

CHARACTERISTICS OF SHORT-TERM MEMORY OF MEDICAL STUDENTS AT CAN THO UNIVERSITY OF MEDICINE AND PHARMACY

*Dang Tran Dang Khoa, Nguyen Cao Thien Kieu, Tran Tri Nam, Nguyen Ngoc Han,
Nguyen Huynh Bao Tran, Tran Thi Nhu Y, Pham Kieu Anh Tho, Nguyen Hoang Tin**

Can Tho University of Medicine and Pharmacy

**Corresponding author: nhtin@ctump.edu.vn*

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ABSTRACT

Background: Short-term memory is the foundation of long-term memory, which greatly influences cognitive activities, especially in the field of education. Medical students contribute to showing an overview of the characteristics of short-term memory of medical students in particular and students in general in a developing country like Vietnam. **Objectives:** Surveying the characteristics of visual and auditory short-term memory through numerical data and image data in medical students. **Materials and methods:** Using a cross-sectional descriptive design method on 160 medical students studying at Can Tho University of Medicine and Pharmacy. The study includes surveys of visual and auditory short-term memory using two types of numerical and image information, using a questionnaire built based on the Nachaive method in the form of online through a website app and collected the results via email. **Results:** The median results of visual short-term memory (VSTM) in numerical and image data are 11 and 12 respectively. The VSTM figure in numerical data shows that the highest score is 12 ($f=46$). The VSTM figure in image data records that the score 12 has a dominant frequency ($f=87$). The median results of

auditory short-term memory (ASTM) in numerical and image forms are 10 and 9 respectively. The ASTM figure in numerical data shows that the highest score is 12 ($f=32$). The ASTM figure in image data notes that score 9 has the highest frequency ($f=37$). **Conclusions:** Students of Can Tho University of Medicine and Pharmacy have visual short-term memory that is superior to auditory short-term memory in terms of memorization. The results of visual short-term memory in image data are better than visual short-term memory in numerical data. Conversely, the results of auditory short-term memory in numerical data are better than auditory short-term memory in image data.

Keywords: Short-term memory; visual short-term memory; auditory short-term memory

I. INTRODUCTION

"Memory" is an indispensable condition for humans to have a normal psychological life [1]. I.M. Xesenov affirmed that memory is "the basic condition of psychological life", the "basis of psychological development" [2]. Nowadays, memory is not only considered within the scope of expressing cognitive ability but also the core of human personality. Without memory, there would be no development in life and knowledge [3]. Following the development of the times, science gradually discovered the mechanism of memory and its influence on individual life. Especially short-term memory - the starting door of the memorization process, the premise for building a long-term memory system, thus controlling almost all mental activities [1], [2], [3], [4], [5]. In education, the influence of memory or short-term memory is more clearly shown. The amount of information that students have to access and memorize is immense throughout their study time. Without memory, it is impossible to study and even more impossible to think, so having a fast and good memory is always a major advantage. In recent years, there have been many studies on short-term memory in developed and developing countries [6], [7], [8], [9]. In Vietnam, most of these studies are conducted on elementary, secondary, and high school students [10], [11], [12], [13]. Nowadays, there are very few studies on university students, especially medical students and students in health majors. The specialized study requires high sensitivity, thinking, and memorization ability of learners to handle a huge amount of medical knowledge." Therefore, we conducted this study to survey the characteristics of visual and auditory short-term memory of medical students, thereby contributing to showing an overview of the short-term memory ability of students in a developing country like Vietnam.

II. MATERIAL AND METHODS

2.1. Materials

2.1.1. Study population

The study was conducted on medical students of the regular system studying at Can Tho University of Medicine and Pharmacy.

2.1.2. Inclusion criteria

In this study, we selected the students who followed the curriculum of the school and agreed to participate in the research.

2.1.3. Exclusion criteria

The study did not select the students who had one of the following factors: A history of neurosurgery diseases; Being treated for acute or mental disorders; Using groups of sedatives such as benzodiazepines, anticonvulsants, addictive analgesics (opioids), dopamine agonists.

2.1.4. Time and place of the study

The study was conducted at Can Tho University of Medicine and Pharmacy from August 2021 to August 2022.

2.2. Methods

2.2.1. Study design

This was a cross-sectional descriptive study.

2.2.2. Samples and sampling

$$n = \frac{S^2 \cdot t^2}{d^2}$$

With:

n: is the estimated sample size for the study

S: is the standard deviation calculated as a percentage of the mean, also known as the coefficient of variation - CV (from the preliminary investigation we take CV=30% of the mean).

t: is the value corresponding to the preselected reliability of the result. With $p=0.05$ and $n = \infty$, t has a value of 1.968.

d: is the preselected allowable error of the mean is $\pm 5\%$ (95% confidence).

The estimated minimum sample size is 139 students. Our study surveyed 160 students. Using a simple random sampling method, we select 2 to 3 students per class in each course.

2.2.3. Study contents

Based on the theoretical basis, we study two types of short-term memory: visual short-term memory (VSTM) and auditory short-term memory (ASTM).

Visual short-term memory (VSTM) involves the reception of stimuli signals from cone and rod cells in the retina that create action potentials in bipolar cells. The impulses from here follow the optic nerve and are transmitted to the visual cortex in the occipital lobe. The visual center is divided into two regions: (1) Primary visual area: directly receives impulses from the eyes, giving us sensations of light, darkness, and color, allowing us to see objects; (2) Secondary visual area: receives impulses from the primary visual area, playing a role in analyzing the meaning of images.

Auditory short-term memory (ASTM) has the organ of perception as the ear consisting of the outer ear, middle ear, and inner ear; sound moves in the air in the form of sound waves from our ear to the auditory area of the cerebral cortex located in the temporal lobe. The auditory center is divided into two regions: (1) the primary auditory area: which directly receives impulses from the ear, giving us sensations of sound, and (2) the secondary auditory area: which receives impulses from the primary auditory area, which is the cognitive auditory area that plays a role in analyzing the meanings of sounds heard.

From these two methods of receiving information, we developed two pairs of surveys using data in numerical and image data. The questionnaire was built using the Nechaiev method [10], [14]. A table of 12 digits or images was randomly selected (not using special digits) and arranged without following any rules. We designed a website to put the questionnaire that we built on. The subjects will provide information and take the test directly on the website. The results will be sent to us via email. The subjects will observe or listen to the content of the information for 30 seconds to memorize it, then have 30 seconds to select the results they have remembered. Corresponding to each digit and image

remembered correctly, one point is counted, and the total is the short-term memory evaluation score.

2.2.4. Statistical analysis

All data collected from the study will be processed by SPSS 20.0 software using medical statistics methods. To test whether a variable has a normal distribution, we use the Kolmogorov-Smirnov test. Our quantitative variables do not have a normal distribution, so they are presented as median, maximum value, and minimum value.

2.2.5. Ethical approval

The study was conducted in compliance with ethical principles in medical research and approved by the Medical Ethics Committee of Can Tho University of Medicine and Pharmacy.

III. RESULTS

3.1. Visual short-term memory (VSTM)

Table 1. Characteristics of VSTM

	Median	Maximum	Minimum
VSTM – Numerical data	11	12	6
VSTM – Image data	12	12	6

VSTM in numerical data and image data has the same highest score of 12 points.

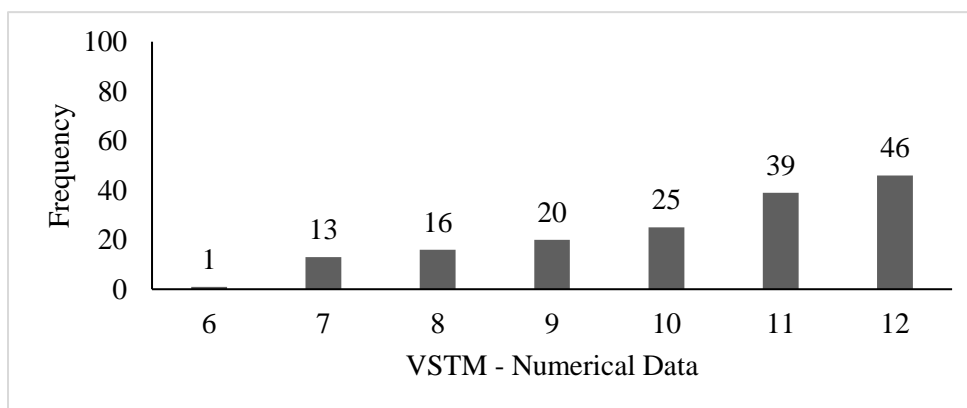


Figure 1. Frequency of VSTM - Numerical data

The result of 12 points has the highest frequency (f=46).

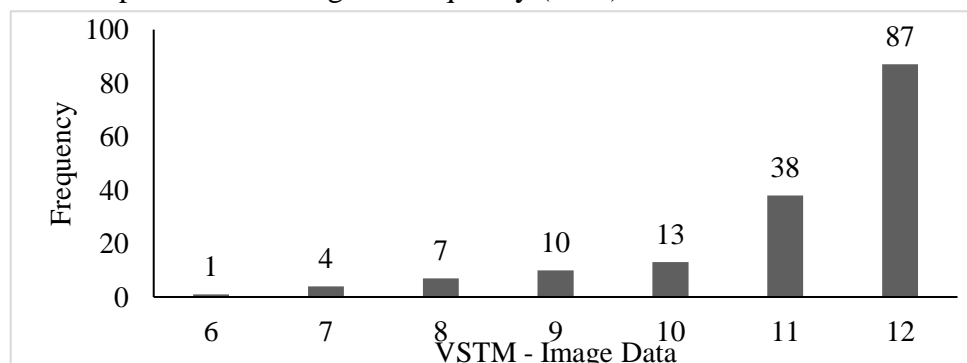


Figure 2. Frequency of VSTM – Image data

The result of 12 points has a dominant frequency compared to other scores (f=87).

3.2. Auditory short-term memory (ASTM)

Table 2. Characteristics of ASTM

	Median	Maximum	Minimum
ASTM – Numerical data	10	12	6
ASTM – Image data	9	12	7

ASTM in numerical data has a median of 10 and ASTM in image data has a median of 9.

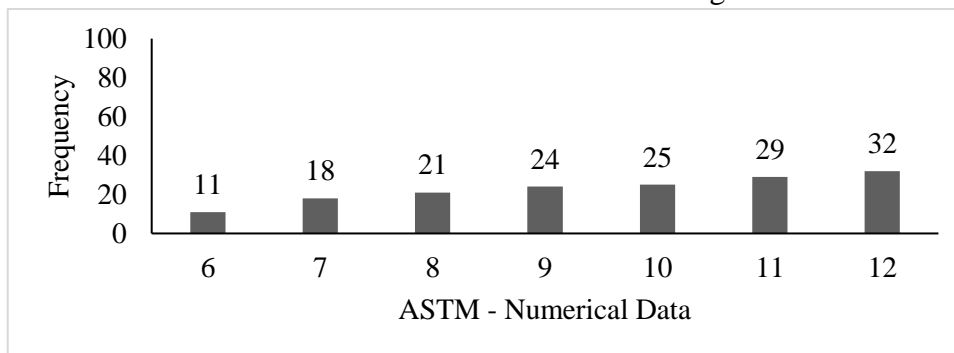


Figure 3. Frequency of ASTM – Numerical data

The result with the highest frequency is 12 points (f=32).

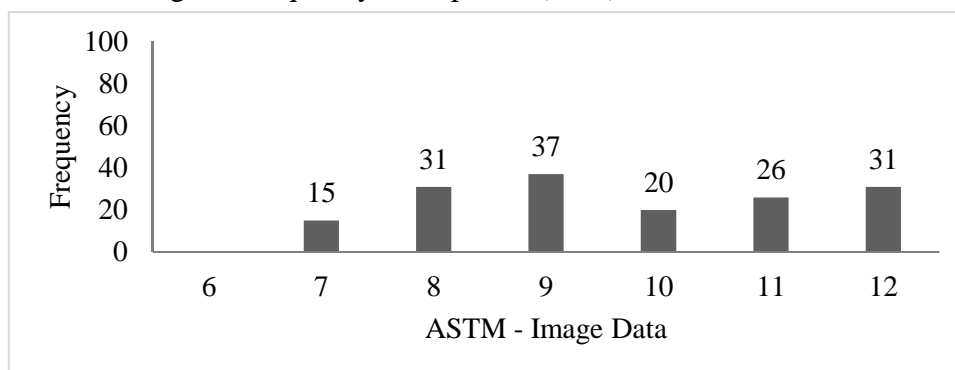


Figure 4. Frequency of ASTM – Image data

The result with the highest frequency is 9 points (f=37).

IV. DISCUSSION

4.1. Visual short-term memory (VSTM)

We conducted a study on VSTM (visual short-term memory) and ASTM (auditory short-term memory) based on two pairs of aspects: numerical and visual, which is different from many authors who only studied VSTM and ASTM using only numerical data [10], [11], [12], [13]. The questionnaire was built based on the Nechaiev method similar to the study of Tran Long Giang [7]. Some studies on ASTM and VSTM in the form of numbers by Nguyen Phi Ho, Ngo Thanh Trang, and Pham Thi Huyen Trang showed some differences when using 10 digits and 20s to memorize [11], [12], [13]. In addition, this study was conducted through online surveys, not directly surveyed like other authors [10], [11], [12], [13]. Based on the physiological basis of memory and the Nechaiev method, we expanded

the construction of ASTM and VSTM questionnaires using image data. This is completely new compared to previous studies.

The results of the study recorded high scores with a relatively high proportion, so the distribution of scores did not follow a normal distribution. While the studies of Tran Long Giang, Nguyen Phi Ho, Ngo Thanh Trang, and Pham Thi Huyen Trang had normal distributions, comparing and analyzing based on the mean value. This can be explained because the input of general medicine requires a very high amount of knowledge and information, which requires students to practice thinking and memorizing well. That is the reason why most students of general medicine in the regular system have a better ability to receive and remember information. Besides, the above studies surveyed all students, regardless of academic performance or natural social groups [10], [11], [12], [13].

The study recorded the result of numerical VSTM with a median of 11 points, the highest score of 12, and the lowest score of 6. In Figure 1, the groups of scores 10–12 have a higher frequency than those of scores 6–9. The difference between the two groups is there, but it is not very clear. This result shows that students at Can Tho University of Medicine and Pharmacy have relatively good visual short-term memory in the form of numerical information. The image VSTM has a median of 12 points; the highest and lowest scores are 12 and 6, respectively. Figure 2 records that the score of 12 has a dominant frequency completely compared to other scores ($f = 87$). This shows that the ability to remember short-term information through image data is good for students.

From the results of both forms of visual short-term memory survey data, it is shown that the image VSTM is better than the numerical VSTM. VSTM in image data has a higher median than VSTM in numerical data ($12 > 11$). The difference is more clearly shown in Figures 1 and 2. While in Figure 1, the difference between groups is not too significant, Figure 2 records that the score of 12 has a higher frequency than other scores. This shows that for Can Tho University of Medicine and Pharmacy students, visual short-term memory in image data has an advantage over numerical data.

4.2. Auditory short-term memory (ASTM)

The numerical ASTM results have a median of 10 points; the highest score is 12, and the lowest is 6. Figure 3 records that the frequency of the score groups is not too different; however, score groups 10–12 still have a higher frequency than the remaining groups. This difference is not clear enough to show whether the short-term auditory memory level for numerical data in students is good or not. Still, it can suggest that when memorizing numerical information through hearing, there are difficulties and obstacles during the process of memorizing and reproducing information. The image ASTM results have a median of 9, the highest score is 12, and the lowest is 7. In figure 4, it shows a complete difference from the other short-term memory survey groups. Score 9 has the highest frequency ($f = 37$), and score 8 also has a relatively high frequency ($f = 31$), which is equal to the frequency of score 12 ($f = 31$). The score groups 10–12 have a relatively lower frequency. This difference shows that in the process of memorizing images through hearing, there is much more complexity than in the process of memorizing images through vision (The image VSTM: score 12 has $f = 87$), leading to results at a fairly high level.

From the above results, we see that the numerical ASTM has a higher median than the image ASTM ($10 > 9$). Figures 3 and 4 also record the difference between these two

types of data. In figure 4, it shows that the highest frequency score is 9, and the score levels 10–12 have a lower frequency. Figure 3, shows a completely different result when the score 12 has the highest frequency and the distribution of scores at levels 10–12 still accounts for a high proportion. This difference may be due to the image-based questions we constructed being different from the memory habits of the research subjects. Most data in numerical form does not require too much analysis in the memorization process because it is a common characteristic of data in mathematics. While nouns indicating objects are often multi-syllabic words through reading and listening, those can become a major obstacle when having to analyze and memorize.

Besides comparing the types of data memorized in each type of short-term memory, we record that numerical VSTM is better than numerical ASTM (median: 11 > 10), and image VSTM is better than image ASTM (median: 12 > 9). The above results show that VSTM is better than ASTM in both aspects of numerical data and image data. Similar to the research results for ages 6–17 by author Tran Long Giang (2017) [10]. In the study of author Elizabeth Hilton (2001), which also shows similar results, she affirmed that visual short-term memory (VSTM) has a longer memory duration and a higher accuracy rate than auditory short-term memory (ASTM), proving that visual reception has a better memory ability than auditory reception. Elizabeth Hilton also believes that short-term memory can be improved if the process of repeated memorization practice through hearing can increase the accuracy of auditory short-term memory [15].

V. CONCLUSIONS

The medical students at Can Tho University of Medicine and Pharmacy recorded that the median of VSTM in both types of data was higher than ASTM. This partly proves the advantage of memorizing through vision better than through hearing. In VSTM, image data was more beneficial than numerical data. Conversely, this study recorded that ASTM numbers were better than ASTM images.

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