INVESTIGATING THE CORRELATION BETWEEN LEARNING STYLES AND VOCABULARY SIZE AMONG MANDARIN LEARNERS AT UNIVERSITI SAINS ISLAM MALAYSIA (USIM): A CASE STUDY

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Abstract*: Learning Mandarin is often regarded as a challenging and demanding endeavor, requiring learners to demonstrate strong commitment and invest significant effort to achieve success. However, previous studies have shown that many Mandarin learners encounter various difficulties, challenges, and negative experiences throughout the learning process. These obstacles can lead to frustration, disengagement, or even withdrawal from the course. This study investigates the correlation between learning styles and vocabulary size among Mandarin learners at Universiti Sains Islam Malaysia (USIM), utilizing Reid's Learning Style Model (RLSM) as its theoretical framework. A fully quantitative approach was adopted, with surveys distributed digitally to undergraduate students enrolled in Mandarin language courses at USIM. A total of 189 questionnaires were distributed, and 176 valid responses were analyzed. All respondents were non-native speakers (Malay). Data analysis was conducted using SPSS, employing descriptive statistics, Pearson's correlation analysis, and multiple regression analysis. The findings revealed that visual, kinesthetic, and tactile learning styles were the top preferences among USIM learners. Pearson's correlation analysis determined that all six learning styles in RLSM had a significant correlation with vocabulary size. However, only visual, kinesthetic, and tactile learning styles were found to have a significant impact on learners' vocabulary size. The findings provide practical implications for Mandarin language*

instructors and curriculum designers, emphasizing the importance of incorporating visual aids, hands-on activities, and tactile learning tools to support vocabulary acquisition. By addressing these preferred learning styles, educators can create more engaging and effective learning environments, ultimately fostering greater success and motivation among Mandarin learners.

Keywords*: Learners**, Learning Styles, Mandarin, Universiti, Malaysia, Vocabulary Size*

Introduction

Mastering Mandarin is widely acknowledged as a complex and demanding process, requiring learners to demonstrate strong dedication and invest considerable effort to achieve proficiency (Shen & Ke, 2007; Zhang & Koda, 2022). As a tonal language with a logographic writing system, Mandarin presents distinct challenges that differentiate it from alphabetic languages, necessitating specialized learning strategies, diverse learning styles, and sustained engagement (Li & DeKeyser, 2021). These challenges include mastering tonal pronunciation, memorizing thousands of characters, and understanding the cultural context embedded in the language (Xu & Chang, 2022; Yang & Fox, 2023). For non-native learners, especially Malay speakers, these challenges can hinder their learning progress, possibly resulting in frustration, loss of motivation, or even discontinuation of Mandarin courses (Abdul Rahman & Wang, 2023; Tan & Lee, 2022).

Despite the growing global interest in Mandarin as a critical language for economic, cultural, and diplomatic purposes, many learners struggle to achieve proficiency, particularly in vocabulary acquisition, which is a cornerstone of language learning (Li & DeKeyser, 2023; Wang & Kirkpatrick, 2022; Zhang & Koda, 2023). In these challenging circumstances, learning style can be considered a key factor that influences learners' ability to acquire and retain vocabulary effectively. By understanding and catering to individual learning preferences, educators can design more targeted and effective teaching strategies, helping learners overcome the unique challenges of Mandarin and achieve greater success in their language learning journey (Chen & Hung, 2023; Lee & Tsai, 2024; Li & Sweller, 2022; Wang & Mayer, 2022; Wu & Huang, 2023). However, while most previous studies have explored various factors influencing Mandarin learning, such as motivation, teaching methods, and cultural background, very few studies have focused on learning styles among Mandarin learners. In other words, there is limited research has been done to investigate learning styles influence Mandarin vocabulary size, particularly in diverse and multilingual contexts like Malaysia. This gap in research is especially pronounced in the Malaysian context, where Mandarin learning is gaining prominence due to the country's strong economic and cultural ties with China (Hashim & Leong, 2020; Lee & Tan, 2021; Wong & Chen, 2019; Zhan & Omar, 2020). Malaysia's unique linguistic landscape, characterized by a multilingual population (e.g., Malay, English, Chinese, and Tamil speakers), presents a rich but underexplored setting for investigating language learning. Moreover, the increasing number of Mandarin learners in Islamic universities, such as Universiti Sains Islam Malaysia (USIM), introduces further complexity. Most of these learners primarily focus on religious studies and Arabic language education, presenting a unique set of challenges and opportunities that remain underexplored.

Therefore, this study aims to address this gap by investigating the correlation between learning styles and vocabulary size among Mandarin learners at Universiti Sains Islam Malaysia (USIM). Using Reid's Learning Style Model (RLSM) as the theoretical framework, the study seeks to identify the predominant learning styles among Malaysian Mandarin learners and

examine how these styles influence vocabulary acquisition. The findings of this study will offer valuable insights for educators, curriculum designers, and policymakers, enabling them to develop more effective and inclusive Mandarin learning environments in Malaysia and beyond. In essence, this research is crucial for designing tailored teaching strategies that align with the diverse learning preferences of Malaysian learners, ultimately enhancing their Mandarin proficiency and fostering greater engagement with the language.

Literature Review

Learning Style

Learning styles refer to the preferred ways individuals process, retain, and internalize information. These preferences influence how learners perceive, interact with, and make sense of new knowledge (Felder & Silverman, 1988; Fleming & Mills, 1992; Kirschner, 2017; Pashler et al., 2008). According to previous studies, learning styles play a crucial role in shaping a learner's ability to absorb and apply new knowledge effectively (Pashler et al., 2023; Reid, 1995; Oxford, 2003). For instance, some learners excel when information is presented visually, such as through diagrams, charts, or written text, while others may prefer auditory methods, such as listening to lectures or engaging in discussions. Similarly, kinesthetic learners often benefit from hands-on activities or experiential learning, where they can physically engage with the material. Understanding one's learning style is essential because it allows learners to identify the strategies and methods that work best for them, leading to greater engagement and motivation (Coffield et al., 2004; Kirschner, 2017; Newton & Miah, 2017). When learners are engaged, they are more likely to retain information and apply it effectively in real-world contexts. For educators, recognizing and accommodating diverse learning styles can transform the teaching process, making it more inclusive and effective (Riener & Willingham, 2010; Rogowsky et al., 2020). By tailoring instructional approaches to match individual preferences, teachers can create a learning environment that caters to the needs of all students, ensuring that no one is left behind (Alghamdi & Al-Salouli, 2023; Dunn & Dunn,1993; Felder & Silverman, 1988; Tomlinson, 2014).

In the context of language acquisition, learning styles influence how students develop key skills such as listening, speaking, reading, and writing. Different learners may prefer visual aids, auditory instruction, or hands-on practice to reinforce their understanding of a new language (Chen & Wang, 2023; Ehrman & Leaver, 2003; Pei-Shi, 2012; Wong & Nunan, 2011). This is particularly significant in Mandarin learning, as the language presents unique challenges, including tonal pronunciation, character memorization, complex grammatical structures, and the vast vocabulary required for proficiency. By aligning teaching methods with students' learning styles, educators can help learners overcome these challenges more effectively, making the process of mastering Mandarin more accessible and enjoyable (Jie & Xiaoqing, 2006; Tseng et al., 2022).

Reid's Learning Style Model

Reid's Learning Style Model, developed by Joy Reid in the 1980s, categorizes learners into six distinct styles: visual learners prefer seeing information through images, charts, or written text; auditory learners excel through listening to lectures, discussions, or audio recordings; kinesthetic learners learn best by doing, using physical movement or hands-on activities; tactile learners focus on touch, interacting with physical materials like flashcards or writing tools; group learners thrive in social settings, benefiting from collaboration and discussions; and individual learners prefer working alone, focusing better through self-study and independent

activities (Reid, 1987; Oxford, 2003; Wintergerst et al., 2003). Reid emphasized that learners have inherent preferences for how they process and retain information, and these preferences significantly influence their language acquisition process (Al-Hoorie & Vitta, 2024; Reid, 1987, 1985).

Previous studies have extensively demonstrated the influence of Reid's learning style model on language learning outcomes. For instance, Oxford (2003) emphasized that aligning instructional methods with students' preferred learning styles not only enhances engagement but also fosters greater motivation and retention of knowledge. Similarly, Dunn and Griggs (2000) conducted a study that revealed students who received instruction tailored to their dominant learning styles exhibited significantly higher academic performance compared to those taught using a one-size-fits-all approach. In the realm of second language or foreign language acquisition, Reid's model has played a pivotal role in shaping personalized learning strategies (Lovelace, 2005; Huang, 2021). For example, visual learners benefit from the use of imagery, flashcards, and written materials to aid comprehension, while auditory learners thrive in environments that incorporate verbal explanations, pronunciation drills, and listening exercises. Additionally, social learners often excel through collaborative activities such as group discussions, peer interactions, and role-playing exercises. By catering to individual learning styles, educators can create more effective and inclusive language learning experiences (Kamińska, 2014; Oxford, 2003; Tseng et al., 2022, Zhang & Zou, 2023).

However, some scholars argue that an over-reliance on learning styles may inadvertently neglect the dynamic and evolving nature of the learning process (Dörnyei & Ryan, 2015; Elgort & Brysbaert, 2023; Kirschner, 2017; Li & Kirby, 2024; Newton & Miah, 2017; Pashler et al., 2008). Particularly in the context of diverse linguistic systems, such as Western (alphabet-based) and Eastern (logographic) languages, students may need to adapt and refine their learning preferences over time (Koda, 2007; Koda & Yamashita, 2022; Wang et al., 2005; Wang & Koda, 2023). As learners navigate the complexities of acquiring a new language, exposure to various instructional methods can help them develop a more flexible and multifaceted approach to language learning, ultimately fostering long-term proficiency and adaptability.

Mandarin Vocabulary

Vocabulary refers to the collection of words within a language that an individual understands and uses to communicate effectively. It serves as a fundamental component of language learning, enabling learners to express ideas, comprehend written and spoken texts, and engage in meaningful conversations (Byram & Wagner, 2024; Ellis,1994; Laufer & Hulstijn, 2001; Nation, 2001; Schmitt, 2008, 2023; Webb, 2007). According to Nation (2001), vocabulary knowledge is essential for language proficiency, as it directly influences reading, writing, listening, and speaking skills. Without an adequate vocabulary, learners struggle to grasp context and convey meaning, making vocabulary acquisition a central focus in language education. The significance of vocabulary lies in its role as the foundation of communication. Wilkins (1972) famously stated, "Without grammar, very little can be conveyed; without vocabulary, nothing can be conveyed." A strong vocabulary enhances comprehension, builds confidence, and facilitates seamless interactions in real-world contexts. For language learners, expanding vocabulary is not only essential for achieving fluency but also for developing cultural awareness and contextual understanding (Kramsch, 1998; Laufer, 1997; Pellicer-Sánchez & Siyanova, 2023; Puimège & Peters, 2023; Schmitt, 2010; Uchihara & Saito, 2024, Webb, 2023).

However, Mandarin vocabulary presents unique challenges due to its distinctive linguistic features. Unlike alphabetic languages, Mandarin employs a logographic writing system, where each character represents a word or morpheme rather than a combination of phonetic sounds This requires learners to memorize thousands of characters, each with its own meaning, pronunciation, and tone (Everson, 2011; Shen, 2005, Uchihara & Saito, 2024; Wang & Perfetti, 2023). Additionally, as a tonal language, Mandarin alters word meanings based on tone variations, adding another layer of complexity. Shen (2013) highlights that these features make Mandarin vocabulary particularly challenging for non-native learners, necessitating tailored learning strategies such as visual aids, spaced repetition, and contextual learning to aid retention. In short, while vocabulary acquisition is a crucial aspect of all language learning, Mandarin's unique system demands innovative and personalized approaches to ensure effective mastery (Liu & Ko, 2023; Xu et al., 2014; Ke, 2012 Xu & Chang,2023).

Vocabulary Size

Vocabulary size refers to the number of words a learner knows and can use in a language. It is a key indicator of language proficiency, as a larger vocabulary enables better comprehension, communication, and expression (Laufer & Goldstein, 2004; Milton, 2009; Nation, 2006; Uchihara & Clenton, 2024). According to Nation (2001), vocabulary size is directly linked to language skills, with studies showing that learners need to know approximately 2,000-3,000 high-frequency words to understand everyday conversations and texts. For advanced proficiency, this number increases significantly, highlighting the importance of continuous vocabulary expansion. The importance of vocabulary size lies in its impact on language mastery. Schmitt (2000) emphasizes that vocabulary size is a strong predictor of reading comprehension, listening ability, and overall communicative competence. A larger vocabulary allows learners to understand nuanced meanings, engage in diverse topics, and express themselves more precisely. For language learners, increasing vocabulary size is essential for achieving fluency and confidence in real-world interactions (Schmitt, 2019; Nation & Coxhead, 2024; Webb & Nation, 2017; Zhang & Zou, 2024).

In the context of Mandarin vocabulary, the challenge becomes more pronounced due to the language's unique characteristics. Mandarin uses a logographic writing system, where each character represents a word or morpheme, requiring learners to memorize thousands of characters (Koda & Miller, 2024; Packard,2000; Taft & Chung, 1999; Wang et al., 2005; Wang & Perfetti, 2023). The HSK (Hanyu Shuiping Kaoshi) test, the standardized proficiency test for Mandarin, reflects this complexity. For example, HSK Level 1 requires knowledge of 150 words, while HSK Level 6 demands mastery of over 5,000 words and their corresponding characters. Studies by Shen (2013) highlight that Mandarin's tonal nature and character-based system make vocabulary acquisition particularly challenging. Learners must not only memorize characters but also associate them with correct pronunciations and tones, adding layers of difficulty to the learning process. Therefore, vocabulary size is a critical factor in language learning, and for Mandarin learners, the unique demands of the language require focused strategies to meet the benchmarks set by tests like the HSK. Effective vocabulary acquisition in Mandarin involves a combination of visual, auditory, and contextual learning methods to overcome its inherent complexities (Jiang, 2020; Wang & Perfetti, 2023; Zhang & Lu, 2015; Zhang & Zou, 2024).

Research Questions

This study aims to show there is a relationship between learning styles and vocabulary size of the Mandarin learners in USIM. Therefore, the specific objectives of this study are:

1. To investigate the learning style preference of Mandarin learners at USIM?
2. To determine the learning styles that affect job vocabulary size of Mandarin learners at USIM.

Conceptual Framework

A Conceptual Framework is a theoretical structure that outlines the relationships among variables in a research study. It provides a clear visual or descriptive representation of how different factors interact to influence the study's outcome (Imenda, 2014; Ravitch & Carl, 2021). In this study, the researcher adapted and adopted the Reid's learning style model which included six different learning styles: visual, auditory, kinesthetic, tactile, group, and individual. These learning styles were integrated into the conceptual framework to examine their influence on students' academic performance and engagement within the study context, as illustrated below (Figure 1).
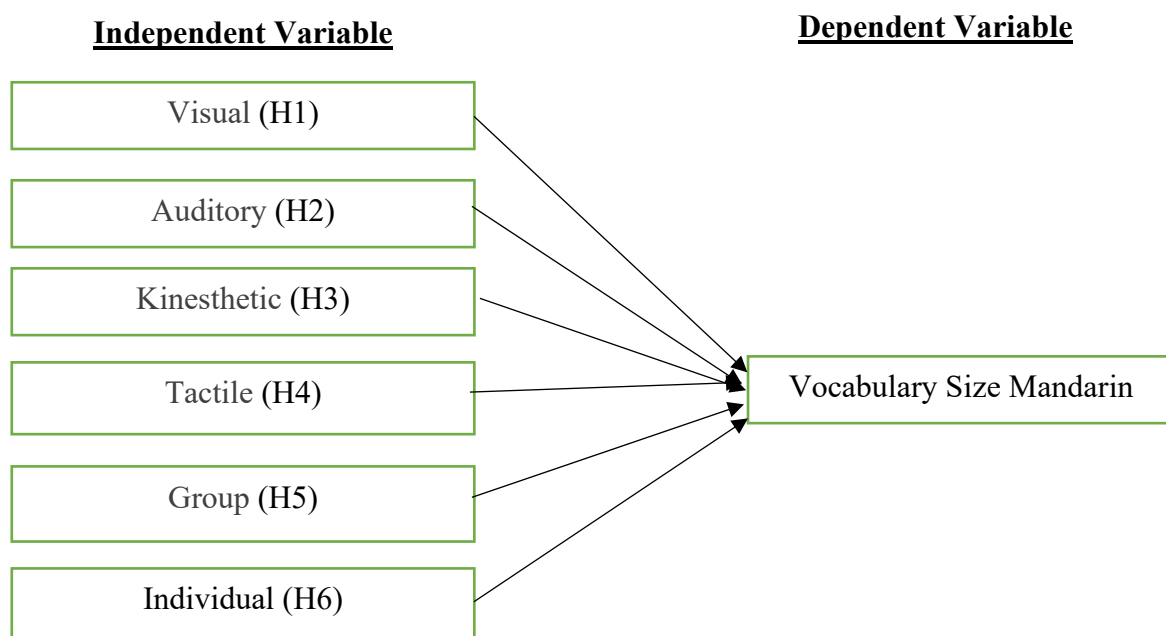
Independent Variable   **Dependent Variable**

Visual (H1)

Auditory (H2)

Kinesthetic (H3)
                                          Vocabulary Size Mandarin
Tactile (H4)

Group (H5)

Individual (H6)

Figure 1: Conceptual Framework

Based on the theoretical framework (Figure 1), this theory approach ensures that all critical variables influencing learners' vocabulary size are considered. It provides deeper insights into the factors affecting vocabulary development in Mandarin learning course.

Methodology

This study adopted a quantitative approach, utilizing a survey method to gather data from Mandarin Level 3 learners at Universiti Sains Islam Malaysia (USIM). These learners were chosen due to their prior experience and foundational knowledge of Mandarin, having completed earlier levels, making their experiences more reflective of long-term engagement with the language, as supported by previous research (Qin et al., 2023; Teh et al., 2021). The research instrument, a questionnaire, was adapted from Reid's learning style model. To ensure its relevance, modifications were made, and its content was validated by five experts from different universities. Face validity was further tested with a group of 10 Mandarin learners. A pilot test was conducted to assess the questionnaire's validity, reliability, and feasibility (Awang, 2012; Hair et al., 2023; Tabachnick & Fidell, 2019).

The questionnaire was divided into eight sections: demographic profile (Part A), visual (Part B), auditory (Part C), kinesthetic (Part D), tactile (Part E), group (Part F), and individual (Part G) learning styles, and Mandarin vocabulary size (Part H). Each section, except Part A, consisted of six items measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), chosen for its ability to capture nuanced responses while minimizing cognitive load (Aybek & Toraman, 2020; Kusmaryono et al., 2022). Data were analyzed using SPSS version 26, employing Pearson correlation and regression models to explore relationships between learning styles and vocabulary size. Data collection began with departmental approval, followed by coordination with course facilitators. A Zoom meeting was held to brief coordinators on the study's objectives and confidentiality measures. The Google Form questionnaire was distributed via lecturers to respondents, who had two weeks to complete it voluntarily. Cluster sampling ensured a representative sample (Levy & Lemeshow, 2013; Lohr. 2022).

After data collection, missing values were addressed through imputation or case deletion (Dong & Peng, 2013; Little & Rubin, 2019). Common method variance (CMV) was assessed using Harman's single-factor test or a marker variable (Lindell & Whitney, 2001; Podsakoff et al., 2003). Response bias, such as social desirability, was also evaluated. Following data cleaning and validation, analysis was conducted to ensure accurate, valid, and reliable findings (Schaeffer et al., 2003; Tourangeau & Yan, 2007).

Data Analysis and Results

Respondents' demographic

In this study, the researcher distributed 189 surveys, of which 176 were returned as valid responses, resulting in an excellent response rate of 93% (Fincham, 2008). The results revealed that a significantly higher proportion of female Mandarin learners (83%) completed the questionnaire compared to male Mandarin learners (17%). The age group with the highest participation was 20-24 years old, accounting for 70% of respondents, followed by those aged 16-19 years old (30%), The vast majority of respondents were Malay (98.3%), with the remaining 1.7% belonging to non-Malay. In terms of education background, most respondents were come from language and linguistic (31.8%), followed by economic (10.2%) and syariah and law (9.6%), social science, management and leadership (9%), information technology (5.6%). Table 1 presents the demographic profile of the respondents.

Table 1: Demographic Profile of Respondents

Demographic variables	Category	Frequency	Percentage (%)
Gender	Male	19	17.0
	Female	157	83.0
Age	16 – 19 years old	53	30
	20 – 24 years old	123	70
Race	Malay	173	98.3
	Others	3	1.7
Education background:	Language and Linguistic	56	31.8
	Economy	18	10.2
	Information Technology	10	5.6
	Social Science	16	9

Management	16	9
Syariah and Law	17	9.6
Biology or other Sciences	8	4.5
Leadership	16	9
Others:	9	5.1

Research Question 1: To investigate the learning style preference of Mandarin learners at USIM?

The results of RQ 1 in the study reveal interesting insights into the learning style preferences of the Mandarin learners. The findings are presented below (Table 2).

Table 2: Learning Style Preference of Mandarin Learners

Learning Style	Mean	Standard Deviation (SD)	Degree	Rank
Visual	3.62	0.63	High	1
Kinesthetic	3.55	0.79	High	2
Tactile	3.53	0.83	High	3
Auditory	3.43	0.62	Moderate	4
Group	3.09	0.75	Moderate	5
Individual	3.02	0.91	Moderate	6

The data indicates that the **visual learning style** has the highest mean score (M = 3.62, SD = 0.63), ranking first among all learning styles. This suggests that visual learning is the most preferred and effective method for the participants, aligning with the notion that many individuals benefit from visual aids such as pictures, charts, and videos. The **kinesthetic learning style** follows closely in second place (M = 3.55, SD = 0.79), indicating that hands-on activities and physical engagement are also highly valued by the participants. The **tactile learning style** ranks third (M = 3.53, SD = 0.83), further emphasizing the importance of touch and physical interaction in the learning process. Both kinesthetic and tactile styles are also categorized as "high," reinforcing the idea that experiential learning plays a significant role for the Mandarin learners. In contrast, the **auditory learning style** ranks fourth (M = 3.43, SD = 0.62) and is categorized as "moderate," suggesting that while listening and verbal instruction are still important, they are less preferred compared to visual, kinesthetic, and tactile methods. The **group learning style** (M = 3.09, SD = 0.75) and **individual learning style** (M = 3.02, SD = 0.91) rank fifth and sixth, respectively, both falling into the "moderate" category. This indicates that collaborative and solitary learning approaches are less favored compared to sensory-based methods like visual, kinesthetic, and tactile learning. Overall, the findings highlight a strong preference for sensory and experiential learning styles, with visual learning being the most dominant, while group and individual learning styles are relatively less emphasized. This suggests that educators and instructional designers should consider incorporating more visual and hands-on activities to cater to the predominant learning preferences of the participants.

According to previous studies, the strong preference for visual, kinesthetic, and tactile learning styles is well-supported by research in the field of learning styles and educational psychology. For instance, Fleming and Mills (1992) introduced the VARK model, which identifies visual learning as one of the most effective methods for information retention and comprehension. This aligns with your results, where visual learning ranked first with a mean score of 3.62, suggesting that learners benefit significantly from graphical and spatial representations of

information. Similarly, Dunn and Dunn (1978) emphasized the importance of kinesthetic and tactile learning styles, particularly for learners who thrive on hands-on activities and physical engagement. This study's results, which show kinesthetic (M = 3.55) and tactile (M = 3.53) learning styles ranking second and third, respectively, support their findings that experiential learning enhances understanding and retention. On the other hand, auditory learning, which ranked fourth in this study with a mean score of 3.43, is often considered less dominant compared to sensory-based methods. Pashler et al. (2008) found that while auditory learning can be effective for some individuals, it generally falls short when compared to visual or kinesthetic approaches. This is consistent with the findings of this study, where auditory learning was categorized as "moderate." Additionally, group and individual learning styles ranked fifth and sixth, with mean scores of 3.09 and 3.02, respectively. This aligns with research by Johnson, Johnson, and Smith (1998), who found that while collaborative and individual learning can be effective in certain contexts, they are often less preferred compared to sensory-based methods. Kolb's (1984) experiential learning theory further supports these results, highlighting the importance of concrete experiences and reflective observation in the learning process, which aligns with the high preference for visual, kinesthetic, and tactile styles in this study.

Research Question 2: To determine the learning styles that affect job vocabulary size of Mandarin learners at USIM.

Table 3: Pearson's Correlation Coefficient of All Variables

Pearson Correlation	Comfort Level						
	Visual	Kinesthetic	Tactile	Auditory	Group	Individual	Vocabulary Size
Visual	1						
Kinesthetic	.783	1					
Tactile	.668	.549	1				
Auditory	.582	.635	.647	1			
Group	.445	.536	.369	.425	1		
Individual	.527	.487	.401	.568	.491	1	
Vocabulary Size	.689.	.578	.602	.462	.398	.484	1

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

The correlation coefficient analysis results are presented in both tables above. As expected, the correlations provide support for the validity of the measures of visual, kinesthetic, tactile, auditory, group, individual and vocabulary size of USIM learners. Result illustrated in table 2 shows no any negative correlation were found among the variables. The result shows that there are positive correlations between the independent and dependent variables. The Pearson correlation matrix reveals significant relationships between comfort levels in different learning styles and vocabulary size among Mandarin learners, with **visual learning style** showing the strongest correlation ($r=0.689$, p < 0.01) followed by **tactile** (0.602, p < 0.01) and **kinesthetic** ($r=0.578$, p < 0.01), indicating that learners who prefer visual, hands-on, and interactive methods tend to have larger Mandarin vocabularies. **Auditory learning** also shows a weaker but significant correlation ($r=0.462$, p < 0.01), reflecting its role in mastering tones and pronunciation, while **group learning** has the weakest correlation ($r=0.398$, p < 0.01), suggesting collaborative activities are less effective for vocabulary acquisition compared

to **individual learning** (r=0.484, p < 0.01), which supports self-study. Intercorrelations between learning styles further highlight overlaps, such as the strong relationship between visual and kinesthetic (r=0.783, p < 0.01) and visual and tactile (r=0.668, p < 0.01), emphasizing the interconnectedness of these preferences.

Based on the results, H1, H2, H3, H4, H5 and H6 are accepted as each independent variable has a positive impact on vocabulary size of Mandarin leaners, the result has been displayed as below table 4.

Table 4: Hypothesis Testing

Hypothesis	Statement	Findings
H1	Visual style has a positive effect on vocabulary size	Accepted (r=0.689, P < 0.01)
H2	Kinesthetic style has a positive effect on vocabulary size	Accepted (r=0.578, P < 0.01)
H3	Tactile style has a positive effect on vocabulary size	Accepted (r=0.602, P < 0.01)
H4	Auditory style has a positive effect on vocabulary size	Accepted (r=0.462, P < 0.01)
H5	Group style has a positive effect on vocabulary size	Accepted (r=0.398, P < 0.01)
H6	Individual style has a positive effect on vocabulary size	Accepted (r=0.484, P < 0.01)

Multiple regression analysis

Multiple regression analysis is a statistical technique used to examine the relationship between a dependent variable and one or more independent variables. Table 5 presents the results of this analysis, exploring how different learning styles influence the vocabulary size of Mandarin learners at USIM. The analysis reveals that the included factors collectively explain 56.6% of the variance in vocabulary size, as indicated by an R^2 value of 0.566. This suggests that the model has moderate explanatory power. The adjusted R^2 value, which provides a more accurate measure of model fit by accounting for the number of predictors, is 0.553, closely aligning with the R^2 value. This consistency indicates that the model is well-fitted to the data. However, it also implies that 44.7% of the variance in vocabulary size is influenced by other factors not captured in the model. Additionally, the standard error of 0.341563 is relatively low, further confirming that the model offers a reliable prediction of learners' vocabulary size.

According to Pallant (2016), the beta coefficient represents the relative impact of a one-standard-deviation change in each independent variable on the dependent variable. In this model, the independent variables vary in their influence, with visual (β = 0.435) having the strongest positive effect, followed by kinesthetic (β = 0.329), tactile (β = 0.268), and auditory (β = 0.180). In contrast, both group (β = -0.142) and individual (β = -0.156) exhibit weak negative effects, with individual having a slightly stronger negative influence than group. The result have showed as below table 5:

Table 5: Multiple Regression Analysis of Independent Variables and Vocabulary Size

Model	Unstandardized coefficient		standardized coefficient	t	Sig.
	B	Std Error	Beta β		
1 (Constants)	1.619	.896		6.907	.000
Visual	.356	.223	.435	2.253	.000
Kinesthetic	.295	.184	.329	1.601	.000
Tactile	.169	.104	.268	0.966	.003
Auditory	.486	.053	.018	0.266	.083
Group	-.161	.105	-.142	-1.287	.168
Individual	-.231	.102	-.156	-1.266	.201

Note: Dependent Variable: Vocabulary size

Overall, the results suggest that visual learning has the greatest positive impact, while individual learning approaches have a marginal but notable negative effect. The t-test results for individual predictors, presented in Table 5, reveal statistically significant relationships at the $p < 0.000$ level. Specifically, four learning style factors emerge as significant predictors of Mandarin learners' vocabulary acquisition: visual ($\beta = 0.435$, $p < 0.05$), kinesthetic ($\beta = 0.329$, $p < 0.05$), tactile ($\beta = 0.268$, $p < 0.05$), and auditory ($\beta = 0.018$, $p < 0.05$). In contrast, neither group ($\beta = -0.142$, $p > 0.05$) nor individual ($\beta = -0.156$, $p > 0.05$) learning approaches demonstrate a show no significant effect. These findings suggest that sensory-based learning styles particularly visual, kinesthetic, and tactile play a more substantial role in vocabulary development compared to social learning preferences.

Table 6: The Regression Model

Model	R	R-square	Adjusted R-square	Std. error of the estimate
1	.780	.566	.553	. 341563

Note: Predictors: (Constant): visual, kinesthetic, tactile, auditory, group and individual

Based the table 6, This regression model shows strong predictive power, with an R value of 0.780 indicating a substantial relationship between the learning styles and vocabulary acquisition. The R-square of 0.566 means these variables explain 56.6% of vocabulary score differences, while the adjusted R-square of 0.553 confirms this remains significant after accounting for multiple predictors. The standard error of 0.34156 suggests the model's predictions are reasonably precise, typically within about 0.34 units of actual scores.

Conclusion
This study examines the relationship between learning style preferences and vocabulary acquisition outcomes among Mandarin language learners. Through comprehensive analysis, the research identifies visual learning as the most dominant cognitive style, accounting for the highest proportion of learning preference, followed sequentially by kinesthetic, tactile, and auditory modalities, with individual learning approaches demonstrating the lowest preference levels. Empirical results establish statistically significant positive correlations between these sensory-based learning styles (visual, kinesthetic, tactile, and auditory) and vocabulary acquisition metrics. The regression model provides particularly compelling evidence, indicating that these four primary learning modalities collectively explain 56.6% of observed variance in vocabulary test scores. Notably, visual learning emerges as the most robust predictor ($\beta = 0.435$,

$p < 0.01$), followed by kinesthetic ($\beta = 0.329$) and tactile ($\beta = 0.268$) approaches, all showing statistically significant effects. While auditory learning presents marginal predictive value, collaborative (group) and independent (individual) learning strategies show no statistically significant relationship with vocabulary outcomes. These empirical findings strongly suggest that Mandarin instruction incorporating multisensory techniques particularly visual aids, kinesthetic activities, and tactile learning materials - could substantially improve vocabulary retention rates. The study's outcomes provide evidence-based guidance for curriculum designers and language instructors seeking to develop pedagogically sound teaching methodologies aligned with learners' cognitive preferences and demonstrated effective learning pathways.

Recommendation And Suggestion
Based on the findings of this study, which revealed that visual, kinesthetic, and tactile learning styles significantly impact vocabulary size among Mandarin learners at USIM, several recommendations can be made to enhance vocabulary acquisition. First, instructors should incorporate multimodal teaching strategies that cater to these dominant learning preferences. For visual learners, this could include using character flashcards, infographics, and video-based learning tools that demonstrate stroke order. Kinesthetic learners would benefit from hands-on activities such as writing characters repeatedly or using gesture-based mnemonics, while tactile learners could engage with physical manipulatives like magnetic Chinese radicals or character puzzles. Digital tools such as duolingo, which combine visual and tactile feedback, should be integrated into lessons, along with interactive games and role-playing activities to reinforce vocabulary retention in a dynamic way.

While auditory, group, and individual learning styles showed less correlation with vocabulary size, they should not be entirely dismissed. Instead, these styles should be strategically scaffolded to support the dominant learning preferences. For instance, auditory learners could benefit from tonal drills and listening exercises, especially when paired with visual aids like color-coded tone markers in subtitles. Group and individual learners might engage in structured peer discussions or self-paced digital quizzes that allow them to process vocabulary at their own speed. By blending these methods, instructors can create a more inclusive learning environment that accommodates diverse preferences while still prioritizing the most effective styles.

To further optimize vocabulary learning, the policy maker, syllabus maker or universities should consider implementing personalized learning pathways. Given the variation in learning style preferences among students, diagnostic assessments could be used to tailor vocabulary modules to individual needs. For example, learners with strong visual preferences could be given additional resources like annotated texts or character decomposition charts, while kinesthetic learners might receive more interactive tasks such as writing in air or using body movements to memorize tones. This approach aligns with educational research emphasizing the importance of customized instruction in language learning. Additionally, future studies could explore the long-term effects of these interventions on vocabulary retention and overall Mandarin proficiency, providing deeper insights into how learning styles influence language acquisition over time.

Finally, professional development for Mandarin instructors should include training on multisensory teaching techniques. Workshops could demonstrate how to integrate visual, tactile, and kinesthetic activities into lesson plans effectively, ensuring that educators are

equipped to meet the diverse needs of their students. By adopting these recommendations, USIM can create a more engaging and effective learning environment that maximizes vocabulary growth for Mandarin learners. Further research could also investigate the interplay between learning styles and other factors, such as motivation or cultural background, to develop an even more comprehensive approach to language instruction.

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