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**LEARNING STRATEGIES OF NON SCIENCE AND SCIENCE
UNDERGRADUATES IN LEARNING MANDARIN**

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Abstract

The study uses survey methods to investigate Mandarin learning strategies of L2 learners. The Strategy Inventory for Language Learning (SILL), a 50-item questionnaire developed by Oxford in 1990 was used to collect the data. 129 Malay undergraduates enrolled in Mandarin II and III courses participated as subjects. To identify the overall means used by degree students, descriptive statistics such as mean and standard deviation of learning strategies for instance memory, cognitive, compensatory, metacognitive, affective, and social strategies were conducted. To ascertain the pattern of learning strategies preferred by Faculty of Accountancy (FPN) and Faculty of Computer Science and Mathematics (FSKM) degree students in learning Mandarin, descriptive statistics mean, and standard deviation of the learning strategies based on faculties were also done. The significant differences in the learning strategies applied by the undergraduates in FSKM and FPN were determined using the Independent Sample t-Test. The findings indicate that the degree students' preferred learning strategies are the metacognitive strategy. Also, regardless of faculty, Metacognitive Strategy ranked as the most preferred learning strategy. According to the studies, the FPN and FSKM undergraduate did not show any statistically significant differences in their use of memory, cognitive, compensatory, metacognitive, affective, or social strategies

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1. Introduction

Since China has become an enormous market in the world, interest in learning the Mandarin language has increased tremendously in many countries. Many people have begun to learn Mandarin because those who speak Mandarin have an advantage in tapping into the Chinese market. This phenomenon can also be seen in Malaysian universities where the number of students learning Mandarin as a foreign or third language has been growing rapidly. For instance, the students' registration of Universiti Teknologi MARA (UiTM) shows that 19,994 undergraduates enrolled for Mandarin language classes at the end of 2022. The Mandarin language has always been the most popular elective courses among other foreign languages. However, learning Mandarin is a challenging task for non-native speakers. The learners are always facing the problems such as insufficient learning time, learning environment (Cheun, 2006), lack of vocabulary (Tan & Hoe, 2009), difficulties in construct basic sentences precisely (Terng & Yin, 2009) and psychological reasons (Tan & Hoe, 2007). Consequently, the purpose of this study is to ascertain how Malay Mandarin learners use language learning strategies to solve learning difficulties and create an easier, quicker, congenial, autonomous, constructive and more "learning easier, faster, more enjoyable, more self-directed, more effective and more transmittable to new circumstances (Oxford, 1990).

The results of this study are hoped to help in the general knowledge of the nature, style, and patterns of strategy utilization of Mandarin as a Third Language learners. Also, the study's results will be crucial to instructors of Mandarin as a third language as they choose strategies, pedagogical approaches, teaching materials, and activities to implement in their language classes.

Language learning strategies (LLSs) is viewed as an important move to ease the challenges for learners to learn a language. Lee (2010) perceived LLSs as varied techniques that assist learners to be better at learning and acquiring the target language. Mayer (1988) mentioned LLSs exist in learners' behaviour which determine the way learners process knowledge from the perspective of cognitive psychology. LLSs are also described as broad strategies and high-level groups of instructional strategies that work together to produce learners' predictable learning results (Schmeck, 1988). Using the right language learning strategies can accelerate learners to experience a more self-directed and easier learning process. Meanwhile, LLSs is also able to build autonomous learning for learners to carry out their learning independently. This statement is supported by Cohen (1998) stating that LLS helps learners to reserve, memories, recall and apply the knowledge in the language learning process. Oxford (1990) highlighted the most essential of LLSs criteria is the ability to construct autonomous learners. Learners can plan and guide their own learning according to their ability and situation rather than depending solely on teachers throughout the learning process. Independent and dynamic learning integrated LLSs have become a part of learning a language.

There exists a very extensive literature on the topic related to LLSs that have been conducted by researchers in learning second language and foreign language. However, much uncertainty still exists about the use of LLSs by comparing both social science and science learners in learning Mandarin as a foreign language. The study has argued that both social science and science students have shown significant differences in using LLSs in learning foreign languages. Mohd Soupi et al. (2022) compared

the use of LLSs by TESL students and non-TESL students which indicated there were no significant differences between these two groups. This is in contrast to study done by Adnan and Anwar (2020) to examine the LLSs used by Art School ESL learners which argued that Metacognitive was the most preferred LLS followed by Compensation is the least used in learning English as Second Language. The contradictory findings from these studies have shown that there are inadequate studies in this aspect.

Literature on the use of LLSs in learning language has provided a view on the significant impact of employing LLSs. Gender plays a crucial role to affect the pattern use of LLSs. Study done by Eng et al. (2022) showed that undergraduates employed memory the most in direct learning strategy, whereas Gan et al. (2022) disputed that undergraduates mostly preferred metacognitive indirect learning strategy for learning Mandarin as a foreign language. Likewise a study done by Thao (2020) asserted that gender factors could affect the low usage of autonomous English LLSs by ESL learners at a technical Ho Chi Minh City- based university in Vietnam.

Studies on the application of LLS provided a more positive impact towards the learning process among learners. Metacognitive LLS has been identified as mostly used LLS by 582 students learning Mandarin as foreign language and study proved that there is no statistically differences across learning levels such as Mandarin Level One, Mandarin Level Two and Mandarin Level Three on Metacognitive LLS (Tan et al., 2019). Similarly, Lam and Kuan (2019) argued that metacognitive is the least popular learning strategy used to learn Mandarin vocabularies. A study conducted by Nair et al. (2021) on the language learning strategies utilized by students in a rural primary school found that memory strategy is the most popular strategy among the students. Pawlak and Kiermasz (2018) justified second language learners highly used language learning strategy in contrast to the third language learners, which both employed mostly memory strategies in their learning process.

2. Research Questions

The purpose of this study is to define the language learning strategies used by Mandarin learners. The study's research questions (RQ) are as follows:

- i. What overall direct learning strategies are FPN and FSKM degree students using to master Mandarin?
- ii. What pattern of learning strategies do FPN and FSKM undergraduates favor when learning Mandarin?
- iii. Are there any notable differences between the learning strategies employed by FPN and FSKM degree students when learning Mandarin?

Based on the RQ3, three hypotheses were suggested as below:

- i. H1: There are no appreciable differences in the memory learning systems employed by FSKM degree students and FPN degree students when learning Mandarin.
- ii. H2: There are no appreciable differences in the cognitive learning strategy employed by FSKM degree students and FPN degree students when learning Mandarin.
- iii. H3: There are no appreciable differences in the compensation learning strategy employed by FSKM degree students and FPN degree students when learning Mandarin.

- iv. H4: There are no appreciable differences in the metacognitive learning strategy employed by FSKM degree students and FPN degree students when learning Mandarin.
- v. H5: There are no appreciable differences in the affective learning strategy employed by FSKM degree students and FPN degree students when learning Mandarin.
- vi. H6: There are no appreciable differences in the social learning strategy employed by FSKM degree students and FPN degree students when learning Mandarin.
- vii. students and FPN degree students when learning Mandarin.

3. Research Methods

The Oxford (1990) Strategy Inventory for Language Learning (SILL) was used in this study to explore how FPN and FSKM students learn Mandarin. Oxford has categorized strategies into direct strategies and indirect strategies as shown in Figure 1. Learning strategies are defined under the research model as memory, cognitive, compensatory, metacognitive, affective, and social strategies that are applied in a classroom situation. Figure 1 shows proposed research model.

Direct strategies need mental processing of the language where memory, cognitive and compensation function differently and for different purposes. Memory strategies help learners to keep and retrieve information. Cognitive strategies help learners to understand and produce new language using various means. Compensation strategies assist learners to use the language nevertheless of their big gaps in knowledge. On the contrary, Oxford (1990) explained indirect learning strategies are functioned to support and manage language learning without directly intervene in the target language. Metacognitive strategies act as emotion controller and coordinator of their learning through centering, arranging, planning and evaluating. Affective strategies help to adjust emotions, motivations and attitudes. Social strategies help learners learn via interaction with others.

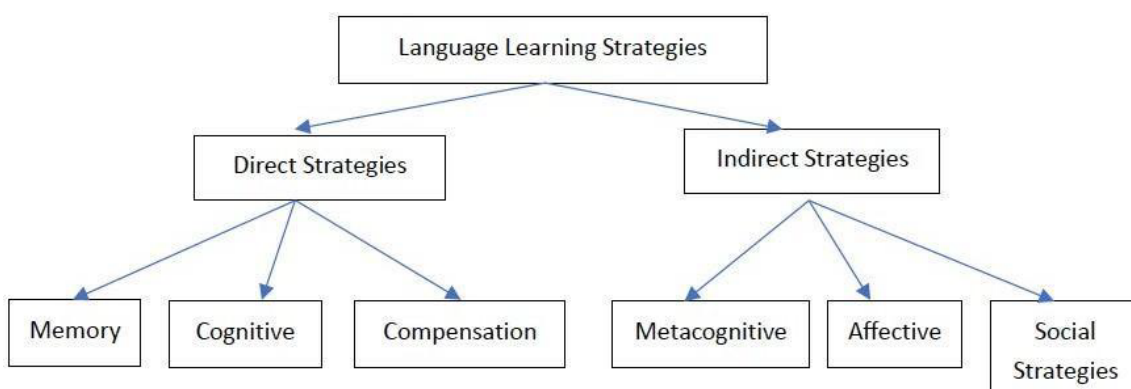


Figure 1. Research model - learning strategies (SILL)

3.1. Sample

The respondents for this study were 129 undergraduate students from Faculty Accountancy (FPN) (N=78/240) and Faculty Computer Science and Mathematics (FSKM) (N=51/167). They were undergraduates who had enrolled in both Introductory Mandarin Levels II and III for one of the foreign

language enrollment requirements. The respondents came from various campuses in the same university, however they all resided in different states of Malaysia. These are thought to be able to supply a variety of helpful perspectives and information about the study due to the disparities in background, such as education and social circumstances.

3.2. Instruments

A questionnaire is used in this quantitative study to gather data regarding L2 direct learning strategies in Mandarin. There are two sections to the questionnaire: part one is the general information of the participants are gender, faculty, course code, and background of learning Mandarin. Part two is Language Learning Strategy Questionnaire. This study employed the Oxford-created Strategy Inventory for Language Learning (SILL) to compile data on how language learning strategies were really being implemented Hapsari (2019). SILL is a reference for language teachers on what strategies have been used by their language learners. There are 50 items in the 5-point Likert scale questionnaire, including both direct learning strategies such as memory, cognitive, compensation and indirect learning strategies such as metacognitive, affective and social strategies. The SILL questionnaire has been adapted specifically to measure the frequency of Mandarin language learning strategies, though. The learning strategies (memory, cognitive, compensation, metacognitive, affective and social strategies) are examined in the second section of the questionnaire using a five-point Likert scale, with 1 representing "*strongly disagree*" and 5 representing "*strongly agree*" as shown in Table 1.

Table 1. 5-Point likert scale of the instruments

Scale	1	2	3	4	5
	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree

3.3. Reliability test

Pilot test was carried out to assess the internal consistency and reliability of the study instrument. Table 2 shows the Cronbach's Alpha Reliability Test results. The instruments in table 2 have Cronbach's alpha values greater than 0.70. As a result, the scale used for all of the study's items can be said to have good reliability and validity.

Table 2. Reliability coefficient of study instruments

Reliability statistics					
Cronbach's alpha	Cronbach's alpha Based on standardized items	N of items			
.884	.911	6			
Item total statistics					
	Scale mean if item deleted	Scale variance if item deleted	Corrected item total correlation	Squared multiple correlation	Cronbach's alpha if item deleted

memory	127.2481	500.735	.751	.595	.854
Cognitive	115.5426	355.922	.808	.680	.878
Compensation	139.1628	587.247	.714	.575	.872
Metacognitive	126.2636	504.367	.764	.652	.853
Affective	138.5271	566.439	.729	.570	.866
Sosial strategies	138.0620	541.355	.745	.637	.860

3.4. Data collection and analysis

Participants were given the surveys to complete using Online Survey from October 2022 to November 2022. Total of 129 valid questionnaires among all were returned. The Statistical Package for Social Sciences (SPSS-v-19) software was used to analyze the information gathered from the questionnaire after being entered into the computer. The descriptive statistics mean and standard deviation of learning strategies named memory, cognitive, compensatory, metacognitive, affective, and social strategies) were examined in order to explore the pattern of learning strategies used by undergraduates in Mandarin courses based on faculty. The Independent Sample t-Test was performed to examine the differences between the significant learning strategies employed by FSKM degree students and FPN degree students. Also, according to Oxford (1990), the research result was additionally been utilized the following range: "low strategy users = 1.0 to 2.4," "mid strategy users = 2.5 to 3.4," and "high strategy users = 3.5 to 5.0."

4. Findings

This section investigates the learning strategies of undergraduate students attending Mandarin courses. The findings and comments are given in accordance with the research questions stated

4.1. Research question 1: What overall direct learning strategies are FPN and FSKM degree students using to master Mandarin?

Table 3. Overall learning strategies used by the FPN and FSKM degree students

	Learning Strategies	Mean	SD	Rank
Total (N=129)	Memory	3.3015	0.61319	2
	Cognitive	2.9585	0.65079	6
	Compensation	2.9664	0.56802	5
	Metacognitive	3.4109	0.59489	1
	Affective	3.0724	0.64913	4
	Social Strategies	3.1499	0.74647	3

Table 3 shows the learning strategies of the subjects in terms of six categories: memory, cognitive, metacognitive, affective, social strategies. According to the findings, undergraduate students prefer the metacognitive strategy (M=3.4109, SD=0.59489) the most when learning Mandarin. Following this in the learning of Mandarin were the following strategies: Cognitive (M=2.9585, SD=0.65079), Social (M=3.1499, SD=0.74647), Affective (M=3.0724, SD=0.64913), Compensation (M=2.9664, SD=0.56802), Memory (M=3.3015, SD=0.61193), and Affective (M=3.0724, SD=0.64913). According to

Oxford (1990), respondents are "mid strategy users" based on the average Learning Strategies scores, which varied from 2.95 to 3.41.

4.2. Research question 2: What pattern of learning strategies do FPN and FSKM undergraduates favor when learning Mandarin?

Table 4. Learning strategies used by degree students based on faculty

Learning Strategies	FPN (N=78)			FSKM (N=51)		
	M	SD	Rank	M	SD	Rank
Memory	3.3632	0.64033	2	3.2070	0.56219	2
Cognitive	3.0256	0.65728	5	2.8557	0.63334	6
Compensation	3.0214	0.60384	6	2.8824	0.50254	5
Metacognitive	3.4886	0.59481	1	3.2919	0.58074	1
Affective	3.1410	0.67263	4	2.9673	0.60279	3
Social Strategies	3.2863	0.69936	3	2.9412	0.77447	4

According to Table 4, students in both FPN and FSKM chose metacognitive strategies (FPN; M=3.4886, SD=0.59481, FPN; M=3.2919, SD=0.58047) and memory strategies (FPN; M=3.3632, SD=0.64033, FSKM; M=3.2070, SD=0.56219). Also, as shown in table 4, the findings also showed that neither FPN nor FSKM degree students preferred the Cognitive or Compensation strategies. According to Oxford's classification, the outcome indicates that both FPN and FSKM degree students were "mid strategy users" for all learning methods as evidenced by their scores, which ranged from 2.85 to 3.48. (1990). Regardless of FPN or PSKM degree students, metacognitive methods clearly gained the most popular LLS.

4.3. Research question 3: Are there any notable differences between the learning strategies employed by FPN and FSKM degree students when learning Mandarin?

Table 5. Independent t-test for equality of means for memory learning strategy based on faculty

Direct Learning Strategies		F	p	t	df	Sig.(2-tailed)	Mean difference	Std. Error Difference
Memory	Equal variance assumed	1.072	.303	1.421	127	.158	.15628	.10999
	Equal not variance assumed			1.460	116.411	.147	.15628	.10702

Table 6. Independent t-test for equality of means for cognitive learning strategy based on faculty

Direct Learning Strategies		F	p	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference
Cognitive	Equal variance assumed	.083	.773	1.456	127	.148	.16990	.11668
	Equal not variance assumed			1.467	109.844	.145	.16990	.11577

Table 7. Independent t-test for equality of means for compensation learning strategy based on faculty

Direct Learning Strategies		F	p	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference
Compensation	Equal variance assumed	.904	.343	1.364	127	.175	.13901	.10195
	Equal not variance assumed			1.417	119.694	.159	.13901	.09811

Table 8. Independent t-test for equality of means for metacognitive learning strategy based on faculty

Indirect Learning Strategies		F	p	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference
Metacognitive	Equal variance assumed	.053	.819	1.853	127	.066	.19666	.10612
	Equal not variance assumed			1.863	108.858	.065	.19666	.10559

Table 9. Independent t-test for equality of means for affective learning strategy based on faculty

Indirect Learning Strategies		F	p	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference
Affective	Equal variance assumed	2.694	.103	1.493	127	.138	.17371	.11634
	Equal not variance assumed			2.570	99.216	.102	.34515	.13428

Table 10. Independent t-test for equality of means for social strategies learning strategy based on faculty

Indirect Learning Strategies		F	p	t	df	Sig. (2-tailed)	Mean difference	Std. Error Difference
Social Strategies	Equal variance assumed	.088	.767	2.626	127	.010	.34515	.13428
	Equal not variance assumed			2.570	99.216	.012	.34515	.13428

In order to compare the equality of scores for Memory, Cognitive, and Compensation, Metacognitive, Affective, and Social Strategies used by undergraduates from the Faculty of Accountancy (FPN) and Faculty of Computer Science and Mathematics, this study referred to an independent sample T-test (FSKM). To examine the homogeneity of the Direct and Indirect Learning strategies, Levine's Test for Equality of Variances was also modified. Table 5, 6, 7, 8, 9 and 10 indicated that there were no significant difference p in the scores for Memory [$t(127)=1.421, p=.303$], Cognitive [$t(127)=1.456, p=.773$], Compensation [$t(127)=1.364, p=.343$], Metacognitive [$t(127)=1.853, p=.819$], Affective [$t(127)=1.493, p=.103$] and Social Strategies [$t(127)=2.626, p=.767$] used by FPN and FSKM

undergraduates. The results indicate that FPN and FSKM undergraduates were used Memory, Cognitive, Compensation, Metacognitive, Affective and Social Strategies which support the hypotheses (H₁, H₂, H₃, H₄, H₅ and H₆) where the value in the *sig.(2-tailed)* is $>p=0.05$.

4.4. Discussion

This study focused on Malay undergraduate students undergoing a Mandarin language course. In total, 129 valid SILL surveys were collected. The findings of the investigation are displayed for six categories of learning strategies. They include memory, cognitive, compensation, metacognitive affective and social strategies. The study found that when learning Mandarin, respondents from FPN and FSKM prefer to use metacognitive strategies (FPN $M=3.4886$, $SD=0.59481$) and memory strategies (FSKM $M=3.2070$, $SD=0.56219$) as compared to the other strategies. According to (Bessai, 2018; Oxford, 1990), Metacognitive strategies are acts that go beyond solely cognitive devices and that give learners a method to coordinate their own learning process. (Oxford, 1990; Tan et al., 2019) defines LLS as a “specific actions taken by the learners to make learning easier, faster, more enjoyable, more self-directed, more efficient and more transferable to a new situation” (p. 8). It is an indication that metacognitive strategies are crucial for assisting learners in their learning.

The outcomes of this study are in line with Cheng (2019), their study found that social, metacognitive and memory strategies were the most frequently used strategies. According to Adnan and Anwar (2020), the most preferred LLSs by artistically talented students in an art school is the metacognitive strategy that records the highest mean value. Furthermore, (Gan et al., 2022) disputed the idea that students preferred metacognitive indirect learning strategies the most when learning Mandarin.

However, the results are not consistent with (Pawlak & Kiermasz, 2018), second language learners make extensive use of language learning strategies, as opposed to third language learners, who both primarily utilize memory strategies. According to Lam and Kuan (2019), the study's findings showed that learners used cognitive strategies most frequently and metacognitive strategies least frequently.

According to the results of an independent sample T-test, there is no significant difference between the six categories of learning strategies employed by students who pursue the FPN and FSKM degrees to learn Mandarin. By the way, the study is in line with the findings of Tan et al. (2019), who found that They discovered that on the Metacognitive LLS are no statistically significant differences between learning levels of Mandarin, such as Mandarin Level One, Mandarin Level Two, and Mandarin Level Three. According to (Mohd Soupi et al., 2022), here were no significant differences between TESL students and non-TESL students in terms of their use of LLSs.

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5. Conclusion

This result of this study indicated that science and non-sciences undergraduates have no significant differences between direct learning strategies and indirect learning strategies to learn Mandarin. However, metacognitive strategies appeared as the mostly used learning strategies in this study. Non science and science undergraduates learn the same targeted language and they share the same attributes which they are more left-brained learners although both are from different streams sophomores. It could be the metacognitive strategies are very essential for successful language learning. Three Metacognitive strategies for instance centering learning, arranging and planning learning, and evaluating learning could trigger learners' interest to find more opportunities to learn a new language outside the classroom. It is suggested that in-depth research can be carried out in the future on how or why learners choose the strategies indicated in the survey. To acquire more detailed info about the usage of strategies, it would be advantageous for future research to integrate a quantitative and qualitative approach in order to obtain comprehensive information, participants' data based on other demographic variables, such as age, gender, academic performance, and other factors, can be generalized. Therefore, it is recommended that future studies could research on the use of different strategies by looking at the cognitive and aptitude of non-science versus science learners.

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