A Study of Types of Memory in Learning Mandarin

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ABSTRACT

Memory is the ability to retrieve what has been learnt and retained. In order to acquire memory, learners need to process incoming information and store it in the brain. Miller (1956) reports that when learners gain new knowledge, the new knowledge first enters the sensory memory, then the short-term memory and finally the long-term memory. Aben et al. (2012) further adds that learners need to process the knowledge in the working memory before the knowledge can stay in the long-term memory. This quantitative study was conducted to explore the information processing of undergraduate students studying Mandarin in Malaysia. A purposive sample of 30 participants responded to the survey. The instrument used is a 5 Likert-scale survey and is rooted from Miller (1956) and Aben et al. (2012). The survey has 4 sections. Section A has items on demographic profile. Section B has 6 items on sensory memory. Section C has 6 items on short-term memory. Section D has 6 items on long-term memory and section E has 7 items on working memory. Overall, respondents gave positive feedback on their perceptions of various types of memory when learning Mandarin. In order to improve students' learning, memory enhancement plays an important role. Therefore, the teacher may begin by identifying the students' existing memory strategies and helping them to assess their level of success. In addition, the teacher may need to suggest various models or strategies. After all, students should be encouraged to perform memory tasks and assess which model or strategy could lead to better results for them.

Keywords: memory, information processing, learning Mandarin

INTRODUCTION

Background of Study

Memory is the ability to retrieve what has been learnt and retained (D' Souza & Avati, 2021). The relationship between memory and learning has been defined as 'memory is a change in behaviour caused by an experience, while learning is the process of acquiring a memory' (Okano et al., 2000). In order to acquire memory, learners need to process incoming information and store it in the brain. The structure of human memory was originally proposed by Atkinson and Shiffrin (1968) and is often described within the framework of information processing theory (Eggen & Kauchak, 2014).

Woolfolk (2007) elaborates on information processing theory stating that processing involves encoding (collecting information and organising it based on what is known), storage (holding information) and retrieval (accessing information when needed). For meaningful learning to take place, where information is

transferred from the working memory to the long-term memory, information processing has to occur (Van der Merwe, 2013). Until now, information processing theory remains a widely accepted basis for learning and teaching. It contributes to understand aspects of cognition and inform instruction by emphasising the presentation of information in meaningful ways enable students to connect new and existing information for long-term learning.

Statement of Problem

The process of brain development is important in the teaching and learning process (Krause et al., 2009). Information processing theory views humans as computers that input, process, store and retrieve information. The brain's neural processing system is the hardware, the rules of reasoning (e.g., data processing) are the software, while input fuels output as behaviour and beliefs (Masuda & Nisbett, 2001). Information processing theory and analogies between thinking and computers help to show that information is transferred from different memory stores and to understand cognition, learning processes and pedagogical development (Gurbin, 2015).

In language teaching and learning, a great deal of research has been conducted on the memory system based on information processing theory, with great emphasis on the cognitive processes of second language learners. For example, Liang (2021) mentioned that vocabulary acquisition is a complex process that is closely related to memory. Research results show that attention, synthesis and memory play an important role in the cognitive process. Vocabulary can be acquired more effectively if teachers consciously adopt strategies such as assigning interactive questions and providing familiar information. Darmuki et al. (2017) also found that cooperative learning based on information processing improves students' speaking skills.

A study by Grenfell & Harris (2015) demonstrated that 11-15 year old beginners learning Mandarin as a foreign language in an inner London school used their own strategies to memorise Chinese characters. In addition to using 'generic' strategies common to learning any language, the students developed strategies specific to Mandarin. Principal Axis Factor Analysis showed that beginners filtered their 'prior knowledge' to identify 'labels' for memorising characters. This finding is consistent with a study conducted by Rahmat (2024), which mentioned that language learners need to process information in order to communicate in the target language. However, the researcher suggest that future research could investigate specific language learning strategies and their relationship to learners' information processing.

Objective of the Study and Research Questions

Therefore, this study is done to explore perception of learners on their use of learning strategies. Specifically, this study is done to answer the following questions:

- How do learners perceive sensory memory in the learning of Mandarin?
- How do learners perceive short-term memory in the learning of Mandarin?
- How do learners perceive long-term memory in the learning of Mandarin?
- How do learners perceive working memory in the learning of Mandarin?

LITERATURE REVIEW

Difficulties in Learning Mandarin

According to Sim et al. (2021), learning Mandarin as a foreign language is quite challenging for beginners. The uniqueness of Mandarin tones, the uniqueness of Chinese characters, and the lack of distinct morphological symbols are the difficulties in learning Mandarin. In the study by Chu et al. (2024), which focused on Mandarin tones, the researchers agreed that Mandarin, as a tonal language, is often considered

difficult to perceive for speakers of non-tonal languages. Therefore, a step-by-step approach to teaching and learning (starting with monosyllables and moving on to disyllables) is logical. Grenfell & Harris (2015) found that Chinese characters is challenging to spell as it consists of 'characters', 'radicals', and 'strokes'. There are 28 different types of strokes, and the number of strokes per character can range from 1 to 30. Radicals are the basic units of phonology and morphology. Characters can consist of a single radical (whole) or two or more (compound). Similarly, Huang (2000) and Guo et al. (2022) also agreed that writing Chinese characters is the most difficult in learning Mandarin. In addition, Mandarin grammar does not rely on morphological changes, but mainly uses word order and function words to express grammatical relations and grammatical meanings, so Mandarin learners whose mother tongue is a language with a lot of word form changes will definitely not be able to adapt to Mandarin grammar (Rahmat et al., 2020).

Information Process

According to Srivastava & Srivastava (2019), information processing theory describes the process by which the human brain receives, processes and stores information and the way it retrieves it. George A. Miller (1956), an American psychologist, developed the information processing theory, which explains how the brain receives a stimulus, processes it, stores it, localises it, and then responds to it. Information processing theory is an approach to human cognitive development that involves studying and analysing the sequence of events that occur in the human brain when some new information is received. Learning, says Miller, is simply a change in the knowledge stored in memory. In short, it is an analysis of the way humans learn new things. There is a fixed pattern of events that occur in this context, and by understanding this pattern we can enable children and adults with special abilities to learn new things more quickly. Information processing theory plays an important role in second language learning. The information processing theory of acquiring a second language suggests that learning a new language involves several basic processes. Attention, encoding, rehearsal, storage, and retrieval are all aspects that lead to the mastery of those mental representations that allow a person to process information in the new language (Altarriba & Basnight-Brown, 2009).

Past Studies on Information Processing

Many studies have been conducted to investigate information processing for language learning. Shahid et al. (2022) studied the application of information processing theory in memory, language and working memory. The researchers mentioned that the information processing theory is a reaction to behaviourism, proposing that the brain processes information in stages. The study delves into the main ideas of bottom-up and top-down processing, shedding light on how sensory input is transformed into higher cognitive processes. This study provides a comprehensive analysis of the literature on information processing theory, memory, language and working memory, including recent developments in cognitive neuroscience. Information processing theory has been found to be useful in understanding how the brain processes information. The link between memory and language is crucial and language processing is essential for memory.

In a study by Nur, L. et al. (2020), the effectiveness of the information processing learning model in improving Arabic reading skills among Islamic high school students was analysed. The study was conducted using a quasi-experimental approach with a pre-test-post-test design consisting of an experimental and a control group. The treatment was conducted systematically according to the 8 learning steps in the information processing model. Data were analysed using descriptive statistics and t-tests. The results of the study showed that the learning model of statistical information processing improves students' performance related to their ability to read Arabic, but the effectiveness of this learning model is still below the expected minimum standard as far as achievement is concerned.

Rahmat (2024) conducted a quantitative study explored language learners' perceptions of their information processing. A purposive sample of 154 participants responded to the survey. The results of the survey

showed that learners reported their information processing through sensory memory, short-term memory and working memory to store long-term memory. In addition, the study demonstrated interesting relationships between different types of memory in language learners. There was a strong positive correlation between sensory and short-term memory. In addition to that, there is also a strong positive correlation between short-term memory and working memory. Secondly, there is also a strong positive correlation between working memory and long-term memory as well as between long-term memory and sensation.

Conceptual Framework

Figure 1 shows the conceptual framework of the study. This study explores the relationship of all types of memory in the learning of Mandarin. According to Rahmat (2020), learners store knowledge so that the knowledge can be transformed into memory to be used later in future learning. Miller (1956) reports that when learners gain new knowledge, the new knowledge first enters the sensory memory, then the short-term memory and finally the long-term memory. Aben et al. (2012) further adds that learners need to process the knowledge in the working memory before the knowledge can stay in the long-term memory. Miller (1956) states that sensory memory involves echoic, iconic and haptic memory. Short-term memory involves phonological, spatial and visual. Long-term memory involves declarative or explicit memory, as well as non-declarative or implicit memory. Aben et al. (2012) states that working memory involves central executive, visuospatial sketchpad, phonological loop and also episodic buffer.

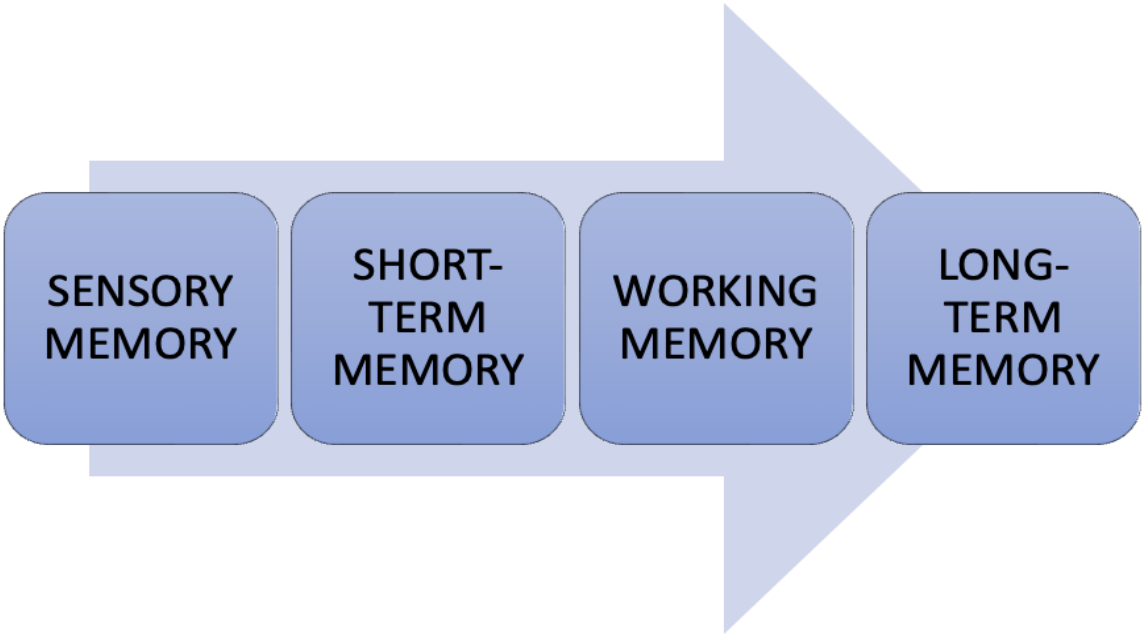

Figure 1- Conceptual Framework of the Study

A Study of Types of Memory in the Learning of Mandarin

METHODOLOGY

This quantitative study is done to explore information processing among undergraduates who are learning Mandarin in Malaysia. A purposive sample of 30 participants responded to the survey. The instrument used is a 5 Likert-scale survey and is rooted from Miller (1956) and Aben et al. (2012) to reveal the variables in table 1 below. The survey has 4 sections. Section A has items on demographic profile. Section B has 6 items on sensory memory. Section C has 6 items on short-term memory. Section D has 6 items on long-term memory and section E has 7 items on working memory.

Table 1- Distribution of Items in the Survey

SECTION	TYPE OF INFORMATION PROCESSING	TYPE OF MEMORY	SUB-COMPONENT	ITEM		Cronbach alpha
A	Sensory Memory Miller (1956)	Echoic memory		2	6	.925
		Iconic memory		3		
		Haptic memory		1		
B	Short-Term Memory Miller (1956)	Phonological		2	6	.941
		Spatial		2		
		Visual		2		
C	Long-Term Memory Miller (1956)	Declarative or Explicit Memory	Episodic Memory	2	6	.945
			Semantic Memory	3		
		Non-Declarative or Implicit Memory	Procedural Knowledge	1		
D	Working Memory Aben et al. (2012)	Central Executive		3	7	.956
		Visuospatial Sketchpad		2		
		Phonological Loop		1		
		Episodic Buffer		1		
	Total number of items			25		.982

Table 1 also shows the reliability of the survey. SPSS analysis was carried out to determine the reliability of the instrument. Individual analysis shows a Cronbach alpha of .925 for Sensory Memory, a Cronbach alpha of .941 for Short-Term Memory, a Cronbach alpha of .945 for Long-Term Memory, a Cronbach alpha of .956 for Working Memory and an overall Cronbach alpha of .982 for all 25 items; thus, revealing a good reliability of the instrument chosen. Further analysis using SPSS is done to present findings to answer the research questions for this study.

FINDINGS

Findings for Demographic Profile

Table 2- Percentage for Gender

1	Male	23%
2	Female	77%

Table 2 shows the percentage for gender. 23% are male while 77% are female respondents.

Tabe 3- Percentage for Discipline

1	Engineering	30%
2	Applied Sciences	47%

3	Built Environment	10%
4	Computing, Informatics and Mathematics	13%

Table 3 above shows the percentage for discipline. 30% are from Engineering. 47% of the respondents are from Applied Sciences. 10% of the students are from Built Environment while 13% are from Computing, Informatics and Mathematics.

Table 4- Percentage for Level of Study

1	Degree	100%
2	Diploma	53%

Table 4 presents the percentage for Level of study. Only students from degree responded to the survey.

Table 5- Percentage for Mandarin level

1	Level 1	50%
2	Level 2	10%
3	Level 3	40%

Table 5 shows the percentage for Mandarin level. 50% of the respondents are studying Level 1. Next, only 10% are at Level 2 while 40% are at level 3.

Findings for Sensory memory

This section presents data to answer research question 1- How do learners perceive sensory memory in the learning of Mandarin?

Table 6- Mean for SENSORY MEMORY

Item	Mean
BSMQ1 I understand new words immediately when I HEAR it being said	3.9
BSMQ2 I remember new words immediately after I HEAR it	3.8
BSMQ3 When I SEE new words for the first time, I try to understand it	4.2
BSMQ4 When I SEE new words in for the first time, I try to remember it	4.2
BSMQ5 After learning new words, I will use it in my communication	3.9
BSMQ6 I can remember better things if I can TOUCH them	4

Table 6 above presents the mean for sensory memory. Two items share the highest mean of 4.2 and they are “BSMQ3 When I SEE new words for the first time, I try to understand it” and “BSMQ4 When I SEE new words in for the first time, I try to remember”. Next, the item “BSMQ6 I can remember better things if I can TOUCH them” had a mean of 4. The lowest mean is 3.8 for the item “BSMQ2 I remember new words immediately after I HEAR it”.

Findings for Short-term memory

This section presents data to answer research question 2- How do learners perceive short-term memory in the learning of Mandarin?

Table 7- Mean for SHORT-TERM MEMORY

	Mean
CSTMQ1 I am able to REMEMBER how to pronounce a new word after I hear it	4.2
CSTMQ2 I am able to REPEAT how to pronounce a new word after I hear it	4.3
CSTMQ3 I can recall different locations of objects	3.9
CSTMQ4 I can recall different relationships of information given to me	4.1
CSTMQ5 I can remember the faces of people I have seen only once	4
CSTMQ6I can remember specific details about objects, building or places	4

Table 7 above shows the mean for short-term memory. The highest mean is 4.3 for the item "CSTMQ2 I am able to REPEAT how to pronounce a new word after I hear it". Next, the item "CSTMQ1 I am able to REMEMBER how to pronounce a new word after I hear it" had a mean of 4.2. The lowest mean is 3.9 for the item "CSTMQ3 I can recall different locations of objects".

Findings for Long-term memory

This section presents data to answer research question 3- How do learners perceive long-term memory in the learning of Mandarin?

Table 8- Mean for LONG-TERM MEMORY

	Mean
DLTMQ1 I can remember information about recent past events	4
DLTMQ2 I can remember information about recent or past experience	4
DLTMQ3 I easily recall words and their meaning	3.9
DLTMQ4 I easily recall facts about the things around me	4
DLTMQ5 I easily recall information that I have memorized	4
DLTMQ6 I can easily recall how things are done	4

Table 8 shows the mean scores for long-term memory. Only one item had a mean of 3.9 and it is "DLTMQ3 I easily recall words and their meaning". Five items share the same mean of 4 and they are "DLTMQ1 I can remember information about recent past events", "DLTMQ2 I can remember information about recent or past experience", "DLTMQ4 I easily recall facts about the things around me", "DLTMQ5 I easily recall information that I have memorized" and "DLTMQ6 I can easily recall how things are done".

Findings for Working memory

This section presents data to answer research question 4- How do learners perceive working memory in the learning of Mandarin?

Table 9-Mean for WORKING MEMORY

	Mean
EWMQ1 I can direct my attention when I need to	4.1
EWMQ2 I can maintain my task goal when I am working	4
EWMQ3 I am able to organize, plan and carry out my tasks efficiently	4.1

EWMQ4 When I want to remember anything, I try to recall what they look like	4.3
EWMQ5 When I want to remember anything, I try to recall the location of the object	4.2
EWMQ6 I can easily remember words I hear	3.9
EWMQ7 I can easily repeat words I have heard	4

Table 9 shows the mean for working memory. The highest mean is 4.3 for the item "EWMQ4 When I want to remember anything, I try to recall what they look like". This is followed by the item "EWMQ5 When I want to remember anything, I try to recall the location of the object" with a mean of 4.2. The lowest mean is 3.9 for "EWMQ6 I can easily remember words I hear".

CONCLUSION

Summary of Findings and Discussions

Overall, respondents gave positive feedback on their perceptions of various types of memory when learning Mandarin. The respondents can understand new words or things better when they have a sensory memory (see hear, and touch) for them. Through the experience gained, the respondents were able to remember and repeat the new words they learnt, which means that they gained short-term memory in their learning. Subsequently, the respondents managed to retrieve the learnt knowledge stored in their long-term memory. They were able to apply and implement the learnt knowledge while performing the task. This change in the learning process fulfils the information processing theory proposed by Miller (1956), which explains how the brain receives a stimulus, processes it, stores it, localises it and then responds to it. Learning is simply a change in the knowledge stored in memory. In short, it is an analysis of the way humans learn new things.

The findings are also in line with the suggestion of Shahid et al. (2022) that information processing theory is a reaction to behaviourism, proposing that the brain processes information in stages. This study reported that sensory input can be translated into higher cognitive processes as suggested by Shahid et al. (2022). Therefore, more strategies can be used to improve respondents' Mandarin learning as demonstrated by Nur, L. et al. (2020) in their study on Arabic language.

Pedagogical Implications and Suggestions for Future Research

In order to improve students' learning, memory enhancement plays an important role. Therefore, the teacher may begin by identifying the students' existing memory strategies and helping them to assess their level of success. In addition, the teacher may need to suggest various models or strategies. After all, students should be encouraged to perform memory tasks and assess which model or strategy could lead to better results for them.

Further research may focus on how people incorporate new knowledge or new linguistic patterns into their memory through more technologically advanced means of learning and pay more attention to forms of diversity in linguistic structures and the relationship between diversity and new patterns of learning.

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