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Exploring Information Processing among Language Learners

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Abstract

One of the main skills that learners need to have is the skill to process information. Learners need to process the information received so that it can be stored successfully for future use. Similarly, learning a language requires learners to process information so that they can use the target language for communication in future. This quantitative study explores the perception of language learners on their information processing. A purposive sample of 154 participants responded to the survey. The instrument used is a 5 Likert-scale survey and is rooted from (Miller's, 1956; Aben,et.al., 2012). Findings revealed that learners reported their use of information processing via sensory memory, short-term memory through working memory for storage in the long-term memory. In addition to that, this study also showed interesting relationships of different types of memory for language learners. There is also a strong positive relationship between sensory and short-term memory. Next, there is also a strong positive relationship between short-term and working memory. There is also a strong positive relationship between working and long-term memory and a strong positive relationship between long-term memory and sensory. Findings in this study bear interesting implications in language learning and interaction.

Keywords: Language Learning, Sensory Memory, Short-Term Memory, Working Memory, Long-Term Memory

Introduction

One of the main skills that learners need to have is the skill to process information. Learners need to process the information received so that it can be stored successfully for future use. Broadbent (1958) presented a model that explains how learners process information (refer to figure 1). He states that learning begins when the learner receives the stimulus for learning. This information then passes through the input processes. Next, the information will be stored after undergoing storage processes. From the storage processes, the information will go through the output processes to enable the learner to create a response to the learning done.

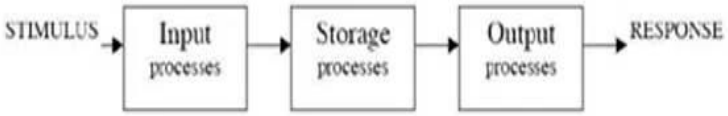

Figure 1- Information Processing (source: Broadbent, 1958)

Nevertheless, for many, remembering information is not automatic. Learners need to make conscious efforts to store the information for future use and understanding. Watson's (1930) theory of behaviourism explains that the external factors are needed to ensure information is stored. This can be done through repetition to reinforce the remembering of the information. However, does the process of language learning go through similar information processing?

Darmuki,et.al (2017) reported that the use of information processing is evident in language learning. They conducted a study to show the effectiveness of information processing cooperative learning in the language classroom. In addition to that Fourie and Schlebusch (2022) also reported that the language of learning influenced the way learners process information. They suggested that future researchers look further into information processing and language.

This study is done to explore perception of learners on their use of information processing in language classrooms.. Specifically, this study is done to answer the following questions;

- How do learners perceive their use of sensory memory?
- How do learners perceive their use of short-term memory?
- How do learners perceive their use of working memory?
- How do learners perceive their use of long-term memory?
- Is there a relationship between all types of memory in learning?

Literature Review

Information Processing and. Language Learning

Learning a language involves learners processing information as well. According to Srivastava & Srivastava (2019), there are several components involved when learners process information for language learning. The three major components are (a) perception, (b) parsing and (c) utilization. The first stage of learning a language is perception where the learners attend to sound patterns and transfer this into their working memory. When learners learn a language, they learn better in a conducive environment. When learners are exposed to the language, they would construct a mental representation of that learning situation and this is called parsing. The last component in language learning is utilization. Learners need to be able to use the language in the context they are used.

Just like any types of learning, successful language learning requires learners to follow processing principles. According to Srivastava & Srivastava (2019), there are three information processing principles. The first principle is (a) advance organizers. Learners need to be guided to connect new materials with prior learning. Next, language learners need to adhere to the (b) conditions of learning. Learners learn best when the learning activity takes place at right circumstance. The last condition is (c) cognitive load. This involves the learners understanding their own capacity to learn.

Once the information is processed, others factors are also involved to maximise learning. Gagné (1984) suggested five types of learning outcomes for learners. Firstly, learners need (a) intellectual skills. These include the use of rules, procedures and even concepts. These skills involve the use of procedural knowledge or production and are needed to learn skills such as speaking, writing and reading, Next, learners also need (b) verbal information and this involves learners understanding facts or meaningful information. The third outcome is (c) cognitive strategies. This involves the learners attending to the new information, making decisions, and making elaborations. These involve the learners using their long-term memory especially retrieval strategies and also problem- solving strategies. The forth outcome is (d) motor skills. According to Ericsson, et.al (1993), these skills are developed through movements gained through practice. The last outcome is (e) attitude. Learning involves learners having attitude towards the success and can include the internal beliefs of the learners.

Past Studies on Information Processing

Fourie and Schlebusch (2022) explored how learners process information in the classroom. They conducted a quantitative study using the hierarchical linear modelling (HLM). They assumed that through learning, the learner's cognition can develop long-term changes in their mental representation. They also believed that the environment play an important role in learning experiences. The independent variables are age, home language, language of learning and teaching (LOLT) as well as the average size of the class. Findings revealed that the information ability of learners are significantly influenced by the variables such as age, home language, language of learning and teaching and the average size of the class.

Next, the study by Darmuki,et.al (2017) was done to evaluate the effectiveness of information-processing cooperative learning and teaching speaking and also to find if there is any significant differences for pre and post information-processing cooperative teaching. This mixed method research was carried out in a university in Indonesia. The instruments used were questionnaire, interview questions and speaking test. Findings revealed that there is a significant difference between pre and post test of cooperative model in the classroom.

Conceptual Framework

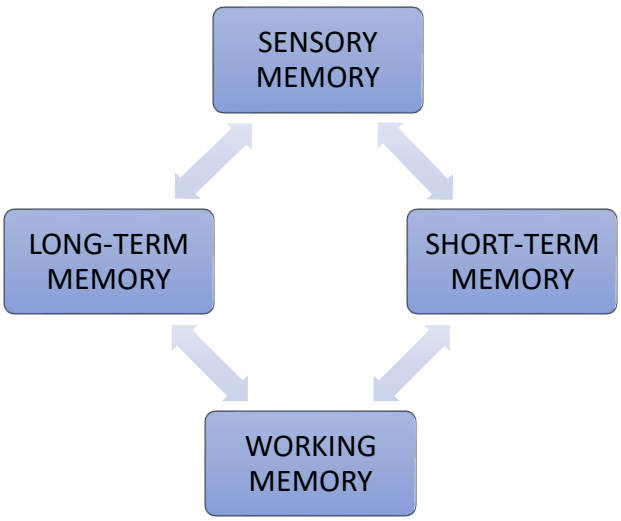

Figure 2-Conceptual Framework of the Study

Information Processing among Language Learners

Figure 2 above shows the conceptual framework of the study. This study explores the perception of language learners in their information processing strategies. The study is rooted from Miller's (1956) information processing such as sensory memory, short-term memory, and long-term memory. In addition to that the framework of the study includes working memory by (Aben et. al., 2012). Based on the framework, in the learning process, information received by the learner first goes to the sensory memory. Information goes to the sensory memory almost automatically as they are received via the five senses; hearing, vision, touch, smell, and taste. However, information in the sensory memory is stored momentarily. Some effort is needed from the learners to allow the information to store longer and enter the short-term memory. To achieve long-term memory storage, teachers can provide learning activities. Nevertheless, in order for permanent storage and future usage of the information into this long-term memory, teachers need to enhance learners working memory through the execution of cognitive tasks.

Methodology

This quantitative study is done to explore motivation factors for learning among undergraduates. A purposive sample of 154 participants responded to the survey. The instrument used is a 5 Likert-scale survey and is rooted from Miller's (1956) information processing and Aben,et.al (2012) for working memory to reveal the variables in table 1 below. The survey has 4 sections. Section A has items on demographic profile. Section B has 14 items on reading difficulties. Section C has 17 items on global strategies. Section D has 8 items on problem-solving strategies and section E has 9 items on support strategies.

Table 1
Distribution of Items in the Survey

SECTION	TYPE OF INFORMATION PROCESSING	TYPE OF MEMORY	SUB-COMPONENT			C.A
B	Sensory Memory (BSM) Miller (1956)	Echoic memory		2	6	.812
		Iconic memory		3		
		Haptic memory		1		
C	Short-Term Memory (CSTM) Miller (1956)	Phonological		2	6	.840
		Spatial		2		
		Visual		2		
D	Long-Term Memory DLTM) Miller (1956)	Declarative or Explicit Memory	Episodic Memory	2	6	.956
			Semantic Memory	3		
		Non-Declarative or Implicit Memory	Procedural Knowledge	1		
E	Working Memory(EWCM)	Central Executive		3	7	.903
		Visuospatial Sketchpad		2		

	(Aben,et.al, 2012)	Phonological Loop		1		
		Episodic Buffer		1		
	Total number of items			25		.964

SPSS analysis was carried out to determine the internal consistency of the instrument. The analysis revealed individual Cronbach alpha for each section of the survey. Table 1 also shows the individual reliability of the survey. The items on Sensory Memory was found to have a Cronbach alpha of .812. Next, the section on Short-Term Memory has a Cronbach alpha of .840. The section on Long-Term Memory has a Cronbach alpha .956 . while the section on Working Memory has a Cronbach alpha of .964. Thus, the instrument was found to have good internal reliability.

Further analysis using SPSS is done to present findings to answer the research questions for this study. Firstly descriptive analysis was used to answer research questions 1-4 and the findings were presented in the form of mean scores. Next, to answer the last research question, correlation analysis was carried out to determine the relationships of variables.

Findings

Findings for Demographic Profile

Table 2

Percentage for Demographic Profile

Q	ITEM	PERCENTAGE	
1	Gender	Male (48%)	Female (52%)
2	Discipline	Science & Technology (Engineering) -64%	Non-Science (Business & Humanities)-36%
3	Level of Study	Diploma (62%)	Degree (38%)

The findings for demographic profile was presented in the form of percentages .Table 2 above shows the findings for demographic profile. 48% of the participants are male while 52% are female. Next, 64% of the respondents are from the Science & Technology (Engineering) discipline while 36% are from the Non-Science (Business & Humanities). Finally, 62% of the respondents are at the Diploma level while 38% are from the degree level.

Findings for Sensory Memory

This section presents data to answer research question 1- How do learners perceive their use of sensory memory?

Table 3

Mean for SENSORY MEMORY

ITEM	MEAN
BSMQ1 I understand new words immediately when I HEAR it being said	3.5
BSMQ2 I remember new words immediately after I HEAR it	3.4
BSMQ3 When I SEE new words for the first time, I try to understand it	4.
BSMQ4 When I SEE new words in for the first time, I try to remember it	4
BSMQ5 After learning new words, I will use it in my communication	3.8
BSMQ6 I can remember better things if I can TOUCH them	3.9

Table 3 shows the mean for sensory memory. Two items share the highest mean of 4 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 it". Next, the item "BSMQ6 I can remember better things if I can TOUCH them" had a mean of 3.9. The lowest mean is 3.4 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 their use of short-term memory?

Table 4

Mean for SHORT-TERM MEMORY

ITEM	MEAN
CSTMQ1 I am able to REMEMBER how to pronounce a new word after I hear it	3.7
CSTMQ2 I am able to REPEAT how to pronounce a new word after I hear it	3.9
CSTMQ3 I can recall different locations of objects	3.8
CSTMQ4 I can recall different relationships of information given to me	3.7
CSTMQ5 I can remember the faces of people I have seen only once	3.6
CSTMQ6I can remember specific details about objects, building or places	3.7

Table 4 shows the mean for short-term memory. The highest mean is 3.9 for the item "CSTMQ2 I am able to REPEAT how to pronounce a new word after I hear it". Next, the item "CSTMQ3 I can recall different locations of objects" had a mean of 3.8. The lowest mean is 3.6 for the item "CSTMQ5 I can remember the faces of people I have seen only once".

Findings for Working Memory

This section presents data to answer research question 3- How do learners perceive their use of working memory?

Table 5

Mean for WORKING MEMORY

ITEM	MEAN
EWMQ1 I can direct my attention when I need to	3.9
EWMQ2 I can maintain my task goal when I am working	3.8
EWMQ3 I am able to organize, plan and carry out my tasks efficiently	3.7
EWMQ4 When I want to remember anything, I try to recall what they look like	4
EWMQ5 When I want to remember anything, I try to recall the location of the object	3.9
EWMQ6 I can easily remember words I hear	3.8
EWMQ7 I can easily repeat words I have heard	3.7

Table 5 presents the mean for working memory. The highest mean is 4 for the item "EWMQ4 When I want to remember anything, I try to recall what they look like". Two items shared the same mean of 3.9 and they are "EWMQ1 I can direct my attention when I need to" and "EWMQ5 When I want to remember anything, I try to recall the location of the object". The lowest mean is 3.7 and two items shared the lowest mean and they are "EWMQ3 I am able

to organize, plan and carry out my tasks efficiently" and "EWMQ7 I can easily repeat words I have heard".

Findings for Long-Term Memory

This section presents data to answer research question 4- How do learners perceive their use of long-term memory?

Table 6

Mean for LONG-TERM MEMORY

ITEM	MEAN
DLTMQ1 I can remember information about recent past events	3.7
DLTMQ2 I can remember information about recent or past experience	3.9
DLTMQ3 I easily recall words and their meaning	3.6
DLTMQ4 I easily recall facts about the things around me	3.6
DLTMQ5 I easily recall information that I have memorized	3.7
DLTMQ6 I can easily recall how things are done	3.8

Table 6 shows the mean for long-term memory. The highest mean is 3.9 for the item "DLTMQ2 I can remember information about recent or past experience". Next, the item "DLTMQ6 I can easily recall how things are done" had a mean of 3.8. Two items shared the same lowest mean of 3.7 and they are "DLTMQ1 I can remember information about recent past events" and " DLTMQ5 I easily recall information that I have memorized".

Findings for Relationship between all types of Memory

This section presents data to answer research question 5- Is there a relationship between all types of memory in learning?

To determine if there is a significant association in the mean scores between all types of memory, data is anlaysed using SPSS for correlations. Results are presented separately in table 7, 8, 9 and 610below.

Table 7

Correlation between Sensory and Short-Term

Correlations

		SENSORY	SHORTTERM
SENSORY	Pearson Correlation	1	.816**
	Sig. (2-tailed)		.000
	N	154	154
SHORTTERM	Pearson Correlation	.816**	1
	Sig. (2-tailed)	.000	
	N	154	154

**. Correlation is significant at the 0.01 level (2-tailed).

Table 7 shows there is an association between sensory and short-term memory. Correlation analysis shows that there is a high significant association between sensory and short-term memory (r=.816**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between sensory and short-term memory.

Table 8
Short-Term and Working Memory

Correlations

		SHORTTERM	WORKINHG_ MEMORY
SHORTTERM	Pearson Correlation	1	.822**
	Sig. (2-tailed)		.000
	N	154	154
WORKINHG_MEMORY	Pearson Correlation	.822**	1
	Sig. (2-tailed)	.000	
	N	154	154

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8 shows there is an association between short-term and working memory. Correlation analysis shows that there is a high significant association between short-term and working memory (r=.822**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between short-term and working memory.

Table 9
Working memory and Long-Term Memory

Correlations

		WORKINHG_ MEMORY	LONG_TERM
WORKINHG_MEMORY	Pearson Correlation	1	.781**
	Sig. (2-tailed)		.000
	N	154	154
LONG_TERM	Pearson Correlation	.781**	1
	Sig. (2-tailed)	.000	
	N	154	154

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9 shows there is an association between working and long-term memory. Correlation analysis shows that there is a high significant association between working and long-term

memory (r=.781**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between working and long-term memory.

Table 10
Long-Term and Sensory

Correlations

		LONG_TERM	SENSORY
LONG_TERM	Pearson Correlation	1	.793**
	Sig. (2-tailed)		.000
	N	154	154
SENSORY	Pearson Correlation	.793**	1
	Sig. (2-tailed)	.000	
	N	154	154

**. Correlation is significant at the 0.01 level (2-tailed).

Table 10 shows there is an association between long-term memory and sensory. Correlation analysis shows that there is a high significant association between long-term memory and sensory (r=.793**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between long-term memory and sensory.

Conclusion

Summary of Findings and Discussions

In the context of this study, respondents reported that when it comes to sensory memory, learners did not prefer to listen to new information. They need to see the written form to understand to be able to remember it instantly.

Moving on from sensory memory is the ability to store the information at least in the short-term memory. Findings from this study revealed that learners were able to remember is they repeated the word learnt. Repetition is a good way of learning and this concept is taken from Watson's (1930) theory of behaviourism.

Aben,et.al (2012) suggested that activities (in the working memory) to be carried out to encourage learners to shift information from the short-term memory to the long-term memory. Findings for long-term memory showed that learners easily recall past experiences. They can also recall procedural knowledge easily. This study also revealed that activities such as directing learners' attention towards the target learning is a good activity in the working memory. In addition to that, teachers can guide learners to organise, plan and carry out their learning tasks.

Finally, this study also showed interesting relationships of different types of memory for language learners. There is also a strong positive relationship between sensory and short-term memory. Next, there is also a strong positive relationship between short-term and working memory. There is also a strong positive relationship between working and long-term memory and a strong positive relationship between long-term memory and sensory.

Motivations , Contributions & Suggestions for Future Research

This study has shown that for storing information during learning can become a snowball effect from sensory memory to short-term memory. In addition to that, through working memory, learners are able to transfer information into their long-term memory. Language teachers can plan classroom activities that involve collaboration (Darmuki, et.al., 2017) which encourages interaction among learners. According to Vygotsky (1978), interaction enhances learning. Especially for language learning, interaction forces learners to use the target language and in that way enhances their memory of the language use.

Future researchers could look into specific language learning strategies and their relationship to information processing among learners. The study could also focus on the depth of the information processing skills or even the mapping of information processing skills with language strategies.

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