; (2) How may the working memory capacity of the respondents be described in terms of Complex Span Tasks in terms of their Operation Span Task (OSpan), Reading Span Task (RSpan), and Verbal Span Tasks (VSpan); and (3) Is there significant relationship between the profile and the working memory capacity of the respondents?

2. METHOD AND MATERIAL

2.1. Research Design

The study used the Descriptive method of research in order to determine the working memory capacity through the Stratified random sampling technique.

2.2. Respondents

About 153 respondents from grade 11 of Mayapyap National High School were chosen for this study.

2.3. Data collecting instrument

A questionnaire was devised by the researcher in order to gather data regarding the respondents' profile, while the Working Memory Capacity Assessment Test was used to describe the working memory capacity of the respondents.

2.4. Data analysis

Frequency counts, percentage and ranking were used to describe the profile of the respondents and the Pearson r was used to determine if there was significant relationship between the profile of the respondents and their working memory capacity

3. RESULT AND DISCUSSION

3.1. Profile of the Respondents

Table 1 shows the distribution of the respondents according sex. It can be seen that 54.2% of them were females and 45.8% of the respondents were males. The data show that there were more girls officially enrolled in the school. Furthermore, according to the researcher's unstructured interview with the respondents, male students chose not to continue studying because of the responsibilities given to them. They chose to work than to study to help their families.

Age of the Respondents

Table 2 shows the distribution of the respondents according to age. It can be seen that 61.4% of them were 17 years old which had the highest frequency of respondents. Further, 17.7% of them were 16 years old which had the lowest frequency of respondents.

The findings show that majority of the respondents were 17 years old which meant

Table 1. Sex of the respondents

Sex	Frequency	Percentage (%)
Male	70	45.8
Female	83	54.2
Total	153	100%

Table 2. Distribution of the respondents according to age

Age	Frequency	Percentage (%)
16 years old	27	17.6
17 years old	94	61.4
18 years old	32	20.9
Total	153	100%

they were at the right age as Grade 11 learners. Based on the Philippine Education system, 16-17 years olds were expected for grade 11 learners.

3.2. Working Memory Capacity of the Respondents

3.2.1. Operation Span Task

Presented in Table 3 is the working memory capacity in terms of operation span task.

It can be seen on the table that 37.3% of the respondents scored 7-8 out of 10 with a verbal description of "*very satisfactory*." However, there was 0.7% among the respondents who scored 0 and described as "very poor."

The findings of the study show that most of the respondents had "*very satisfactory*" working memory in terms of operation span task despite the social status they belonged to. Based on the unstructured interviews of the researcher among the respondents, they were focused and driven to study harder because they want their families to experience better lives in the future.

According to Pearson Education (2016), the effects of having good working memory capacity are being able to stay focused, can resist

distractions, plan activities, complete tasks, and follow and contribute to complex discussions [4]. Therefore, the respondents can do dual-tasks such as learning mathematics and language while being able to resist distractions.

3.2.2. Reading Span Task

Table 4 showcases the working memory capacity in terms of reading span task.

The table displays that 43.8% of the respondents scored 9-10 out of 10 with a verbal description of "*outstanding*." There was 1.3% among the respondents who scored 0 and described as "*very poor*." The findings of the study show that most of the respondents had "*outstanding*" Reading Span Task working memory. The result implies that learners were motivated to read and learn due to the urge of changing their social status. On the unstructured interview, they said that they give importance to education because they still believe that it will be their key to a successful life.

According to Boudreaux (2015), this working memory test is designed to tax both storage and processing functions of working memory that involves sentence comprehension, the ability to maintain and retrieve the first or final word from each sentence, and the ability to make judgments about each sentence [10]. Therefore, the respondents who got outstanding scores in the test tend to comprehend, maintain, and retrieve words and sentences in an "*outstanding*" manner.

3.2.3. Verbal Span Task

Table 5 shows that 48.4% of the respondents scored 13-16 out of 20 with a verbal description of "*very satisfactory*." However, there was 0.7% among the respondents who scored 1-4 out of 10 and described as "*poor*."

The findings of the study show that most of the respondents have "*very satisfactory*" working memory in terms of Verbal Span Task. The respondents said that they were much interested in studying because it will help them change their lives. They were found to get good results despite poor social status because their status serves as their inspiration to work on, as what the respondents said in the unstructured interviews. According to Pearson Education (2016), an individual with better working memory will experience better ability to focus, resist distractions, and control impulses [4]. That is why the learners were good at deciding whether the words were correct or not and even recalled them consecutively and correctly.

3.2.4. Correlation Analysis

Correlational analysis of the profile of the respondents and their working memory capacity is presented in table 6 below. It shows the correlational analysis between the profile of the respondents and their working memory capacity. As shown in the table, sex is positively correlated to Operation, Reading and Verbal Span Tasks by having Pearson correlations of 0.167, 0.274 and 0.185 respectively with corresponding significance or p-values of 0.040, 0.001 and 0.022. It meant that female respondents did have better working memory capacity in terms of all the three areas such as Operation, Reading and Verbal Span Tasks.

Overall, there was a limited correlation between the profile of the respondents and their working capacity. Thus, the null hypothesis "There is no

Table 3. Working Memory Capacity in Terms of Operation Span Task			
Score in Operation Span Task	Description	Frequency	Percentage (%)
9 – 10	Outstanding	30	19.6
7 – 8	Very Satisfactory	57	37.3
5 – 6	Satisfactory	44	28.8
3 – 4	Fair	14	9.2
1 – 2	Poor	7	4.6
0	Very Poor	1	0.7
Total		153	100%

Table 4. The working memory capacity in terms of reading span task

Score in Reading Span Task	Description	Frequency	Percentage(%)
9 – 10	Outstanding	67	43.8
7 – 8	Very Satisfactory	40	26.1
5 – 6	Satisfactory	35	22.9
3 – 4	Fair	4	2.6
1 – 2	Poor	5	3.3
0	Very Poor	2	1.3
Total		153	100%

Table 5. The working memory capacity in terms of verbal span task

Score in Verbal Span Task	Description	Frequency	Percentage(%)
17 – 20	Outstanding	16	10.5
13 – 16	Very Satisfactory	74	48.4
9 - 12	Satisfactory	45	29.4
5 - 8	Fair	17	11.1
1 - 4	Poor	1	0.7
Total		153	100%

Table 6. Correlational analysis between the profile of the respondents and their working memory capacity

Profile variables		Operation Span Task	Reading Span Task	Verbal Span Task
Sex	Pearson Correlation	.167*	.274**	.185*
	Significance	.040	.001	.022
	N	153	153	153
Age	Pearson Correlation	-.095	.059	.020
	Significance	.245	.471	.804
	N	153	153	153

significant relationship between the profile of the respondents and their working memory capacity was not rejected. It meant that the working memory capacity of the respondents did not depend on their profile.

The findings of the study show that working memory correlates more in the respondents' sex. The females had greater working memory abilities compared to males [11]. Females tend to outperform males on tasks dealing with object location, relational object location memory, verbal working memory and spatial working memory. Females have been shown to have consistently stronger working memory than males. Females were thought to be able to hold more items of verbal information in short-term storage at once. This advantage in working memory is thought to be linked to women's superior ability to attend to more than one task at once, or 'multitask'. In general, the profile of

the respondents and their working capacity has limited relationship. Despite that, the null hypothesis was not rejected. Overall, the respondents' working memory capacity did not rest on their profile.

4. CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

- The respondents were mostly females and aged 17 years old.
- Most of the respondents were described to have "very satisfactory" Working Memory Capacity in terms of Operation Span Task; "outstanding" in terms of Reading Span Task; and "very satisfactory" in terms of their Verbal Span Task.
- The Sex of the respondents is positively correlated to Operation, Reading and Verbal Span Tasks. It meant that female respondents did have better working memory capacity in terms of all the three areas of Complex Span Task such as Operation, Reading and Verbal Span Tasks.

5. ACKNOWLEDGEMENT

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

7. SOURCE/S OF FUNDING

8. REFERENCES

1. Conti, F. (2015) Eight important facts about Working Memory and their implications for MFL teaching and learning.

2. Malamed, S. F. (2010). Knowing your patients. *The Journal of the American Dental Association*, **141**, S3-S7.

3. Adams, E. J., Nguyen, A. T., & Cowan, N. (2018). Theories of Working Memory: Differences in Definition, Degree of Modularity, Role of Attention, and Purpose. *Language Speech and Hearing Services in Schools*, **49***(3)*, 340

4. Pearson Education, Inc. (2016). Cogmed training delivers substantial improvements in working memory capacity

5. Szmalec, A., Brysbaert, M., & Duyck, W. (2012). Working memory and (second) language processing. In Memory, language, and bilingualism: Theoretical and applied approaches (pp. 74-94). Cambridge University Press.

6. Cowan, N. (2010). The Magical Mystery Four. *Current Directions in Psychological Science*, **19***(1)*, 51–57

7. Shevlin, M., & Rose, R. (2017). Leadership approaches to inclusive education: learning from an Irish longitudinal study. In Inclusive principles and practices in literacy education. Emerald Publishing Limited.

8. Baddeley, A. (2010). Working memory. *Current biology*, **20***(4)*, R136-R140.

9. Dienes, Z., Baddeley, R. J., & Jansari, A. (2012). Rapidly measuring the speed of unconscious learning: Amnesics learn quickly and happy people slowly. *PloS one*, **7***(3)*, e3340

10. Baddeley, A (2012). Working Memory: Theories, Models, and Controversies retrieved from www.annualreviews.org

11. Boudreaux, C. (2018), Working Memory and Multitasking retrieved from http://www.mrc-cbu.cam.ac.uk/wp

12. Geiger, J. F., & Litwiller, R. M. (2005). Spatial working memory and gender differences in science. *Journal of Instructional Psychology*, **32*(1)***, 49.