Investigating Mandarin Writing and ChatGPT Using the Sociocultural Theory

*[1]Lim Siew Mei, [2]Lee Ai Chat, [3]Chee Sie Ching, [4]Noor Hanim Rahmat, [5]Ang Wei Yin, [6]Cai Ziyu, [7]Lim Siew Chu, [8]On Yee Min

[1,2,4,8]Akademi Pengajian Bahasa, Universiti Teknologi MARA, Shah Alam, Malaysia

[3]Akademi Pengajian Bahasa, Universiti Teknologi MARA, Kampus Arau, Malaysia

[5]Pusat Pengajian Bahasa, Tamadun & Falsafah, Universiti Utara Malaysia, Sintok, Malaysia

[6]Kong Zi Institute of China

[7]Sekolah Menengah Kebangsaan Katholik, Petaling Jaya, Malaysia

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ABSTRACT

The rapid development of artificial intelligence (AI) has transformed language learning methods. ChatGPT has become one of the most popular tools in language learning as it can assist learners in different aspects, including generating ideas, checking vocabulary and grammar, improving sentence structure, and revising written work. This study aims to investigate Mandarin writing and ChatGPT through the perspective of sociocultural theory, focusing on the More Knowledgeable Other (MKO), Scaffolding, and the Zone of Proximal Development (ZPD). This quantitative study used a 5-point Likert-scale survey adapted from Vygotsky (1978), Raoofi et al. (2017), and Youssef et al. (2024). A total of 203 Mandarin learners from a local university in Malaysia participated in this study. The findings showed that learners generally perceived ChatGPT as a useful, supportive tool in Mandarin writing. The study also found significant relationships between ChatGPT and MKO, Scaffolding, and ZPD. The result suggests that ChatGPT can be integrated into Mandarin writing tasks as a guided learning tool. However, learners should still think critically to verify ChatGPT responses independently and be actively involved in the whole writing process.

Keywords: (ChatGPT; Mandarin Writing; Sociocultural Theory; More Knowledgeable Other; Scaffolding; Zone of Proximal Development)

INTRODUCTION

Background of the Study

The rapid advancement of artificial intelligence (AI) technologies has significantly transformed educational practices, particularly in language learning and writing instruction. Among recent AI innovations, ChatGPT has emerged as a widely used AI-assisted tool capable of generating ideas, organising content, improving grammar, and providing instant feedback during writing activities. Educational institutions are increasingly integrating AI technologies into learning environments, resulting in changes in how students approach writing tasks and construct knowledge. Despite the increasing adoption of ChatGPT in educational contexts, concerns remain regarding its influence on learners' cognitive development, learning engagement, and writing processes.

Writing is generally recognised as a complex cognitive activity involving planning, organising, revising, and constructing meaning through language. According to Flower and Hayes (1981), writing is a recursive cognitive process that involves planning, translating ideas, and reviewing written output continuously throughout the writing task. To support this process, learners commonly employ writing strategies that facilitate both cognitive and metacognitive functioning. Raoofi et al. (2017) categorised writing strategies into metacognitive, cognitive,

social, affective, and effort regulation strategies, which collectively assist learners in managing writing tasks effectively. Therefore, writing development does not merely involve linguistic abilities but also requires interaction, support, and guidance throughout the learning process.

The development of digital technologies has increasingly encouraged learners to rely on AI-assisted tools such as ChatGPT to support writing activities. In educational settings, ChatGPT may function as a writing assistant by providing immediate responses, suggestions, explanations, and feedback to support learners during writing tasks. Nevertheless, while existing studies have largely focused on students' perceptions and acceptance of ChatGPT, limited attention has been given to understanding the interaction between learners and AI tools from a theoretical perspective.

This study is anchored in the sociocultural theory proposed by Vygotsky (1978), which emphasises that cognitive development occurs through social interaction and mediation. Rather than discussing all components of the theory, the present study focuses on three important elements: the More Knowledgeable Other (MKO), Scaffolding, and the Zone of Proximal Development (ZPD). MKO refers to an individual or source with greater knowledge that assists learners in completing tasks; scaffolding refers to temporary support provided during learning, while ZPD represents the difference between what learners can accomplish independently and what they can achieve with assistance. In technology-mediated learning environments, ChatGPT may potentially function as a form of MKO by providing guidance and scaffolding support that extends learners' capabilities within their ZPD.

Although numerous studies have investigated ChatGPT in education, the topic remains relevant for several reasons. First, previous studies mainly examined learners' perceptions and the effectiveness of ChatGPT usage without considering how learners interact with AI tools through a theoretical lens. Second, little attention has been given to examining whether learners' use of ChatGPT differs across demographic and educational factors such as gender, academic discipline, and Mandarin course level. Learners from different backgrounds may demonstrate different patterns of technological use, writing behaviour, and learning experience. Third, there remains limited research examining ChatGPT through the perspective of sociocultural theory, particularly concerning its role as an MKO and its relationship with Scaffolding and the ZPD during writing activities.

Recent studies suggest that AI-assisted technologies may function as technological mediators capable of supporting collaborative knowledge construction and extending learners' learning capacities within their ZPD (Tran et al., 2025; Li, Y. et al., 2025). However, empirical evidence examining the relationships among ChatGPT, MKO, Scaffolding, and ZPD remains insufficient. Furthermore, the extent to which these relationships vary across gender, discipline, and Mandarin course levels is still unclear.

Therefore, this study aims to investigate writing and ChatGPT using Sociocultural Theory by examining learners' perceptions of ChatGPT, MKO, Scaffolding and ZPD, as well as the relationships among these variables. Specifically, the study explores whether significant relationships exist between writing and ChatGPT across gender, discipline, and Mandarin course levels and further examines the relationships between ChatGPT and the dimensions of MKO, Scaffolding, and ZPD. Findings from this study may contribute to a deeper understanding of the role of AI-assisted learning tools in supporting writing development and may provide pedagogical implications for integrating ChatGPT meaningfully into language learning contexts.

Statement of Problem

ChatGPT has become a popular learning tool due to its ability to quickly answer various questions and generate human-like responses (Adiguzel, 2023). Today, many university students use ChatGPT to assist with their academic writing. Existing research indicates that ChatGPT is helpful for language learning and writing. For example, studies by Ashfaraliana et al. (2024) found that undergraduate students believed ChatGPT was easy to use and very helpful in brainstorming, vocabulary checking, and translation. Furthermore, research by Ahmad Azmi et al. (2023) shows that postgraduate students frequently use ChatGPT to correct grammatical errors and rewrite sentences to save their writing time.

However, over-reliance on ChatGPT leads to negative effects on writing instruction (Ahmad Azmi et al., 2023). Chia & Lee (2024) point out that when students directly use ChatGPT to obtain answers, they bypass the critical thinking process, which limits their writing skills. This over-reliance can harm students' learning outcomes. The study by Silalahi (2025) also showed that students are concerned about the accuracy of the answers provided by ChatGPT.

To solve these problems, students need to learn how to use ChatGPT as a supplementary tool rather than replacing their efforts (Mohammed Abdulkareem A. Alkamel, 2024). Therefore, we need to use solid theoretical foundations to explore how to properly use ChatGPT in the writing learning process. This study employs sociocultural theory to examine how students interact with ChatGPT in their writing assignments.

Objective of the Study and Research Questions

This study is done to explore writing and ChatGPT through sociocultural theory. Specifically, this study is done to answer the following questions:

Is there a significant relationship between writing and ChatGPT across gender?

$H_{01:}$ There is no significant relationship between writing and ChatGPT across genders.

Is there a significant relationship between writing and ChatGPT across disciplines?

$H_{02:}$ There is no significant relationship between writing and ChatGPT across disciplines.

Is there a significant relationship between writing and ChatGPT across the Mandarin course levels?

$H_{03:}$ There is no significant relationship between writing and ChatGPT across the Mandarin course levels.

- How do learners perceive the use of ChatGPT in writing?
- How do learners perceive MKO in writing?
- How do learners perceive Scaffolding in writing?
- How do learners perceive ZPD in writing?
- Is there a significant relationship between ChatGPT and MKO?

$H_{o4:}$ There is no significant relationship between ChatGPT and MKO.

- Is there a significant relationship between ChatGPT and Scaffolding?

H_{o5} There is no significant relationship between ChatGPT and Scaffolding

- Is there a significant relationship between ChatGPT and ZPD?

$H_{o6:}$ There is no significant relationship between ChatGPT and ZPD.

LITERATURE REVIEW

Theoretical Framework of the Study

Vygotsky's (1978) sociocultural theory posits that language and writing originate from social interactions and connections between individuals. He emphasises that meaningful social interactions enhance students' writing abilities. When students are faced with complex discourse structures, advanced vocabulary, and strict grammatical rules, they often encounter cognitive barriers that exceed their ability to cope with. These obstacles are located within their zone of proximal development (ZPD). At this point, external teaching resources, such as

inspirational feedback from tutors, course-provided guidance, or more capable peers (MKOs), can function as "instructional scaffolding".

The sociocultural theory of Vygotsky (1978) also emphasises that the ultimate goal of all instructional scaffolding is to promote the internalisation of psychological functions. In the early stages of writing instruction, writing standards and evaluation criteria are usually based on teacher corrections or imitation of peers' writing. Through the practice of social collaboration and feedback, these external evaluation standards are gradually absorbed by learners and reconstructed into their own cognitive mechanisms. Once students complete this internalisation process, they can truly achieve self-regulation and autonomy over the writing process.

Using ChatGPT in Writing

This study is grounded in the Sociocultural Theory proposed by Vygotsky (1978), which emphasises that learning and cognitive development occur through social interaction and mediated support. In the context of writing, learning is not viewed as an isolated individual process but as an activity shaped by interaction with external sources and cultural tools. The use of ChatGPT in writing can be explained through three major components of the theory, namely the More Knowledgeable Other (MKO), Scaffolding, and the Zone of Proximal Development (ZPD). Traditionally, MKO refers to teachers, peers, or experts who possess greater knowledge and guide learners in accomplishing tasks (Vygotsky, 1978). However, in technology-mediated learning environments, ChatGPT may function as a form of technological MKO by providing explanations, feedback, suggestions, and guidance during writing tasks (Tran et al., 2025). In addition, ChatGPT can provide scaffolding support by assisting learners with idea generation, language construction, content organisation, and revision processes. Such temporary assistance may help learners accomplish writing tasks beyond their current abilities and gradually develop independent writing skills (Wood et al., 1976). Consequently, learners may extend their capabilities within their Zone of Proximal Development (ZPD), which refers to the distance between what learners can achieve independently and what they can achieve with assistance (Vygotsky, 1978). Therefore, from a sociocultural perspective, ChatGPT may function as a technological mediator that facilitates collaborative knowledge construction and supports learners' writing development within technology-enhanced learning environments.

Past Studies on Writing and ChatGPT

The study done by Gasaymeh et al. (2025) explored education students' use of ChatGPT for academic and personal purposes in a developing country context. The study involved university students in Jordan and examined whether students' use of ChatGPT differed according to gender and academic level. The findings showed that students used ChatGPT moderately for both academic and personal purposes, and there were no significant differences in ChatGPT use based on gender or academic level. The findings also highlight that ChatGPT is not yet fully integrated into Jordanian students' routines, and tailored training and awareness initiatives could enhance its adoption among university students.

Next, the study by Jmaiel et al. (2025) investigated the role of ChatGPT as a self-directed learning tool in enhancing English for Specific Purposes (ESP) writing skills among EFL students. The study focused on students' writing improvement and examined gender and academic major differences involving 117 university students. The results indicated that ChatGPT helped improve students' writing skills, especially female students, while the academic major had only a limited impact on the enhancement of writing skills.

The study by Zhang (2025) focused on exploring ChatGPT's role in Mandarin acquisition. The study found that ChatGPT could function as an interactive and adaptable tool that supports Mandarin learners, especially in understanding vocabulary, grammar, and meaning. However, the study also suggested that ChatGPT may work better as a supporting tool rather than a complete content facilitator, which provides ready-made responses.

The study done by Jin et al. (2025) examined knowledge co-construction among artificial intelligence, novice teachers, and experienced teachers in an online professional learning community (OPLC). The findings showed that generative AI could support knowledge construction by acting as a facilitator who provides teaching resources and supports learning, but it cannot replace human interaction. Novice teachers tend to be more willing

to try and adapt to new technologies, while experienced ones engage reflectively with content and focus more on students' learning needs.

The study by Sari et al. (2026) explored students' skills and difficulties in argumentative writing. This study employed quantitative research methods to investigate English language students at the Faculty of Education, Padang State University. Research has found that students face five problems in argumentative writing: difficulty choosing a topic, difficulty organising their thoughts, insufficient vocabulary, a poor understanding of language features, and non-standard grammatical structures.

Rahmat & Whanchit (2024) conducted another study to examine the perception of learners' writing process from a socio-cultural perspective. This quantitative study collected questionnaires from 109 students. The data were analysed using descriptive and inferential statistics. This study indicates that students prioritise planning their thoughts before actually writing. When writing tasks are difficult, students need to interact with others, which can help reduce fear and build confidence and ease in the writing process. The study also demonstrated a strong positive correlation between language use, the zone of proximal development, and social interaction.

The integration of artificial intelligence (AI) into education reflects a shift in education towards technology-assisted learning, encouraging self-directed learning and data-driven writing development (Ammar et al., 2025). Among the main artificial intelligences, ChatGPT gives immediate responses on vocabulary usage, grammar and syntax and refines learners' writing in real time (Subramaniam & Mohamad, 2024). Researchers have conducted numerous studies to explore university students' perceptions, acceptance, and educational impact of using ChatGPT as an academic writing tool.

The study by Sanusi et al. (2025) discovered the role of ChatGPT in improving the academic writing skills of English as a Foreign Language (EFL) university students in Northern and Eastern Syria (NES). Using a quantitative approach, the study was conducted among 350 students at Rojava University. The results showed that students perceived ChatGPT as highly helpful in various aspects of writing, including brainstorming, grammar correction, and vocabulary expansion. The study also recommends that educators integrate ChatGPT into academic writing instruction while encouraging students to engage in reflection and critical thinking.

Next, the study by Silalahi (2025) investigated Indonesian students' perceptions of ChatGPT's usefulness and limitations in essay writing, using a questionnaire that included both closed-ended and open-ended questions. The study involved 76 first-year undergraduate students majoring in Information Technology at a private university in Indonesia. According to the findings, students found that ChatGPT was easy to use and capable of quickly understanding and responding to their questions. ChatGPT was also considered effective in providing relevant materials, checking vocabulary and sentence structure, inspiring ideas, and translating Indonesian sentences into English. This study points out that students use ChatGPT to help with English writing, but they also realise that their answers are sometimes inappropriate.

A study by Ashfaraliana et al. (2024) explored students' acceptance of ChatGPT as an assisting tool in academic writing among English as a Second Language (ESL) undergraduate students. This study employed a quantitative approach and involved 80 ESL undergraduate students who responded to a descriptive cross-sectional survey. This study concludes that ESL undergraduates generally accept ChatGPT as an academic writing tool, and attitude is the main factor predicting their acceptance of ChatGPT. This study indicates that the more positive students' attitudes toward using ChatGPT, the more likely they are to use it as a tool to assist in academic writing.

In summary, students learning a second language often face challenges in writing, such as choosing topics, organising ideas, choosing words poorly, and lacking confidence. Numerous studies have indicated that ChatGPT provides students with assistance in areas such as translation and sentence structure checking.

Conceptual Framework of the Study

Figure 1 presents the conceptual framework of the study. The concept of this study is anchored by the Sociocultural theory of Vygotsky (1978). The main components of this anchor theory of Sociocultural theory include the Zone of Proximal Development (ZPD), Scaffolding, the More Knowledgeable Other (MKO), cultural

tools, and language. These components are needed in the cognitive development of learners. So, this study is focused on factors such as MKO, Scaffolding, and ZPD (Figure 1).

This study merges the concepts from the theory and relates the concepts to the studies by Raoofi et al. (2017) and Youssef et al. (2024). The idea for this study is based on the fact that writing is a cognitive process (Flower and Hayes, 1981). The processes are facilitated using writing strategies (Khairuddin et al., 2021), and the strategies facilitate the writer in completing the writing task. Some strategies help learners with the cognitive aspects, while some strategies help learners with their metacognition (Rahmat, 2020). Additionally, Raoofi et al. (2017) state that writing strategies include metacognitive, effort regulation, cognitive, social, and affective writing strategies.

The age of technology has encouraged writers to turn to ChatGPT to facilitate their writing tasks. According to Youssef et al. (2024), the use of ChatGPT can influence a person's critical thinking abilities, academic achievement, ChatGPT usage, and student engagement. This study also explores the relationship between MKO, scaffolding, and ZPD.

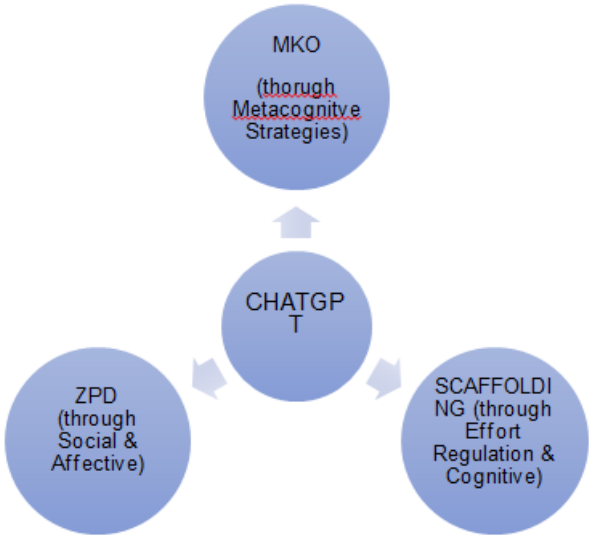

Figure 1 Conceptual Framework of the Study:

Interactions between ChatGPT with MKO, Scaffolding and ZPD

METHODOLOGY

This quantitative study is done to explore writing and ChatGPT through sociocultural theory. A convenient sample of 203 participants responded to the survey. The instrument used is a 5-point Likert-scale survey that is rooted in Vygotsky (1978), Raoofi et al. (2017), and Youssef et al. (2024) to reveal the variables in Table 3 below. Table 1 below shows the categories used for the Likert scale: 1 is for Strongly Disagree, 2 is for Disagree, 3 is for Undecided, 4 is for Agree, and 5 is for Strongly Agree.

Table 1 Likert Scale Use

1	Never
2	rarely
3	Sometimes
4	Often
5	Always

Table 2 Distribution of Items in the Survey

SECTION	VARIABLE	CONSTRUCT	NO OF ITEMS	
B	MKO	Metacognitive	10	10(.931)
C	SCAFFOLDING	Effort Regulation	4	10(.920)
		Cognitive	6	
D	ZPD	Social	4	7(.896)
		Affective	3	
E	CHATGPT	Critical thinking abilities	4	16 (.931)
		Academic achievement	4	
		ChatGPT usage	5	
		Student engagement	3	
				43(.964)

Table 2 shows the distribution of items in the survey. Section B has 10 items on MKO. Section C has 10 items on Scaffolding. Section D has 7 items on ZPD. Section E has 16 items on ChatGPT.

Table 3 Distribution of Items in the Survey

Reliability Level	Cronbach's Alpha range	Interpretation
Excellent	0.9 and above	Indicates very high internal consistency
Good	0.80-0.89	Reflects strong internal consistency
Acceptable	0.70-0.79	Indicates acceptable internal consistency
Questionable	0.60-0.69	Reflects questionable internal consistency
Poor	Below 0.6	Indicates poor internal consistency

In order to determine the internal reliability of the instrument, a reliability analysis is conducted. Table 3 above shows the distribution and interpretation of the Cronbach Alpha range. According to Ahmad et al. (2024), Cronbach's alpha scores between 0.7 and 0.9 are considered acceptable to excellent.

Table 2 also shows the reliability of the survey. The analysis shows a Cronbach alpha of .931 for MKO, .920 for Scaffolding, .896 for ZPD and .931 for ChatGPT. The overall Cronbach alpha for all 43 items is .964, thus revealing a good reliability of the instrument chosen/used. Further analysis using SPSS will be conducted to present findings that address the research questions of this study.

FINDINGS AND DISCUSSION

Demographic Analysis

According to Zienefuss et al. (2021), researchers report demographic data in percentages to establish sample representativeness and allow for generalisability to a larger population. The reporting also provides an overview of participants' characteristics. Percentages offer a clear and understandable picture of the sample makeup.

Table 4 Percentage for Demographic Profile

Question	Demographic Profile	Categories	Percentage (%)
1	Gender	Male	26%
		Female	74%
2	Discipline	Science & Technology	55%
		Social Sciences & Humanities	45%
3	Mandarin Course level	TMC 401	7%
		TMC 402	13%
		TMC 451	32%
		TMC 452	11%
		TMC 501	37%

Table 4 demonstrates the gender distribution, students' disciplines, and Mandarin level of the 200 respondents who participated in this research. There were 26% male and 74% female respondents, showing that the respondent group consists of a greater proportion of females compared to males. The respondents are distributed across various disciplines. Among 200 respondents, 55% are students in science and technology and 45% in social sciences and humanities. Out of a total of 200 respondents, 7% are enrolled in Mandarin Level 1 (TMC401), 13% are enrolled in Mandarin for Business Communication Level 1 (TMC402), 32% are registered in Mandarin Level 2 (TMC451), 11% are registered in Mandarin for Business Communication Level 2 (TMC452), and 37% are registered in Mandarin Level 3 (TMC501).

Inferential Statistics

According to Shah (2023), there are three main functions of a T-test. Firstly, T-tests are done to compare means. This test is also done to determine if the average scores (mean) or values of two groups, or one group against a known value, are different enough to be considered statistically meaningful and are not just due to random chance. Secondly, a t-test is done to test hypotheses. Researchers use t-tests to test hypotheses about means, such as whether a new treatment significantly impacts a variable or if there's a difference in performance between two distinct groups. Lastly, the t-test is used to identify significant differences. The output of a t-test provides a p-value (significance value). If this p-value is below a pre-determined threshold (often 0.05), it indicates a statistically significant difference, allowing researchers to conclude that the populations from which their samples were drawn are different.

Findings for Gender

This section presents data to answer research question 1: Is there a significant relationship between (a) writing and (b) ChatGPT across gender?

$H_{01:}$ There is no significant relationship between (a) writing and (b) ChatGPT across gender.

Table 5 Group Statistics by Gender

	Q1GENDER	N	Mean	Std. Deviation	Std. Error Mean
WRITING	MALE	53	3.5975	.74769	.10270
	FEMALE	150	3.8121	.57070	.04660
CHATGPT	MALE	53	3.5342	.80260	.11025
	FEMALE	150	3.6742	.64622	.05276

Table 6 Independent Samples t-test Results for Writing and ChatGPT by Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance		Mean	Std. Error	95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Difference	Lower	Upper
WRITING	Equal variances assumed	6.138	.014	-2.162	201	.016	.032	-.21461	.09929	-.41039	-.01883
	Equal variances not assumed			-1.903	74.511	.030	.061	-.21461	.11278	-.43931	.01008
CHATGPT	Equal variances assumed	3.811	.052	-1.269	201	.103	.206	-.13997	.11027	-.35741	.07747
	Equal variances not assumed			-1.145	77.138	.128	.256	-.13997	.12222	-.38334	.10340

A two-sample t-test was performed to compare the relationship between (a) writing and (b) ChatGPT across gender. There was a significant difference between (a) writing ($p = 0.032$) across genders. However, there was no significant difference for (b) ChatGPT (0.206) across genders. The null hypothesis is rejected for H_{o1a} and accepted for $H_{o1b.}$

Findings for Disciplines

This section presents data to answer research question 2: Is there a significant relationship between (a) writing and (b) ChatGPT across disciplines?

$H_{02:}$ There is no significant relationship between writing and ChatGPT across disciplines.

Table 7 Group Statistics for Writing and ChatGPT by Discipline

	Q2DISC	N	Mean	Std. Deviation	Std. Error Mean
WRITING	S&T	111	3.6934	.64985	.06168
	SS,H & B	92	3.8317	.59288	.06181
CHATGPT	S&T	111	3.6875	.67431	.06400
	SS,H & B	92	3.5774	.70992	.07401

Table 8 Independent Samples t-test Results for Writing and ChatGPT by Discipline

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance		Mean	Std. Error	95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Difference	Lower	Upper
WRITING	Equal variances assumed	.667	.415	-1.571	201	.059	.118	-.13836	.08808	-.31204	.03531
	Equal variances not assumed			-1.584	199.123	.057	.115	-.13836	.08732	-.31056	.03383
CHATGPT	Equal variances assumed	.582	.446	1.130	201	.130	.260	.11005	.09738	-.08196	.30206
	Equal variances not assumed			1.125	190.060	.131	.262	.11005	.09785	-.08295	.30306

A two-sample t-test was performed to compare the relationship between (a) writing and (b) ChatGPT across disciplines. There were no significant differences for (b) ChatGPT across disciplines. The null hypothesis is accepted for H_{02}.

Findings for Mandarin Level

This section presents data to answer research question 3: Is there a significant relationship between writing and ChatGPT across Mandarin course levels?

H_{03}: There is no significant relationship between writing and ChatGPT across the Mandarin course levels.

Table 9 Descriptive Statistics for Writing and ChatGPT by Course Code

						95% Confidence Interval for Mean			
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
WRITING	TMC401	14	3.6667	.68878	.18408	3.2690	4.0644	2.11	4.89
	TMC402	27	3.5761	.62512	.12030	3.3288	3.8234	2.11	5.00
	TMC452	64	3.8160	.59717	.07465	3.6668	3.9651	2.41	4.85
	TMC452	22	3.8906	.56163	.11974	3.6416	4.1396	2.85	4.96
	TMC501	76	3.7471	.65692	.07535	3.5970	3.8972	1.48	5.00
	Total	203	3.7561	.62697	.04400	3.6693	3.8428	1.48	5.00
CHATGPT	TMC401	14	3.6875	.71974	.19236	3.2719	4.1031	2.38	5.00
	TMC402	27	3.4491	.61654	.11865	3.2052	3.6930	2.38	5.00
	TMC452	64	3.6523	.61094	.07637	3.4997	3.8050	1.50	4.75
	TMC452	22	3.4915	.87506	.18656	3.1035	3.8795	1.44	5.00
	TMC501	76	3.7253	.71378	.08188	3.5622	3.8884	1.50	5.00
	Total	203	3.6376	.69113	.04851	3.5420	3.7333	1.44	5.00

Table 10 One-Way ANOVA Results for Writing and ChatGPT by Course Code

		Sum of Squares	df	Mean Square	F	Sig.
WRITING	Between Groups	1.620	4	.405	1.031	.392
	Within Groups	77.784	198	.393		
	Total	79.404	202			
CHATGPT	Between Groups	2.063	4	.516	1.082	.367
	Within Groups	94.424	198	.477		
	Total	96.487	202			

An ANOVA was performed to compare the relationship between (a) writing and (b) ChatGPT across disciplines. There were no significant differences for (a) writing (p=0.392) and (b) ChatGPT (p=0.516) across Mandarin levels. The null hypothesis is accepted for H_{03}.

Descriptive Statistics

Why is there a need to report the mean and standard deviation? According to Vetter (2017), the mean (M) represents the average, or centre, of a data set. Standard deviation (SD) indicates the typical distance of individual observations from the mean, which shows the data's variability or spread. A low SD means the data points are clustered close to the mean, whereas a high SD indicates they are more spread out. It is good to have a high SD.

Findings for ChatGPT

This section presents data to answer research question 4: How do learners perceive the use of ChatGPT in writing? This study measures this through (i) critical thinking abilities, (ii) academic achievements, (iii) ChatGPT usage, and (iv) student engagement.

Table 11 Mean (M) and Standard Deviation (SD) for CRITICAL THINKING ABILITIES (CT)

ITEM	M	SD
CTQ1 I usually need clarification on the precision and reliability of information provided by ChatGPT, which enhances my critical thinking skills.	3.63	0.97
CTQ2 ChatGPT's responses made me doubt their validity, leading me to seek further clarification or evidence.	3.75	0.90
CTQ3 I actively explore alternative viewpoints or sources of information when using ChatGPT to ensure a comprehensive understanding of the topic.	3.76	0.83
CTQ4 I need clarification about the accuracy of ChatGPT's output, which often encourages me to evaluate the information and conduct additional research independently.	3.84	0.91

The findings in Table 11 indicate that respondents generally demonstrated a moderately high level of critical thinking abilities when using ChatGPT. Among the four items, the highest mean score was recorded for item 4 (M = 3.84, SD = 0.91), indicating that respondents tended to require clarification regarding the accuracy of ChatGPT outputs, which encouraged them to evaluate information critically and conduct additional independent research. This was followed by item 3 (M = 3.76, SD = 0.83), suggesting that respondents actively explored alternative viewpoints and sources of information to gain a more comprehensive understanding of topics when using ChatGPT. Similarly, item 2 (M = 3.75, SD = 0.90) showed that respondents often questioned the validity of ChatGPT responses and sought further clarification or supporting evidence.

The lowest mean score was reported for item 1 (M = 3.63, SD = 0.97), although it still reflected a relatively positive level of agreement, indicating that respondents generally required clarification regarding the precision and reliability of information generated by ChatGPT, which contributed to enhancing their critical thinking skills. Overall, the findings suggest that the use of ChatGPT appeared to encourage learners to engage in critical evaluation, information verification, and independent inquiry, thereby promoting critical thinking development during the learning process.

Table 12 Mean (M) and Standard Deviation (SD) for ACADEMIC ACHIEVEMENTS (AA)

ITEM	M	SD
AAQ1 I actively explore alternative viewpoints or sources of information when using ChatGPT to ensure a comprehensive understanding of the topic.	3.72	0.83.
AAQ2 ChatGPT brings innovative ideas that are ready to be shared with students.	3.64	0.90
AAQ3 Students can anticipate robust writing guidance from ChatGPT.	3.47	0.94
AAQ4 ChatGPT has improved my academic performance.	3.77	0.93

The findings in Table 12 indicate that respondents generally perceived ChatGPT as having a moderately positive influence on academic achievement. Among the four items, the highest mean score was recorded for item 4 (M = 3.77, SD = 0.93), suggesting that respondents perceived ChatGPT as contributing positively to the improvement of their academic performance.

This was followed by item 1 (M = 3.72, SD = 0.83), indicating that respondents actively explored alternative viewpoints and additional sources of information when using ChatGPT, which may help them develop a more comprehensive understanding of a topic. The finding for item 2 (M = 3.64, SD = 0.90) reveals that respondents agreed that ChatGPT could provide innovative ideas that may be useful for learning and teaching purposes. Meanwhile, item 3 (M = 3.47, SD = 0.94) recorded the lowest mean score among all items; however, it still indicated a moderate level of agreement, suggesting that respondents perceived ChatGPT as providing useful writing guidance, although this aspect was rated slightly lower than other academic benefits. Overall, these findings suggest that respondents viewed ChatGPT as a supportive educational tool that may contribute to

academic achievement by improving learning performance, enhancing access to diverse perspectives, and providing valuable support during writing and learning activities.

Table 13 Mean (M) and Standard Deviation (SD) for CHATGPT USAGE (CU)

ITEM	M	SD
CUQ1 ChatGPT is a state-of-the-art writing model that is favourably used today.	3.64	0.92
CUQ2 Students seek help from ChatGPT's assistance in composing essays and articles.	3.47	0.92
CUQ3 ChatGPT helps students with Mandarin language translation.	3.56	0.97
CUQ4 Employing ChatGPT significantly improves human productivity.	3.56	0.94
CUQ5 The advent of ChatGPT marks a groundbreaking transformation in Natural Language Processing capabilities.	3.49	0.92

Table 13 shows the mean (M) and standard Deviation (SD) for ChatGPT usage among respondents. The highest mean score was recorded for item 1 (M = 3.64, SD = 0.92), indicating that respondents generally agreed that ChatGPT is an advanced writing model that is widely used today. This was followed by item 3 and item 4, which recorded the same mean score. Item 3 (M = 3.56, SD = 0.97) suggests that respondents perceived ChatGPT as useful in assisting them with Mandarin language translation. Similarly, item 4 (M = 3.56, SD = 0.94) indicates that respondents believed ChatGPT could help improve productivity.

Item 5 (M = 3.49, SD = 0.92) shows that respondents moderately agreed that the emergence of ChatGPT represents an important development in Natural Language Processing capabilities. Meanwhile, item 2 (M = 3.47, SD = 0.92) recorded the lowest mean score, although it still reflected a moderate level of agreement, indicating that respondents use ChatGPT for getting help writing essays and articles. Overall, the findings suggest that respondents perceived ChatGPT as a useful tool for writing, translation, productivity, and language-related support, with all items showing moderate levels of agreement.

Table 14 Mean (M) and Standard Deviation (SD) for STUDENT ENGAGEMENT (SE)

ITEM	M	SD
SEQ1 ChatGPT is more interactive, human-like, and engaging for the students.	3.43	0.98
SEQ2 ChatGPT increases confidence in my ability to conduct research or search for materials.	3.59	0.90
SEQ3 ChatGPT is easy to use and more engaging for me.	3.77	0.92

Table 14 states the mean (M) and standard deviation (SD) for Student Engagement (SE). With reference to the table above, the highest mean score was recorded for item 3 (M = 3.77, SD = 0.92), showing that respondents generally found ChatGPT simple to use and engaging.

This was followed by item 2 (M = 3.59, SD = 0.90), which indicates that respondents perceived ChatGPT as helpful in increasing their confidence when conducting research or searching for learning materials. Meanwhile, item 1 recorded the lowest mean score (M = 3.43, SD = 0.98), although it still reflected a moderate level of agreement. Respondents still moderately agreed that ChatGPT is interactive, human-like, and engaging. Overall, the findings suggest that ChatGPT may support learning engagement by providing an accessible, engaging, and confidence-enhancing learning experience.

Findings for More Knowledgeable Other (MKO)

This section presents data to answer research question 5: How do learners perceive MKO in writing? In the context of this study, the phenomenon is measured by metacognitive strategies.

Table 15 Mean (M) and Standard Deviation (SD) for METACOGNITIVE WRITING SKILLS (MWS)

ITEM	M	SD
MWSQ1 I organise my ideas prior to writing.	3.36	0.96
MWSQ2 I revise my writing to make sure it includes everything I want to discuss in it.	3.70	0.88
MWSQ3 I check my spelling.	4.05	0.86

MWSQ4 I check my writing to make sure it is grammatically correct.	4.04	0.83
MWSQ5 I evaluate and re-evaluate the ideas in my essay.	3.73	0.84
MWSQ6 I monitor and evaluate my progress in writing.	3.67	0.82
MWSQ7 I revise and edit an essay two or more times before I hand it in to my teacher.	4.07	0.94
MWSQ8 I go through the planning stages in my writing.	3.76	0.84
MWSQ9 I go through the drafting stages in my writing.	3.84	0.90
MWSQ10 I go through the revising and editing stages in my writing.	3.91	0.88

Table 15 presents the mean (M) and standard deviation (SD) for Metacognitive Writing Strategies (MWS). With reference to the table above, the highest mean score was recorded for item 7 (M = 4.07, SD = 0.94), which indicates that respondents generally revised and edited their essays two or more times before submitting them to their lecturer.

This was followed closely by item 3 (M = 4.05, SD = 0.86) and item 4 (M = 4.04, SD = 0.83), suggesting that respondents were likely to check their spelling and ensure that their writing was grammatically correct. Item 10 (M = 3.91, SD = 0.88) also showed that respondents tended to go through the revising and editing stages in their writing process. Meanwhile, the lowest mean score was recorded for Item 1 (M = 3.36, SD = 0.96), which indicates that respondents were less likely to organise their ideas before writing compared with other metacognitive writing strategies. However, it still reflects a moderate level of agreement. Overall, the findings suggest that respondents demonstrated a relatively strong use of metacognitive writing strategies, particularly in revising, editing, and checking language accuracy. Nevertheless, they appear to engage less frequently with prewriting, planning, and organising ideas.

Findings for Scaffolding

This section presents data to answer research question 6: How do learners perceive Scaffolding in writing? In the context of this study, this is measured by (i) Effort Regulation and (ii) Cognitive Strategies.

Table 16 Mean (M) and Standard Deviation (SD) for EFFORT REGULATION STRATEGIES (ERS)

ITEM	M	SD
ERSQ1 I write a lot to develop my writing skills.	3.27	0.92
ERSQ2 I often work hard to do well in my writing, even if I don't like Mandarin writing tasks.	3.63	0.87
ERSQ3 Even if the writing activities are difficult, I don't give up but try to engage in them.	3.93	0.84
ERSQ4 I concentrate as hard as I can when doing a writing task.	3.40	0.84

The results in Table 16 present the mean (M) and standard deviation (SD) for respondents' effort regulation in Mandarin writing. The highest mean scores were recorded for item 3 (M = 3.93, SD = 0.84), indicating that respondents generally showed persistence when completing difficult writing activities and were willing to continue engaging in the tasks without giving up.

This was followed by item 2 (M = 3.63, SD = 0.87), showing that respondents often worked hard to perform well in writing tasks, even when they did not enjoy the Mandarin writing task. Item 4 also recorded a moderate mean score (M = 3.40, SD = 0.84), displaying that respondents tend to concentrate as much as possible when completing writing tasks. Among the four items, item 1 obtained the lowest mean score (M = 3.27, SD = 0.92), indicating that respondents were less likely to practice their writing skills by writing extensively compared with the other aspects of effort regulation. Overall, the findings suggest that respondents demonstrated a moderate to high level of effort regulation in Mandarin writing, particularly in terms of persistence and willingness to work hard despite difficulties.

Table 17 Mean (M) and Standard Deviation (SD) for COGNITIVE WRITING STRATEGIES (CWS)

ITEM	M	SD
CWSQ1 I use memorised grammatical elements in my writing.	3.68	0.85

CWSQ2 I put newly memorised vocabulary in my sentences.	3.64	0.89
CWSQ3 In order to generate ideas for my writing, I usually engage in brainstorming.	3.68	0.84
CWSQ4 I use different words that have the same meaning.	3.20	1.04
CWSQ5 I use my experiences and knowledge in my writing.	3.68	0.93
CWSQ6 I try to use effective linking words to ensure a clear and logical relationship between sentences or paragraphs.	3.63	0.90

The findings in Table 17 indicate that respondents generally demonstrated a moderately high use of cognitive writing strategies in their writing activities. The highest mean scores were recorded for item 1 (M = 3.68, SD = 0.85), item 3 (M = 3.68, SD = 0.84), and item 5 (M = 3.68, SD = 0.93), indicating that respondents tended to use memorised grammatical elements in their writing, engage in brainstorming activities to generate ideas, and apply their own experiences and knowledge during the writing process. Among these highest-scoring items, item 3 showed the lowest standard deviation (SD = 0.84), suggesting greater consistency in responses regarding the use of brainstorming strategies.

The second-highest item was item 2 (M = 3.64, SD = 0.89), indicating that respondents commonly incorporated newly learned vocabulary into their sentences. This was followed closely by item 6 (M = 3.63, SD = 0.90), reflecting that respondents used effective linking words to establish logical relationships between sentences and paragraphs. The lowest mean score was recorded for item 4 (M = 3.20, SD = 1.04), suggesting that respondents were comparatively less likely to use different words with similar meanings in their writing. Overall, the findings suggest that learners relied more heavily on memorised grammar knowledge, brainstorming techniques, and personal experiences than on lexical variation strategies when applying cognitive writing strategies.

Findings for Zone of Proximal Development (ZPD)

This section presents data to answer research question 7: How do learners perceive ZPD in writing? In the context of this study, the ZPD is measured by (i) social and (ii) affective strategies.

Table 18 Mean (M) and Standard Deviation (SD) for SOCIAL WRITING STRATEGIES (SWS)

ITEM	M	SD
SWSQ1 In order to generate ideas for my writing, I usually discuss the writing topic with a friend or classmate.	4.02	0.91
SWSQ2 After revising and editing my essay thoroughly, I ask a friend or my classmate to read and comment on it.	3.88	0.94
SWSQ3 I try to identify friends or classmates whom I can ask for help in my writing.	4.01	0.87
SWSQ4 When I have trouble writing my essay, I try to do it with my classmates or friends.	4.08	0.85

Table 18 presents the mean (M) and standard deviation (SD) for Social Writing Strategies (SWS). The highest mean score was recorded for item 4, with the highest mean score (M = 4.08, SD = 0.85), indicating that respondents tended to seek help from classmates or friends when they faced difficulties in writing their essays. This was followed by item 1 (M = 4.02, SD = 0.91), showing that respondents frequently discussed writing topics with friends or classmates in order to generate ideas.

Next, item 3 (M = 4.01, SD = 0.87) also recorded a high mean score, indicating that respondents try to find friends or classmates who can assist them with their writing. Meanwhile, item 2 (M = 3.88, SD = 0.94) recorded the lowest mean score among the four items, although it still reflected a relatively high level of agreement. This suggests that respondents generally asked friends or classmates to read and provide comments on their essays after revising and editing them carefully. Overall, the findings suggest that respondents demonstrated a strong tendency to use social writing strategies, particularly by seeking peer support, discussing writing topics, and getting feedback from classmates or friends during the writing process.

Table 19 Mean (M) and Standard Deviation (SD) for AFFECTIVE WRITING STRATEGIES (AWS)

ITEM	M	SD
AWSQ1 I try to write an essay in class with confidence and ease.	3.44	0.92

AWSQ2 I try to relax whenever I feel afraid of writing.	3.71	0.90
AWSQ3 I encourage myself to write even when I am afraid of making mistakes.	3.80	0.88

Table 19 states the mean (M) and standard deviation (SD) for Affective Writing Strategies (AWS). With reference to the table above, the highest mean score was recorded for item 3 (M = 3.80, SD = 0.88), showing that respondents tended to encourage themselves to write even when they were afraid of making mistakes. This was followed by item 2 (M = 3.71, SD = 0.90), indicating that respondents tried to relax themselves whenever they felt afraid of writing. Meanwhile, the lowest mean score was recorded for item 1 (M = 3.44, SD = 0.92), although it still reflected a moderate level of agreement. This suggests that respondents were comparatively less confident and less at ease when writing essays. Overall, the findings suggest that respondents demonstrated a moderately positive use of affective writing strategies, particularly in terms of self-encouragement and emotional regulation when having anxiety in writing.

Exploratory Statistics

According to He (2024), correlation is a statistical technique that shows how strongly two variables are related to each other or the degree of association between the two. It's a common tool for describing simple relationships without making a statement about cause and effect. This section presents data to answer the research question on correlation.

According to He (2024), the coefficient is significant at the 0.05 level, and a 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.

To determine if there is a significant association between the mean scores of ChatGPT and all the components of writing, the data are analysed using SPSS for correlations. Results are presented separately in Table 20 below.

Table 20 Correlation between ChatGPT and Writing Components

Correlations					
		CHATGPT	MKO	SCAFFOLDING	ZPD
CHATGPT	Pearson Correlation	1	.388**	.495**	.559**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	203	203	203	203
MKO	Pearson Correlation	.388**	1	.788**	.705**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	203	203	203	203
SCAFFOLDING	Pearson Correlation	.495**	.788**	1	.789**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	203	203	203	203
ZPD	Pearson Correlation	.559**	.705**	.789**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	203	203	203	203
**Correlation is significant at the 0.01 level (2-tailed).					

Findings for the Relationship between ChatGPT and More Knowledgeable Other (MKO)

This section presents data to answer research question 8: Is there a significant relationship between ChatGPT and MKO?

H_{o4}: There is no significant relationship between ChatGPT and MKO.

Table 20 revealed that there is a moderately significant relationship between ChatGPT and MKO (r=.388**) and (p=<.000). The null hypothesis is rejected for H_{04}.

Findings for the Relationship between ChatGPT and Scaffolding

This section presents data to answer research question 9: Is there a significant relationship between ChatGPT and Scaffolding?

H_{o5} There is no significant relationship between ChatGPT and Scaffolding.

Table 20 also revealed that there is a moderately significant relationship between ChatGPT and Scaffolding (r=.495**) and (p=<.000). The null hypothesis is rejected for H_{o5}.

Findings for the Relationship between ChatGPT and Zone of Proximal Development (ZPD)

This section presents data to answer research question 10: Is there a significant relationship between ChatGPT and ZPD?

$H_{o6:}$ There is no significant relationship between ChatGPT and ZPD.

Table 20 also revealed that there is a strong, significant relationship between ChatGPT and ZPD (r=.559**) and (p=<.000). The null hypothesis is rejected for H_{o6}.

CONCLUSION

Summary of Findings and Discussions

The research explored Mandarin writing and ChatGPT through sociocultural theory. In relation to the first research question, the findings showed that there was a significant difference in writing across gender, but no significant difference in ChatGPT across gender. This suggests that male and female respondents may differ in their writing styles or strategies, but their perceptions of ChatGPT were generally similar. This finding is partly in accordance with Gasaymeh et al. (2025), who found that there were no significant gender differences in students' use of ChatGPT for academic and personal purposes. Therefore, although gender may influence certain writing styles in the present study, ChatGPT appears to be perceived as a generally accessible learning tool across gender groups.

Regarding the second research question, the findings indicated that there was no significant difference in ChatGPT use across different academic disciplines. This suggests that respondents from different academic disciplines had relatively similar perceptions and experiences regarding writing and ChatGPT use. This finding can be related to Jmaiel et al. (2025), who found that ChatGPT improved students' writing skills across different academic majors, although some differences were observed among majors. Hence, the present study supports the idea that ChatGPT can be used across disciplines as a writing support tool, although its use may vary depending on the learning context.

For the third research question, the findings showed no significant difference in writing between students and ChatGPT across Mandarin course levels. This suggests that learners at different levels of Mandarin perceived writing and ChatGPT in a relatively similar way. This is in accordance with the study done by Zhang (2025), who examined the use of ChatGPT in learning Mandarin and highlighted its role in supporting learners' interaction with Mandarin vocabulary, grammar, and meaning-making activities. Thus, the present study suggests that ChatGPT may be useful across different levels of Mandarin learning, although learners may still require proper guidance to use it effectively.

To answer the fourth research question, the results indicated that respondents who are Mandarin learners generally demonstrated a moderately high level of critical thinking abilities when using ChatGPT. The findings showed that learners mainly associated ChatGPT with critical evaluation, academic support, usage for writing and translation, and learning engagement. The highest tendency was related to evaluating the accuracy of ChatGPT outputs, while the comparatively lower tendency was related to using ChatGPT for essay and article composition. This finding is in accordance with Youssef et al. (2024), who found that ChatGPT usage had positive effects on student engagement, critical thinking abilities, and academic achievement. Therefore,

ChatGPT may support writing when learners use it critically and reflectively rather than accepting all generated responses without critical evaluation.

For the fifth research question, learners perceived Metacognitive Knowledgeable Objects (MKO) in writing through their use of metacognitive writing strategies. The findings showed that learners demonstrated stronger tendencies in revising, editing, spelling, and grammar checking, while organising ideas before writing was comparatively lower. This indicates that learners were more active in improving their writing after drafting than in planning before writing. This finding is in line with Rahmat (2021), who found that writers use cognitive and metacognitive strategies in academic writing. Therefore, the present study suggests that metacognitive strategies play an important role in helping learners regulate and improve their Mandarin writing process.

In relation to the sixth research question, the findings showed that learners perceived scaffolding in writing through effort regulation and cognitive writing strategies. The findings showed that respondents demonstrated a moderate-to-high level of effort regulation in Mandarin writing, particularly in terms of persistence and willingness to work hard despite difficulties; however, they were less likely to practice writing extensively compared with other aspects of effort regulation. In terms of cognitive strategies, learners relied more on memorised grammatical elements, brainstorming, and personal experiences. This finding supports Raoofi et al. (2017), who stated that writing strategies include cognitive strategies and effort regulation strategies that help learners manage and complete writing tasks. Learners may still need scaffolding to strengthen weaker areas, such as regular writing practice and vocabulary variation.

Next, for the seventh research question, learners perceived the Zone of Proximal Development (ZPD) in writing through social and affective writing strategies. The findings showed that learners demonstrated a strong tendency to seek help from friends or classmates when they faced writing difficulties, discuss writing topics to generate ideas, and ask peers for feedback during the writing process. In terms of affective strategies, learners encouraged themselves to write even when they were afraid of making mistakes, although confidence and ease in writing were comparatively lower. This finding is in accordance with Rahmat and Whanchit (2024), who found that writing is not a solitary process and that learners benefit from interaction, social support, and affective strategies during the writing process. Hence, the present study supports the view that learners can move within their ZPD when they receive peer support and manage writing-related anxiety.

Regarding the eighth research question, the findings revealed a significant relationship between ChatGPT and the More Knowledgeable Other (MKO). This suggests that learners who perceived ChatGPT positively were also likely to perceive MKO-related writing support positively. This finding is in line with Tran et al. (2025), who argued that generative artificial intelligence can function as a More Knowledgeable Other within a social constructivist framework. In the context of the present study, ChatGPT may function as a technological MKO by providing explanations, suggestions, and feedback that assist learners during Mandarin writing activities.

To answer the ninth research question, the findings indicated that there is a moderately significant relationship between ChatGPT and scaffolding. This suggests that ChatGPT may provide temporary support during writing, for instance, in areas such as idea generation, grammar checking, vocabulary support, translation, and revision. This finding was supported by Subramaniam and Mohamad (2024), who reported that ChatGPT and other AI-driven tools can enhance learners' engagement, motivation, personalised learning, and writing skills. Therefore, ChatGPT can be understood as a scaffolding tool that supports learners during the writing process, especially when they face difficulties in language use and content development.

For the tenth research question, the findings revealed a strong, significant relationship between ChatGPT and the Zone of Proximal Development (ZPD). This suggests that ChatGPT may help learners extend their writing ability by supporting tasks that they may not be able to complete independently. This finding is related to Jin et al. (2025), who found that generative AI can contribute to knowledge co-construction as a facilitator or a guide rather than a replacement for human interaction. Therefore, the present study suggests that ChatGPT may support learners within their ZPD by offering guided assistance, while learners still need to remain actively involved in the whole writing process.

In summary, the findings show that learners generally perceived ChatGPT as a useful support tool in Mandarin writing. ChatGPT was associated with critical evaluation, academic support, writing engagement, and writing assistance. At the same time, the findings also suggest that learners still need to verify the outputs generated by ChatGPT, practice writing regularly, strengthen their planning strategies, and improve their lexical variations. From the perspective of Sociocultural Theory, ChatGPT may function as a technological MKO, provide scaffolding support, and assist learners within their ZPD. Therefore, ChatGPT should be used as a supplementary learning tool that supports and assists learners' writing development without replacing their own thinking, knowledge, effort, and interaction with others.

Implications and Suggestions for Future Research

Theoretical and Conceptual Implications

The results of this study support the use of Sociocultural Theory in understanding Mandarin writing and ChatGPT. Based on the theory, learning happens through support, interaction, and guidance. The findings show that ChatGPT can be viewed as one of the learning tools that could provide support to the learners during the writing process.

The significant relationships between ChatGPT, MKO, Scaffolding, and ZPD also support the conceptual framework of this study. ChatGPT may act as a technological MKO by giving learners suggestions, explanations, and feedback. It may also provide scaffolding when learners need help with generating writing ideas, vocabulary, grammar, translation, or revision. In this way, ChatGPT can help learners complete writing tasks that may be difficult for them to do independently.

However, the findings also show that learners still need to think critically, verify the accuracy of ChatGPT's outputs, and continue to make their own effort in writing tasks. Therefore, ChatGPT should not be seen as replacing the role of teachers, peers' support, or learners' own thinking. Instead, it can be understood as a supporting tool that works together with learners' writing strategies and helps them develop their Mandarin writing within the framework of Sociocultural Theory.

Pedagogical Implications

The findings of this study suggest that ChatGPT can serve as a useful tool in Mandarin writing tasks. Since students perceive ChatGPT as useful for writing support, translation, idea generation, and revision, lecturers can guide students to use it during different stages of the writing process. For instance, students may use ChatGPT to brainstorm ideas, check vocabulary, improve sentence structure, and revise their writing drafts.

However, lecturers should also remind students that ChatGPT should not replace their own effort. The findings showed that learners still needed to verify the accuracy of ChatGPT's responses and evaluate the information provided. Hence, lecturers should guide students on how to question, verify, and improve ChatGPT's responses instead of simply copying the outputs without thinking. This can help students develop stronger critical thinking and a more responsible use of AI tools.

The findings of the study also suggest that students may need more support in generating ideas, writing extensively, and applying different vocabulary in their writing tasks. Therefore, lecturers may try to design writing tasks that could encourage students to plan before writing, practise writing regularly, and use a wider range of words and expressions. Besides that, peer discussion and feedback should also be included in the writing tasks, as students showed a strong tendency to seek help from friends and classmates when completing written assignments.

In summary, Mandarin writing instruction should not reject or avoid using ChatGPT but should integrate it meaningfully into the learning process. Lecturers can use ChatGPT as a guided teaching and learning tool while still encouraging students to take the initiative to think independently, interact with peers, and take responsibility for their own Mandarin writing skill development.

Suggestions for Future Research

Future research may expand this study by involving a larger number of respondents from different universities and academic backgrounds. This would help provide a broader understanding of how learners from different contexts use ChatGPT in Mandarin writing.

Besides that, future studies may include qualitative methods such as focus group interviews with lecturers and students or classroom observations to gain deeper insights into learners' actual experiences when using ChatGPT in doing writing tasks in different languages and not just the Mandarin language. This would help researchers understand not only what learners think about ChatGPT, but also how they utilise it during the whole writing process.

Future research can also investigate the effect or influence of ChatGPT on students' actual Mandarin writing performance. For example, future studies can compare students' writing performances before and after using ChatGPT to determine whether there are improvements in various aspects, such as idea organization, vocabulary use, grammar accuracy, and overall writing quality.

In addition, future research may explore how lecturers can guide students to use ChatGPT more effectively and responsibly. Since the findings showed that learners still need to verify ChatGPT's responses and make their own effort in writing, future studies can focus on AI literacy, critical thinking, and suitable teaching and learning strategies for using ChatGPT in language learning.

Lastly, future studies may compare ChatGPT with other AI applications or tools to identify which tools are more suitable for supporting Mandarin writing. This can help educators choose appropriate digital tools and design better writing activities for language learners.

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