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**PHONOLOGICAL LOOP PHENOMENA ON QUR’AN RECITERS
 “BADDELEY’S MODEL OF VERBAL WORKING MEMORY”**

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Abstract. This study aimed to explore how the process occurs in the working memory to memorize and keep memorizing the Qur’an. Also, to explore how the phenomenon of verbal working memory of phonological loop on the Qur’an reciter and the factors that affect working memory capacity. There were 48 students (25 female and 23 male) and 4 teachers (1 female and 3 male) of two Tahfidz institution in Bogor, West Java, Indonesia, who participated in this study. The study used survey and interview techniques to explore four characteristics of verbal working memory phonological loop: (1) word length effects, (2) articulatory suppression, (3) the irrelevant speech effect, and (4) the phonological similarity effect. Qur’an memorizing is significant with working memory concept that is involving phonological loop. Individual has different response to the phonological loop phenomenon because they have differences in working memory capacity

Keywords: phonological loop; Verbal Working Memory; Qur’an reciters

A. INTRODUCTION

This study aimed to explore how the process occurs in the working memory to memorize and keep memorizing the Qur’an. Also, to explore how the phenomenon of verbal working memory of phonological loop on the Qur’an reciter and the factors that affect working memory capacity. There were 48 students (25 female and 23 male) and 4 teachers (1 female and 3 male) of two Tahfidz institution in Bogor, West Java, Indonesia, who participated in this study. The study used survey and interview techniques to explore four characteristics of verbal working memory phonological loop: (1) word length effects, (2) articulatory suppression, (3) the irrelevant speech effect, and (4) the phonological similarity effect. Qur’an memorizing is significant with working memory concept that is involving phonological loop. Individual has different response to the phonological loop phenomenon because they have differences in working memory capacity, rather than Intelligence ability (IQ). The executive control ability, emotion and motivation are factors that affect the increase or decrease in working memory capacity.

According to the theory of Baddeley and Hitch (2003, 2006), working memory is an active storage to store and manipulate information. This model is a critique of Atkinson and Shiffrin’s short-term memory model that were considered too simple. Baddeley’s model is useful for describing and organizing duration, capacity, and mechanisms in working memory. Working memory is a multi-component system with multiple domain-specific component of short-term storage under the control of central executive unit. Working memory is an extensive and dynamic system if it is compared with short term memory. Short term memory refers to information storage more than a few seconds or minutes, while working memory

refers to the capacity to keep the information when other information process simultaneously occur or are involved in cognitive operations. The approach of working memory proposed by Baddeley showed that working memory is not a passive storage but the new information and the information in the long-term memory was combined, modified, and manipulated so that it can be used for a variety of cognitive activities (Schwartz, 2011; Matlin, 2013).

Working memory consists of (1) the slave system (which is responsible for the short-term information storage and (2) central executive which is responsible for coordination of complex cognitive processes and direct the relevant information at the time inhibit irrelevant information. Baddeley working memory split into two storage buffers, which are phonological loop for verbal information and visuospatial sketchpad for non verbal information. Then, Baddeley classified the working memory into four components which are phonological loop, visuospatial sketchpad, central executive, and episodic buffer (Baddeley, 2001; Baddeley et al., 2009). Phonological loop is a part of working memory component that is responsible to handle the verbal stimulus and written stimulus. Moreover, working memory will be associated with the phonological loop in terms of studying new words. In previous studies, phonological loop described as functional components for the retention of verbal information in a short period. Phonological loop consists of two parts, phonological store and the rehearsal process (Baddeley, 2003).

One of behaviors that describe the activity of cognitive and verbal skills and keep working is to memorize the Qur'an or *hifzul* Qur'an. *Hifz* text is an Arabic word that refers to the the process of memorizing the Qur'an. Thus, if a person has memorized the Qur'an, then they need a commitment to the process of text coding of Qur'an is not lost. The purpose of permanent storage of Qur'an is to be inretrive properly with full accuracy. Thus, memorizing the Qur'an is very active and complex memory-based tasks that can preserve Qur'an in memory.

Memorizing and retaining the text of Qur'an is a high-level cognitive activities. Thus, verses from the Qur'an as a Muslim's way of life is preserved in memory of a hafidz Qur'an. Reading, memorizing, and retaining Qur'an text that stored in the memory not only show an activity and religious value but also improve mental health and performance of working memory. (according to research Kamal, NF, Mahmood, NH, & Zakaria, NA, 2013; Mahjoob, M., Nejati, J., Hosseini, A., & Bakhshani, NM, in 2016; improve memory skills, according to a study Hojjati, A., Rahimi, A., Farehani, MD, Sobhi-Gharamaleki, N., & Alian, B. 2014).

Qur'an reciter is a unique phenomenon. Therefore, being the Qur'an reciter can start from an early age, but does not prevent elderly to be the Qur'an reciter. Even individuals with cerebral palsy can be a Qur'an reciter. Musa (7 year-old), for example, broke the record as the youngest Qur'an hafidz in Indonesia and became the third champion international level. The amazing is people with cerebral palsy, Fahmi Abdurrahim (11 year-old), has been memorized as many as 30 Juz from the age of 4.5 years. Even though, Qur'an is a text of Considerable length. It consists of 30 Parts, and 114 Chapters of varying length. The total number of verses in the Qur'an is 6666. The length to read / Recite the Qur'an from cover to cover may vary According to the fluency, reading style and speed of the Reciter. It shows that reading and memorizing the Qur'an can be done by anyone because it is facilitated by Allah. In the Qur'an, it is repeated four times in Sura Al-Qomar (17): 17, 22, 32, 40). "We make it easy for the lessons of the Qur'an, but is there any who take heed?" (Surah Al-Qamar: 17).

However, not everyone has the ability to memorize Qur'an well. Qur'an reciter is identical with the ability of verbal working memory. The length of time required to read the Qur'an from sheet to sheet can be varied in accordance with fluency, reading style and speed of reading. How does the process of becoming a hafidz so as to Qur'an reciter as much as 30 chapters and keep memorizing 30 Juz Qur'an? Whether it is influenced by factors such as individual differences in intelligence, psychological factors, physical or environmental factors? Anything that affects the process of memorizing the Qur'an? Whether if someone can memorize the Qur'an, also had a positive impact in improving the working memory capacity, so the ability to memorize the Qur'an can assist individuals in completing cognitive tasks, such as academic

problems? Does that affect the capacity of verbal working memory in the Qur'an memorizers? Important to know how the process that occurs when memorizing the Qur'an and the factors that affect the performance Qur'an reciters

To confirm that the process to become Qur'an reciters is significant to the concept of working memory and answering that research problem, a preliminary study was conducted at two Tahfidz institutions (Qur'an reciters agencies) in Bogor, West Java, Indonesia. The process of becoming a Qur'an reciter is not only memorizing Qur'an text with the correct articulation and high accuracy but requires effort to retain the Qur'an text memorizing. The process not only involves the storage process but involves the manipulation and processing of information dynamically. Related research on verbal working memory approach is based on the theory Baddeley in the context of the Qur'an reciters, still not much. The purpose of this study was to explore (1) how the process occurs in the activity of working memory to memorize and keep memorizing the Qur'an. (2) how the phenomenon of verbal working memory phonological loop on the Qur'an memorizers, and (3) whether there are individual differences, and (4) factors that affect verbal working memory in the context of the Qur'an reciter.

B. METHODOLOGY

This research used mixed method research design. Mixed methods combined and integrated the qualitative and quantitative research and the data in a research study. The qualitative data tends to be open-ended responses without predetermined quantitative while the quantitative data usually includes closed-ended responses such as questionnaires or psychological instruments (Cresswel, 2013). Furthermore, the research objective is explorative-descriptive research in which to reveal the phonological loop phenomenon on students in memorizing the Qur'an.

The population in this research was 50 student in Tahfidz Falakiyah (27 students) and Tahfidz Khoiru Ummah (23 students), Bogor, West Java, Indonesia. However, two students did not complete the questionnaire, so the data were not used. Thus, the total of the data, that was being analyzed, is 48 students and 4 teachers. Retrieval technique used purposive random sampling. The data collection technique used questionnaire that distributed to 48 students of the Qur'an reciters (the average of age is 16.5 years old). The questionnaire consists of four semi-enclosed questions on four characteristics of the phonological loop based on the approach of working memory by Baddeley (2003), which consists of (1) word length effects, (2) articulatory suppression, (3) the irrelevant speech effect, and (4) the phonological similarity effect loop. The measurement of IQ score used CFIT Scale 3 Form B that was done by a psychologist. The test was paper and pencil test that was based on test speed. This test consisted four subtests that are series, classifications, matrices, and condition and the duration was 12.5 minutes. Meanwhile, to determine the factors that influence verbal working memory conducted with interview.

C. RESULTS AND DISCUSSIONS

The process of working memory in memorizing and in retaining Qur'an memorization. Based on interviews with two female and two male *Tahfidz* teachers that was held on May 28, 2017, in *Tahfidz* institution and two male *Tahfidz* teachers on June 3rd, 2017 at different *Tahfidz* institution. They say that a *hafidz* candidate must go through three stages of the process. The first stage is the correct technique of reading the Qur'an. The second stage is the process of memorizing the Qur'an and the third is keeping the process of memorizing the Qur'an.

The first stage, the technique of reading the Qur'an correctly performed by *tahsin* master that mastering the technique of reading the Qur'an before the process of memorizing the Qur'an. Because, if you not properly read short or long verses of the Qur'an, it will affect the meaning of Qur'an and the fluency of reading. In this stage, *ghorib* must be mastered, that is something that needs special explanation because of the severity of the problem in terms of

both letters, lafadz, reading, reading for meaning and understanding of the Qur'an. The Qur'an reciters must memorize terms in ghorib. The *tahsin* method is diverse, such as *qira'ati* methods and *ummi* methods. The selection of methods depends on each Tahfidz institution. However, the teaching methods of each method are basically the same. Teachers will give a visual example on how the letters of the Qur'an (*hijaiyyah*) sound. Students must have full attention and awareness to teacher, both visual and verbal modalities. At this stage, students received a few lessons from a teacher such as *mutasabihat* passages (almost identical verses), ghorib readings (foreign reading), correct pronunciation of *makhrijul* (the exit) and *hijaiyyah* letter and laws read the Qur'an (*tajwid*), such as the length of reading, and the time to stop or to continue reading the passage.

The process when students hear the sounds of hijaiyyah letters or Qur'an verse in the concept of stage working memory is the information storage stage that goes into slave system (phonological loop). Information in the form of sound or noise is part of auditory input and the visualization of the movement of the lips and tongue position in pronounce hijaiyyah letters and the letter or the text of the Qur'an are the visual input. Furthermore, both information is stored in an episodic buffer in a short time, and could be lost if it is not trained. After that, the students will imitate the teacher how to sound hijaiyyah letters appropriately. There are several processes that must be considered, namely (1) the fluency of Qur'an text recitation, (2) the reading of the letter length, (3) the production of the correct word. According to Goldstein (2011), auditory input that is correctly coded will increase the chances of recall accuracy. After *hafidz* candidate mastered the reading technique of Qur'an correctly, the next step is to memorize the Qur'an. The method used in the stage of memorizing the Qur'an are (1) *talaqqi* method (face to face), (2) *kitabah* method (writing Qur'an verse), and *tafhim* methods (understanding Qur'an). *Talaqqi* method is teachers orally read the Qur'an, in which the teacher read memorized verses then the students follow the teachers, so errors and mistakes can be avoided. This method consists of two techniques, namely (1) *tasmi* or *simam* method (teacher recites or sees *mushaf* (sheet) of Qur'an, students listen and imitate), and (2) *'arod* method or deposit method (students deposit rote to teacher). *Kitabah* method, such as write Qur'an verses as a means to Qur'an reciter. While the method *tafhim* understand pieces of verse or a whole paragraph in one letter of the Qur'an.

The strategy of memorizing the Qur'an in the specified time target is to memorize (*muroja'ah*) 1-2 pages per day starting from Juz 30 until complete it, and then deposited rote to teachers. This pattern is called rote sewing pattern which is long rote was sewn with new rote so the next deposit have two cases / two letters. This process is continue until the new and old pages collected $\frac{1}{4}$ juz (5 pages/few letters) for one deposit. This means that students are asked to recall the rote or reading that had been independently received before, either orally or writing. Students who have memorized with high accuracy can continue to the next level. Technically, the teacher will check the students. The teacher will read a verse and students are asked to connect verse. The teacher can also recited with a slight error so that it does not sound wrong if the student does not really recognize the verse that was read. Then, the students were asked to point out their mistakes in reading the verse. According to the authors, this means that students perform recognition by selecting or identifying one or more verses that have been studied before, both in terms of letter or legal *makhrojul* read.

The next stage is to retain the Qur'an recitation of 30 Juz (part). This means that after students completed as many as 30 Juz, the next stage is mastery/retain the recitation. Because the recitation will be lost if it not retain. According to all teachers, this stage is the most severe stage, because it requires mental alertness, emotional (mood), and constant high motivation in keeping with the way of practice the recitation, repeating (*muroja'ah*), or rote rehearsal to be long-term memory. According to one female Tahfidz teacher to make sure that someone has been able to keep reading as much as 30 Juz of the Qur'an, should be 30 times the test *sima'* or *tasmi'* (listening). This means the Qur'an reciter was considered to have to recall and recognition ability quickly and accurately, both of verse, letters and *tajweed*.

Evaluation stage (Sima'/tasmi test). Evaluation is performed in each stage. This evaluation is done so that students truly master the entire text of the Qur'an well. In Baddeley concept, meaning that information is processed in the working memory, the next process is the retrieval (Considering the text of the Qur'an). Retrieval is the process of allocating storage of information in the brain and re-access the information (Matlin & Margaret, 2013). There are two types of retrieval process, (1) recall (give or rewriting words in mind) and (2) recognize (recognizing words in mind).

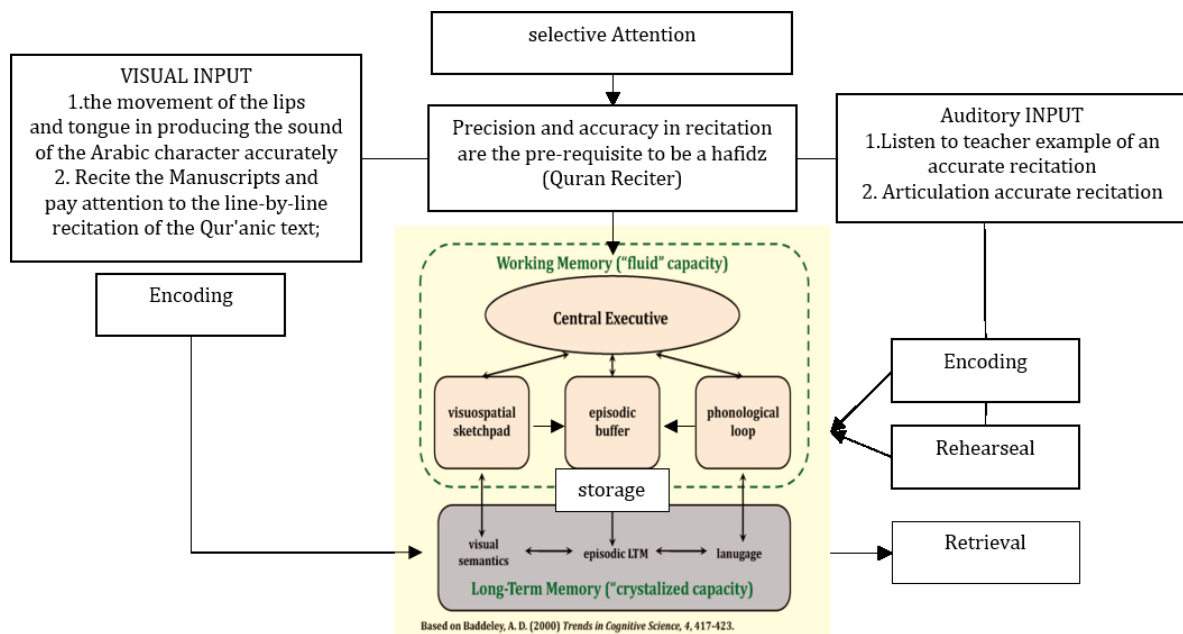


Figure C.1. Baddeley's Working Memory Model

Phonological Loop Model

If Robbin in Baddeley et.al (2009) stated that the chess player has a good ability to move chess that requires the use of central executive and visuospatial sketchpad instead of phonological loop, then according to the author, read and memorize the Qur' an requiring the use of central executive and phononogical loop.

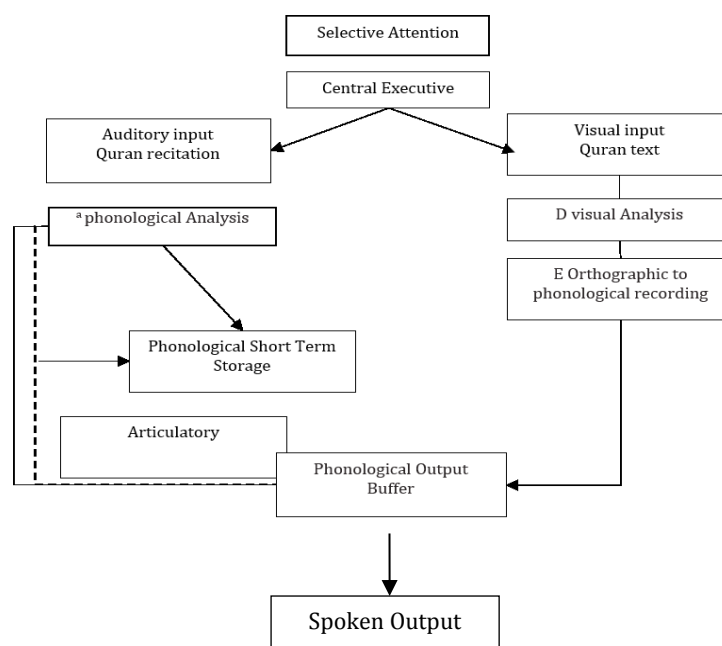


Figure C.2. Functional Model of Phonological Loop

The component of working memory that most widely researched is phonological loop. This system comprises sub-phonological store, which serves to store the information in a short time, for a few seconds, and articulatory rehearsal process, which refreshes the information is lost. Rehearsal process analogous to subvocal speech. In Figure 2. Model phonological loop, illustrated that the input of information in the context of memorizing the Qur'an is reading the Qur'an in the form of a voice is heard (auditory input) and writing or text Qur'an viewed (visual input). The flow chart described as follows:

- Information in the form of Qur'an recitation that will be heard in the analysis phonology
- Furthermore, after analyzed it will go into phonological store and will be easily lost. To help keep the Qur'an readings are stored, then there is a repetition of the articulatory process (sub-vocals) or the inner voice.
- After the readings from the Qur'an phonological store is stored in the output buffer.
- While the visual input of Qur'an writing text to be analyzed visually
- The shape of the Qur'an text orthographical phonology recorded in the form of what will be in the phonological output buffer. After going through the process ae, then reading the Qur'an is heard and seen in text form can be produced in the form of memorizing Qur'an voiced

The summary of the process and keep memorizing the Qur'an can be seen in the table below.

Table C.1. Summary of Phase Process into Qur'an Reciters with Baddeley's Verbal Working Memory Approach

Stage	Description	Verbal Working Memory Process
Mastery Tahsin	Precision and accuracy in recitation are the pre-requisite to be a hafidz	Encoding (visual and auditory input) to phonological store
Proof or Memorize the Qur'an	Memorise the Qur'an simply by repetitions	Articulatory rehearsal Process
Muroja'ah/Mastery (retain) memorizing Qur'an	Elaborative rehearsal involves more effort in the encoding process of information	Encoding from phonological store to Long term memory

Tasmi'/Sima'/Evaluation	Gradual verbal memorisation method was assessment employed in the Qur'anic memorisation process	<i>Retrieval</i> is the process of allocating storage of information in the brain and re-access the information (Matlin, 2005). Retrieval: recall / recognition
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The phenomenon of phonological loop

Qur'an reciters showed the ability of verbal working memory. Hence the phenomenon or characteristics, *phonological loop* explored with a semi-open questionnaire distributes to the students. Furthermore, to confirm the results of the data is done by structured interview questionnaire to teachers and students Tahfidz. Four characteristics of verbal working memory phonological loop (If the other sound disturbed you when memorizing) (4) the phonological similarity effect (whether sound almost the same verse complicates memorizing). These four characteristics are considered to affect the processing of information occurs in the phonological loop. The survey was conducted with 27 female and 14 male in the Qur'an Tahfidz Institute, Bogor. The average age is 16,5 years old, 12 junior high school students and 15 high school students, with a mean of memorizing 28 Juz already completed on May 28, 2017. They were asked to answer questions regarding the fourth semi-open loop phonological characteristics proposed by Baddeley's working memory theory. The survey results can be seen in Figure 3.

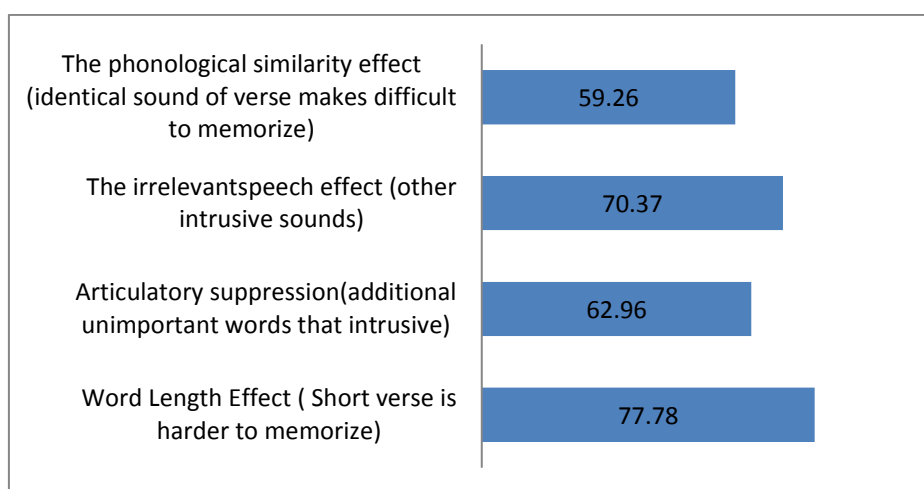


Figure C.3. Percentage of subjects based on a survey Graph characteristics of phonological loop

The word length effect gave evidence to the processing of subvocal repetition. The memory span for the words is inversely proportional to the duration of the words being spoken. Subjects generally can recall the words they say in two seconds (Baddeley, 2000). Baddeley (2012) observed that the effect of word length will reduce the process of memorizing.

There are interesting things from the survey results related to the phenomenon of the word length effect in the phonological loop characteristics. In the process of memorizing the Qur'an, according to 77.78% of the students said that the short verses are even more difficult to remember than the long passages. This means they need more time to remember the verses are short. The survey results were then confirmed to the two teachers and four students, they stated that the word length effect in the context of a long paragraph to memorize the Qur'an is not so affect memorizing them. Conversely, short verses such as in a Ash-Shoffat QS (QS: 37)

dam Arrahman letter more difficult to memorize than the long passages, because the number of verses more.

The articulatory suppression allows to interfere with the exercise performed by the subject subvocal with their repetition of words that are not relevant, as the word 'the'. The word 'the' can hinder the subject to memorize the material. The survey results show as much as 62.96% of participants agreed that they interfere with their articulatory suppression. Teacher confirmed that it will interfere with the recall, for example in the context of the process of memorizing the ghorib. If students add words that are not important or use a sentence that is not effective, then usually it will interfere with memorizing them.

The irrelevant speech effect refers to a decrease in considering the list of items displayed visually at the time of the voices raised irrelevant. A total of 70.73% of participants stated that they were disturbed by the sounds of his friend who was talking at the time of reading and memorizing the Qur'an. But as many as 20, 27% said not disturbed.

The phonological similarity effect. This is an observation that given the composition of the same item with the sound of lowering the memory rather than a different sound. According to Baddeley (2003) in this case because the basic coding involved in phonological storage for the same sound a little difference, therefore, easier to forget. Based on the results of the survey 59.26% of participants stated that it can lower their rote. Examples are sound the same instance of the word a'mmaa ta'maluun with amma ta'lamuun. But as much as 40.74% were not bothered by the problem.

Individual differences

Differences in the response of the participants on the four characteristics of the phonological loop that could affect the processing of information both during encoding and recall of the Qur'an text, indicating the existence of individual differences. Likewise, each individual is different in the speed of memorizing the Qur'an. According to the three teachers that depends on individual ability. However, individuals ability who otherwise have not measured what is meant is IQ or working memory capacity. This is due to both the Tahfidz institution does not require an IQ limit to receive his or her students.

To see an overview participants IQ scores, general intelligence test was conducted to 48 participants (26 female and 22 male), average age 15,7 years old, and in good health on June 3, 2017. The measurement of general intelligence using CFIT Scale 3 Form B is done by psychologist. The test used a paper and pencil test form based on test speed composed of four subtests which are series, classifications, matrices, and condition. The test were performed during 12,4 minutes. IQ profile of participants can be seen in Figure 4..

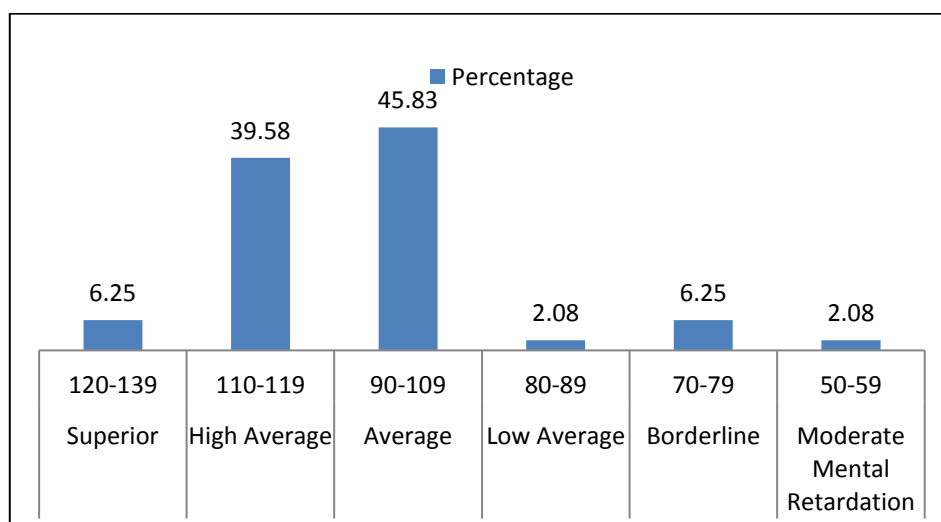


Figure C.4. Percentage of participants based on IQ profile

According to the data of general intelligence measurements based on IQ scores, it appeared that 6.25 % of participants have superior intelligence, 39.58% have intelligence above the average (high average), 45.83% is average, 2.08% is below the average (low average) and 6.25 % is borderline and 2.08% is moderate mental retardation. Figure 4 shows the performance profile IQ (non-verbal). From the above data there is 2.08% which has a borderline IQ qualification, even 2.08% showed moderate mentally retarded. Whether people with these qualifications in verbal skills such as memorizing the Qur'an problematic? Or conversely, whether people with superior IQ qualification has the ability to memorize the Qur'an better than kualifikasi lower IQ?

To confirm the findings, on June 10 2017 academic teachers and teacher Tahfidz in institutions whose students included the category of moderate mentally retarded, average, high average and superior interviewed. According to academic teachers (math teacher), the IQ score profile in accordance with the performance of students in math class. Students who did show superior mathematical skills are very good in any emotional state. Likewise, the students include high average showed almost the same capabilities in addition to the students to study hard. Students who are in the category averages, they could follow the math if diligently. While the students were categorized as moderately mentally retarded can not follow the math well, despite being motivated and be appreciated.

Likewise, the interview was conducted on Tahfidz teacher. The same thing was stated by the Tahfidz teacher that students categorized demonstrated superior ability to quickly memorize, as well as students who are categorized high average or average will have the same speed in memorizing the Qur'an when accompanied by perseverance. However, from the data obtained are students with a superior IQ, but not as much as the amount to be memorized their peers who have the same or lower IQ. According to teacher reports Tahfidz this is because students are less diligent in doing murojaah or repeat rote (rote rehearsal). While the students were categorized as moderate mentally retarded according to him relatively late in memorizing Qur'an, only if diligently able to memorize the Qur'an.

Then, what determines the working memory skills that makes anyone has good or bad working memory skills? This condition related to working memory capacity. The capacity of the working memory refers to the ability to maintain, manipulate and access the mental picture that is required to support a complex cognition. Working memory capacity is closely linked to the ability to maintain attention and as a predictor of achievement (Alloway & Alloway, 2010; Gathercole, Brown, & Pickering, 2003). Besides variations in working memory capacity can predict high-level cognitive abilities such as solving the problem of general fluid (gf) intelligence (Broadway & Engle, 2011). Individuals with greater capacity tend to perform better on cognitive tasks than individuals with a lower capacity. Research on individual differences and variations in working memory, explaining that each individual has limited working memory capacity and relatively fixed and consistent (Jarrold & Towse, 2006; Gathercole & Alloway, 2009). Also, some individual differences in working memory can be explained by the storage capacity. The fundamental characteristic is that working memory capacity is limited, which limits cognitive performance (Conway, Jarrold, Kane, Miyake & Towse, 2007). Some variance in working memory can be attributed to normal cognitive development of individuals as they age. Working memory capacity increased from childhood to adolescence, and at the adult stage has been reached. (Gathercole & Alloway, 2009).

What factors are affecting verbal working memory capacity on Qur'an reciters? the author conducts interviews on 6 students. They say that the factors that affect the ability of verbal working memory are attention, emotion and motivation. Individual differences in maintaining the relevant information related to working memory capacity. Individuals with working-memory capacity of a low have difficulty to ignore information that is not important, so that people with working-memory capacity low, more easy to be distracted from the work being done. Suspected that differences in working memory capacity in individuals related to

differences in attention executive system, which acts as a supervisor in coordinating both processing and storage could also include working memory variants that occur in cognitive tasks of high level. In addition executive control individuals associated with emotion regulation (Hendricks & Buchanan, 2016). Emotions can affect working memory capacity. According to Gray (2001), positive emotions were able to sharpen or reinforce verbal working memory, but weaken or reduce spatial working memory. The study by Yang et al. (2013) found that positive emotions compared to neutral, capable of improving the operating performance on verbal working memory span task. Motivation relationship with working memory capacity is as assumed by Oberauer (2009) that working memory is a system that provides access to an overview for goal-oriented processing. At least in humans it involves processes such as language comprehension, reasoning, planning, thinking hypotheses, and creatively solved problems. The process of memorizing the Qur'an involved working memory. Students who have the intrinsic motivation to achieve the target to memorize several chapters of Qur'an will be able to maintain attention and ignore irrelevant information as a nuisance.

Further research is suggested to conduct experimental research, in order to confirm how the capacity of verbal working memory on Quran reciters and how the role of the factors that influence it.

D. CONCLUSIONS

It can be concluded that there are three stages of the process of memorizing the Qur'an. Each stage is evaluated by *tasmi'* or *sima'* test to ensure the reading standard text of the Qur'an. All significant stage with the concept of working memory. There are differences in response to the phenomenon of phonological loop. The individual difference is because of differences in working memory capacity, rather than differences of intelligence ability (IQ). The executive control ability, emotion, and motivation are factors that affect the increase or decrease in working memory capacity.

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