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Learning Style Preferences, Strategy Use and Chinese Undergraduate EFL Students' English Achievements

Abstract

Research shows that both learning style preference and strategy use are important factors affecting second/foreign language (SL/FL) learning, and that both may vary, as learners are different. Yet, studies on learning style preferences and their interaction with strategy in relation to SL/FL learning outcomes are limited. The present study thus examined Chinese undergraduate EFL (English as a FL) students' preferences for learning styles, use of learning strategies and their predictive effects on their English achievements. Analyses of 439 questionnaires revealed the following major findings: (1) the whole sample, regardless of gender, displayed no major preference for any learning style and generally preferred the kinesthetic style the most, followed by tactile, auditory, visual, group and individual styles respectively; (2) the whole sample, regardless of gender, demonstrated a medium to high level of use of the six types of learning strategies, and used metacognitive strategies the most frequently, followed by cognitive, social, compensation, memory and affective strategies, respectively; (3) cognitive strategy use significantly positively predicted all samples' English achievements, additionally, memory strategy use and the tactile style significantly predicted female students' English achievements, and (4) no significant difference was observed between genders in learning styles or strategy use except for group learning. These findings further pinpoint the importance of learning styles and strategy use in second/foreign language learning, which thus deserve continuous research.

Keywords: learning style, strategy use, achievement in English, gender difference, predictive effect

It is widely acknowledged that various individual factors such as motivation, emotion, learning style and strategy use affect second/foreign language (SL/FL) learning (Oxford, 1990; Sun et al., 2023). Consequently, individual factors have become an important research topic in SL/FL learning and acquisition. Of these

factors, learning style remains relatively less researched, although an increasingly greater number of studies have examined SL/FL learners' learning style preferences and their relations to SL/FL learning since the 1970s (Al Khatib & Ghosheh, 2013; Liu & Chen, 2024).

Research on learning styles in SL/FL learning primarily focuses on ESL/EFL (English as SL/FL) learners, which shows that ESL/EFL learners generally prefer kinesthetic and tactile styles the most, and group learning the least (e.g., Gao, 2016; Mozayan et al., 2013), displaying varying preferences for different styles based on individual factors such as gender, culture, and education (e.g., Alkahtani, 2016; Gao, 2016; Ha, 2019). As for the relationship between learning styles and English learning, the limited available literature reveals mixed findings (Akbarian et al., 2019; Malsawmkimi & Fanai, 2019). All these factors clearly justify more research on learning styles in relation to ESL/EFL learning outcomes.

Compared to learning styles, language learning strategies have been extensively researched in various SL/FL contexts. The results show that good learners tend to utilize more effective strategies and be more flexible in choosing more suitable strategies than poor learners (e.g., Lin et al., 2021; McMullen, 2009; Pongsukvajchakul, 2021). Nevertheless, when individual factors were considered, mixed findings have been found about the use of strategies and its relation to SL/FL learning outcomes (e.g., Gregersen & MacIntyre, 2014; Pongsukvajchakul, 2021). Hence, continuous research on language learning strategies is needed as well.

Moreover, insufficient research has been conducted to explore the interaction of learning styles with other individual factors (Lin et al., 2021; Zokaee et al., 2012). This also motivates the present research, which aims to examine Chinese university EFL students' preferences for learning styles, use of language learning strategies and their predictive effects on their English achievements.

Literature Review

Learning Styles

For decades, learning styles, or differences in how people learn, have caught the attention of educators and researchers as a way of meeting students' individual needs (Whitman, 2023). Keefe (1979, p. 4) defined learning styles as "characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." Reid (1995) regarded learning styles as a student's natural, habitual, and preferred way of absorbing, processing, and retaining new knowledge.

Many theories have been proposed to explain learning styles, of which the most well-known include the Felder-Silverman learning/teaching style model, the Kolb experiential learning theory, Reid's perceptual learning style theory, and Fleming and Mills' sensory-based learning styles (Hawk & Shah, 2007; Whitman, 2023). Though each theory varies in how they describe learning styles and categorize learners, all believe that learners learn in different ways (Hawk & Shah, 2007). For example, Dunn and Price (1975) categorized learning styles as visual, tactile, and kinesthetic. Kolb (1984) grouped learning styles as diverging (perceiving input concretely and processing it reflectively), converging (perceiving input abstractly and processing it actively), assimilating (perceiving input abstractly and processing it reflectively), and accommodating (perceiving input concretely and processing it actively). Reid (1987) classified learning styles into six types: Auditory (learning through the oral-aural channel), visual (learning through the seeing/visual channel), kinesthetic (learning through experiential learning), tactile (learning through hands-on activities), individual learning (learning through working alone), and group learning (learning through working with others). To measure learning styles of non-native speakers of English, Reid (1987) developed the 30-item five-point-Likert Perceptual Learning Style Preference Questionnaire (PLSPQ) which covers these six categories, with five items for each category. Reid (1987) also provided three cut-off scores for major (38–50), minor (27–37), and negligible (24 or less) learning style preferences to analyze the data received from the PLSPQ.

Despite lacking consistent levels of validity and reliability (Pelegrín, 2020), PLSPQ is the most recent and widely used instrument for ESL/EFL learners and its categorization has been widely acknowledged (e.g., Akbarian et al., 2019; Alkahtani, 2016; Gao, 2016; Ha, 2019; Koglin, Arald, & Felicetti, 2021; Lethaby & Russell, 2020; Liu, 2017, 2023; Malsawmkimi & Fanai, 2019; Naserieh & Mohammad, 2013; Reid, 1987, 1995; Zokaee et al., 2012). These studies have shown that ESL/EFL students generally prefer kinesthetic and tactile learning styles the most, and group learning the least. For example, Peacock's (2001) study of 206 EFL students showed that the participants generally preferred kinesthetic and auditory learning styles the most, and individual or group learning the least. This was largely supported by Akbarian et al.'s (2019) study of 235 tertiary EFL learners from two Iranian universities, which showed that kinesthetic, auditory, visual, and tactile styles were the participants' major learning styles while individual and group ones were their minor styles, with group learning being the least preferred style. Nevertheless, different findings have also been revealed (Al Khatib & Ghosheh, 2013). Al Khatib and Ghosheh (2013) examined the preferred learning styles of 210 students of Al Ain University of Science and Technology in relation to gender, academic performance and field of study. The results showed that the students' major learning style preferences were auditory, visual and group styles, while kinesthetic,

tactile and individual styles were their minor styles. In addition, learning style preferences except for group learning preference did not vary by academic performance. Education students were commonly more tactile learners than those in other fields of study, while law students were largely more group learners and pharmacy students were ordinarily more individual learners than those in other fields. Gao (2016) found that almost all Chinese university students were multi-style learners, preferring tactile, visual, and kinesthetic styles the most, and group learning the least. On the contrary, Alkahtani (2016) found that Yanbu EFL students typically preferred auditory and group learning. Ha's (2019) research of 162 Vietnam university students also revealed that group learning was the most preferred style.

Additionally, studies show that male and female students have different preferences for learning styles. Melton (1990) discovered that female Chinese students preferred auditory and kinesthetic learning styles, while their male peers preferred tactile and individual learning styles. Hyland's (1993) study of 440 Japanese university students indicated that female students demonstrated a stronger preference for every learning style than males. This was supported by Mozayan et al.'s (2013) study of Iranian medical sciences students, which found that female students preferred five learning styles more strongly than males. Al Khatib and Ghosheh (2013) found significant gender differences in learning styles as well: Males were generally more auditory and tactile learners, whereas female students were on average more group learners. Akbarian et al. (2019) also found that male Iranian university students preferred the auditory style than females. In contrast, Zokaee et al.'s (2012) research of 54 Iranian EFL learners revealed no significant gender difference in learning style preferences.

All these findings generally reveal that learning style preferences differ with age, education, achievement, gender, culture, major field, and so on. Coupled with the relatively limited number of studies on learning styles in ESL/EFL learning and the large population of ESL/EFL learners, learning styles in relation to ESL/EFL learning outcomes deserves more research. This motivated the present research, which adopted Reid's (1987) classification and measure of learning styles because of the clarity and ease in implementing the PLSPQ and interpreting its results.

Language Learning Strategy Use

The role of strategies in language learning has long been noticed and researched (Lee & Heinz, 2016; Oxford, 1990, 2017; Rubin, 1975; Thomas et al., 2022). Though no consensus about the definition of language learning strategy (LLS) has been reached, LLS refers to the general involvement (all behaviors, techniques, habits, methods, etc.) in language learning (Griffiths, 2020; Rubin, 1975) or the selective and intentional process in language learning (Oxford

& Cohen, 1992). Accordingly, Oxford (1990) grouped LLSs into six types: memory, cognitive, compensation, metacognitive, affective, and social, and developed the Strategy Inventory for Language Learning (SILL) to measure the use of these strategies. Oxford (1990) also provided three cut-off scores for a high (3.5–4.4), medium (2.5–3.4) and low (below 2.5) level of strategy use. As more definitions were proposed, Oxford (2017) reviewed them and summarized that language learning strategy can have many forms: it can be a technique, device, tool, or method; it can be a behavior; it can be a general tendency, or approach. Among the various forms of strategies identified in the definitions, the central feature is mental action or process (Oxford, 2017).

Oxford's influential works have inspired numerous studies on language learning strategies, which have used or adapted SILL in various SL/FL contexts (e.g., Lin et al., 2021; McMullen, 2009; Pongsukvajchakul, 2021; Rahman, 2020; Vimalakshan & Aziz, 2021). Salahshour, Sharifi, and Salahshour (2013) studied LLS use in 65 high school students via SILL and found that the students used metacognitive strategies the most frequently, and cognitive strategies the least frequently. Stracke (2016) administered SILL to 522 sixth graders and found that the participants had high use of social, affective and metacognitive strategies, and moderate use of cognitive strategies. The study also revealed significant differences in strategy use between students who perceived themselves capable of performing English tasks and self-regulating their learning, and those who did not. Rahman (2020) administered the SILL to 30 Saudi-Arabian university students and found that the students used metacognitive strategies the most frequently, followed by compensation, social, memory, cognitive, and affective strategies respectively. Pongsukvajchakul (2021) administered the SILL to 100 Thai undergraduate students, and found that the participants used social strategies the most often, followed by memory, compensatory, metacognitive, cognitive and affective strategies in English writing, respectively. The study also revealed significant differences in LLS use depending on field of study, year of study and writing frequency.

In another case, McMullen's (2009) study of 71 male and 94 female Saudi students via the SILL showed that female students used slightly more LLSs than male students. Salahshour et al. (2013) also found that females used learning strategies more frequently than males.

Concurrently, LLS use also proves to interact with many other variables in SL/FL learning, such as foreign language anxiety (e.g., Noormohamadi, 2009), self-efficacy (e.g., Stracke, 2016), and motivation (e.g., Lin et al., 2021).

All these findings indicate that individual learners' LLS use differs in terms of gender, age, beliefs, nationality/ethnicity, personality and so forth (Gregersen & MacIntyre 2014; Pongsukvajchakul, 2021). This justifies continuous research on LLS in SL/FL learning.

Relationships between Learning Style Preferences, Strategy Use and Second/Foreign Language Achievements

Debates exist regarding the relationship between learning style and learners' academic performance or (perceived) intellectual aptitude. For example, Sun et al. (2023) did three experiments on American children and their teachers and parents, and found that learning style descriptions impacted parents' and teachers' thinking about children's intellectual aptitudes. Yet, Malsawmkimi and Fanai's (2019) research of 192 secondary school students found no correlation between students' academic achievements and learning styles, which was confirmed by Whitman (2023).

The research on learning styles and SL/FL outcomes is limited, and also reveals mixed findings. For example, Huang et al.'s (2018) study of 329 Chinese university students revealed no significant relationship between learning styles and the participants' English proficiency, while Ha (2019) found a significant relationship between Vietnam university students' learning styles and their English language proficiency. Similarly, Akbarian et al. (2019) found that Iranian university students' tactile style scores significantly correlated with vocabulary knowledge. Liu and Chen (2024) collected PLSPQ and strategy use data from 439 Chinese university students and found that learning styles were significantly positively related to and predicted the participants' English achievement.

Regarding strategy use and SL/FL learning, empirical studies reveal that good learners tend to use more effective strategies and choose different strategies to tackle different learning tasks while poor learners tend to use less effective strategies and are not so flexible in choosing different strategies (e.g., Oxford, 1990, 2017; Rubin, 1975; Salahshour et al., 2013; Vimalakshan & Aziz, 2021). Learners may also use different strategies simultaneously for different functions and in different orders (Gao & Hu, 2020). For example, Salahshour et al.'s (2013) study of 65 high school students via SILL found that proficient learners demonstrated significantly more strategy use, particularly of metacognitive and social strategies. This finding was generally consistent with that of other studies in similar contexts (e.g., Lin et al., 2021). Lin et al.'s (2021) study of 547 international university students indicated that language learning strategies significantly affected the students' literal comprehension in Chinese. Liu and Chen (2024) found that learning strategies were significantly positively related to and predicted students' English achievement.

Meanwhile, the available limited research on learning styles and strategy use generally show that the two are positively correlated with each other (Alkahtani, 2016; Gao, 2016; Lin et al., 2021; Zokaee et al., 2012). For example, Zokaee et al. (2012) revealed that Iranian university EFL students' specific learning styles correlated with specific vocabulary learning strategies. Alkahtani's (2016) research of 667 Yanbu EFL students revealed that significant correlations existed

between perceptual language learning styles and the use of language learning strategies, which was supported by the findings in Liu and Chen (2024). Gao's (2016) examination of learning styles and strategy use on 250 Chinese university EFL learners also revealed complex relationships between the two.

Research Questions

As reviewed, language learning strategies are important factors that affect SL/FL learning, and it is likely that learning styles also play a role in SL/FL learning. Considering the limited number of studies on the two, and the mixed findings they have uncovered, the relationship between language learning strategies and learning styles deserves more research. Moreover, preferences for learning styles and use of language learning strategies vary by gender, education, nationality, culture and other individual characteristics. Coupled with rather inadequate research on learning styles in SL/FL learning, research on these two topics in relation to SL/FL learning is always worthwhile. Consequently, this research aimed to investigate Chinese undergraduate EFL students' preferences for learning styles, use of language learning strategies and their predictive effects on their English achievements. The following research questions were of particular interest:

1) What are the students' preferences for learning styles?
2) To what degree are the language learning strategies used by the students?
3) How are the students' learning style preferences related to their language learning strategy use?
4) How do the students' learning style preferences and language learning strategy use predict their English achievements?
5) What are the gender differences in learning style preferences, language learning strategy use, and their predictive effects on English achievements?

Research Design

Participants

The participants were 439 (209 male and 230 female) undergraduate EFL students from different Chinese universities, who had generally studied English for more than 10 years since primary school. With a mean age of 19.71 and

an age range of 17 to 22, these students came from three major disciplines: Engineering (286/65.1%, 178 male and 108 female), science (15/3.4%, 4 male and 11 female) and liberal arts (138/31.4%, 27 male and 111 female).

Instruments

The participants in this study answered a background information questionnaire, the 30-item Perceptual Learning Style Preference Questionnaire (PLSPQ) and the 50-item Strategy Inventory for Language Learning (SILL). Both PLSPQ and SILL were 5-point Likert scales, ranging from "Never or almost never true of me/Strongly disagree" to "Always or almost always true of me/Strongly agree," with values 1–5 assigned to the descriptors respectively.

The PLSPQ

The PLSPQ developed by Reid (1987) was adopted and achieved a reliability score of .86 in the present study, covering six types of learning styles: auditory, kinesthetic, visual, tactile, group and individual. Sample items included: "When the teacher tells me the instructions, I understand better," "I prefer to learn by doing something in class," and "I learn better by reading what the teacher writes on the chalkboard."

The SILL

Since the present research aimed at examining students' learning style preferences and strategy use in general, the SILL designed by Oxford (1990) was utilized and achieved a reliability score of .95 in the present study, covering six types of learning strategies: memory, cognitive, compensation, metacognitive, social and affective. Sample items included: "I use rhymes to remember new English words," "I practice the sounds of English," "I read English without looking up every new word," and "I pay attention when someone is speaking English."

The Background Information Questionnaire

This questionnaire aimed to collect information about the respondents such as gender, age, field of study, and year of study.

English Achievements

Since the students were from different universities, they were asked to self-rate their overall English proficiency on a 10-point scale (from 1 being "very poor" to 10 "nativelike") as an indicator of their English achievements.

Data Collection and Analysis

The study was approved by the Ethics Committee of the writer's institute. Then, all of the questionnaire items were translated into Mandarin Chinese, back-translated, and double-checked by a researcher proficient in both Chinese and English. Due to COVID-19, the survey was administered online. Students were encouraged to participate by their course teachers, yet all participation was voluntary. Finally, 439 valid questionnaires were collected within two weeks. The data was then analyzed via SPSS 20 and Mplus 7. Means and standard deviations were computed to determine preferences for learning styles and levels of strategy use; independent sample t-tests were run to examine differences between male and female students; correlation analyses were conducted to explore correlations between learning styles and strategy use; structural equation modelling (SEM) and multiple stepwise regression analyses were run to examine predictive effects of learning styles and strategy use on students' English achievements.

Results

Students' Preferences for Learning Styles and Use of Language Learning Strategies

As reported in Tables 1 and 2, skewness values for all the styles and strategies were between –1 and 1, indicating that all the styles and strategies had an approximately normal distribution. As shown in Table 1, the respondents scored on average from 34.27 to 37.15 on the six learning styles, meaning that they used all the styles as their minors. They scored the highest on the kinesthetic style (mean = 37.15), followed by tactile (mean = 36.76), auditory (mean = 36.57), visual (mean = 35.35), group (mean = 34.42) and individual learning (mean = 34.27) styles, respectively.

A similar pattern was observed for both male and female students who scored on average 33.51 (individual) to 36.98 (kinesthetic) and 33.60 (group) to 37.31 (kinesthetic) respectively on the six learning styles. However, male

students scored higher on auditory, visual and group styles and lower on the other three styles than their female peers. It should be noted that a significant difference occurred only in group learning ($t = 2.088$, $p = .037$), suggesting that male students preferred group learning significantly more than female respondents.

As shown in Table 2, the respondents on average scored 3.41 on affective, 3.42 on memory, 3.43 on compensation, 3.51 on social, 3.54 on cognitive and 3.76 on metacognitive strategies. This finding means that they used metacognitive strategies the most frequently, followed by cognitive, social, compensation, memory and affective strategies, respectively. It also means that the respondents had a high level, though on the low end, of metacognitive, cognitive and social strategy use, and a medium level, but on the high end, of compensation, memory and affective strategy use (Oxford, 1990).

A similar pattern was observed for both male and female students who scored on average 3.38 (affective) to 3.71 (metacognitive) and 3.44 (memory, compensation and affective) to 3.81 (metacognitive) respectively on the six types of learning strategies. Meanwhile, male students scored higher on affective but lower on all the other five types of strategies than their female peers. Nevertheless, no significant difference occurred in any type of strategies.

Table 1

Means, Standard Deviations and t-test Results of Learning Styles

		Auditory	Kinesthetic	Visual	Tactile	Individual	Group
Whole sample (N = 439)	Mean	36.57	37.15	35.35	36.76	34.27	34.42
	SD	6.55	6.55	6.81	6.44	8.74	8.66
	skewness	−.416	−.513	−.061	−.395	−.274	−.442
Male students (N = 209)	Mean	36.63	36.98	35.67	36.59	33.51	35.32
	SD	6.60	6.71	7.27	6.68	9.13	8.63
	skewness	−.233	−.427	−.095	−.601	−.247	−.315
Female students (N = 230)	Mean	36.50	37.31	35.06	36.90	34.97	33.60
	SD	6.51	6.41	6.36	6.23	8.33	8.61
	skewness	−.251	−.365	−.389	−.769	−.167	−.501
t-test results	t	.203	−.538	.943	−.505	−1.744	2.088*
	P	.839	.591	.346	.614	.082	.037
	Cohen's d	/	/	/	/	/	0.20

Note. ** = $p < .01$;   * = $p < .05$
Effect size of Cohen's d: small = d ≤ 0.2; medium = d = 0.5; large = d ≥ 0.8 (Cohen, 1988).

Table 2

Means, Standard Deviations and t-test Results of Language Learning Strategies

		Memory	Cognitive	Compensation	Metacognitive	Affective	Social
Whole sample (N = 439)	Mean	3.42	3.54	3.43	3.76	3.41	3.51
	SD	0.70	0.67	0.56	0.69	0.73	0.83
	skewness	−.246	−.414	−.246	−.706	−.213	−.424
Male students (N = 209)	Mean	3.40	3.51	3.41	3.71	3.38	3.52
	SD	.72	.72	.56	.76	.75	.80
	skewness	−.335	−.501	−.146	−.471	−.228	−.613
Female students (N = 230)	Mean	3.44	3.56	3.44	3.81	3.44	3.50
	SD	.68	.63	.56	.62	.72	.86
	skewness	−.496	−.522	.010	−.300	−.285	−.302
t-test results	t	−.592	−.723	−.729	−1.431	−.828	.247
	p	.554	.470	.466	.153	.408	.805

Relations between Learning Styles and Strategy Use

Table 3 presents the relations between learning styles and strategy use, which shows that the use of all six types of strategies was significantly positively related to different types of learning styles except for individual learning for the whole sample ($r = .285 \sim .597$, $p < .01$), male ($r = .343 \sim .644$, $p < .01$) and female ($r = .241 \sim .557$, $p < .01$) students. This means that a respondent, whether male or female, who preferred auditory, kinesthetic, visual, tactile or group styles tended to use more frequently memory, cognitive, compensation, metacognitive, affective or social strategies, or vice versa. Meanwhile, individual style was only significantly positively related to compensation strategy use for the whole sample ($r = .129$, $p < .01$) and male ($r = .240$, $p < .01$) students, though the coefficient was not strong. This means that for the whole sample and male students, a respondent who preferred individual learning tended to more frequently utilize compensation strategies, or vice versa.

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Table 3
Correlations between Learning Styles and Strategies

	Auditory	Kinesthetic	Visual	Tactile	Individual	Group
MemoryS	.506**/.525**/.489**	.584**/.574**/.593**	.464**/.542**/.385**	.526**/.570**/.480**	.015/.072/-.049	.489**/.502**/.487**
CognitiveS	.559**/.606**/.513**	.575**/.644**/.500**	.515**/.555**/.472**	.500**/.558**/.434**	.078/.109/.038	.445**/.459**/.444**
CompensationS	.395**/.518**/.281**	.401**/.428**/.374**	.400**/.511**/.289**	.397**/.523**/.271**	.129**/.240**/.012	.285**/.343**/.241**
MetacognitiveS	.550**/.573**/.533**	.597**/.635**/.557**	.476**/.529**/.421**	.555**/.601**/.502**	.083/.128/.017	.451**/.464**/.462**
AffectiveS	.525**/.520**/.532**	.486**/.554**/.418**	.480**/.512**/.453**	.435**/.524**/.344**	.038/.081/-.012	.441**/.480**/.417**
SocialS	.548**/.551**/.547**	.551**/.605**/.506**	.480**/.513**/.453**	.462**/.493**/.436**	.023/.048/.002	.474**/.473**/.478**

Note. The three numbers in each column refer to the coefficients for the whole sample, male and female students respectively; MemoryS = memory strategies; CognitiveS = cognitive strategies; CompensationS = compensation strategies; MetacognitiveS = metacognitive strategies; AffectiveS = affective strategies; SocialS = social strategies ** = $p < .01$; * = $p < .05$.

Predicting Effects of Learning Styles and Strategy Use on English Achievements
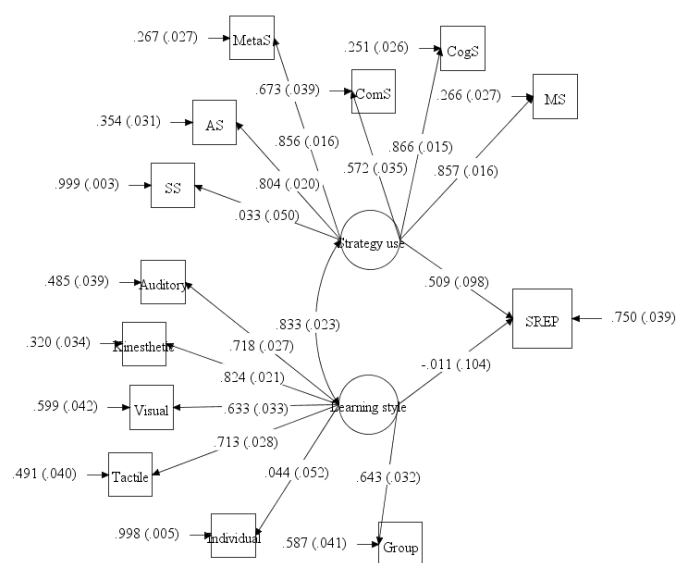
To examine the predictive effects of learning style preferences and strategy use on students' English achievements, structural equation modelling (SEM) and multiple stepwise regression analyses were conducted for the whole sample, for both male and female students respectively. In all situations, self-rated English proficiency was used as the dependent variable, learning style and strategy use scores were used as latent independent variables in SEM, while specific learning style and strategy use scores were used as independent variables in regression analyses. The results are displayed in Figure 1 and Table 4 respectively.

SEM analyses showed that the indicator values of the whole sample's model were: $\chi^2 = 343.063$, $p < .01$, RMSEA = .091, CFI = .898, SRMR = 0.058, meaning that the model was good (Hu & Bentler, 1999). As shown in Figure 1(a), learning strategy use was significantly positively related to learning style ($r = .833$, $p < .001$), and strategy use ($\beta = .509$, $p < .001$) significantly positively predicted the whole sample's self-rated English proficiency while learning style ($\beta = -.011$, p > .05) did not.
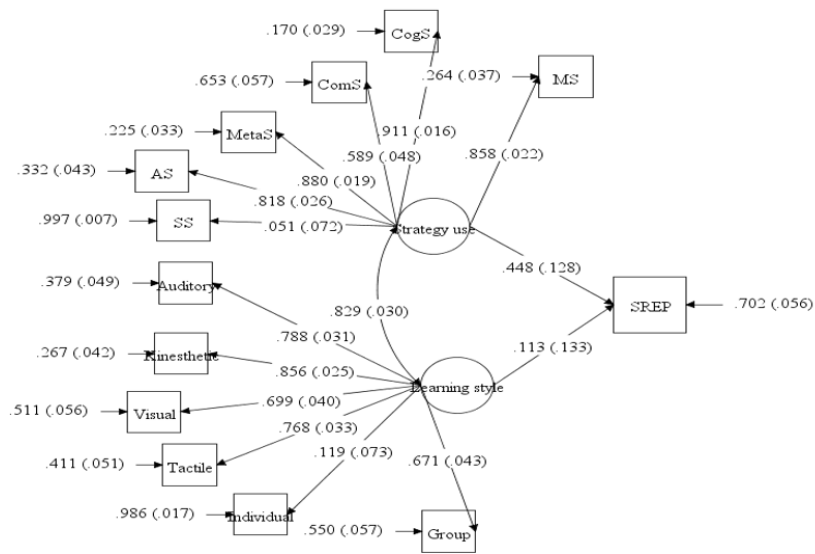
Likewise, the indicator values of male students' models were: $\chi^2 = 205.692$, $p < .01$, RMSEA = .089, CFI = .908, SRMR = .060, meaning that the model was good (Hu & Bentler, 1999). As shown in Figure 1(b), learning strategy use was significantly positively related to learning style ($r = .829$, $p < .001$), and strategy use ($\beta = .448$, $p < .001$) significantly positively predicted male students' self-rated English proficiency, while learning style ($\beta = .113$, $p > .05$) did not.

For female students, the indicator values of the model were: $\chi^2 = 203.638$, $p < .01$, RMSEA = .085, CFI = .885, SRMR = 0.063, meaning that the model was good (Hu & Bentler, 1999). As shown in Figure 1(c), learning strategy use was significantly positively related to learning style ($r = .854$, $p < .001$), and strategy use ($\beta = .669$, $p < .001$) significantly positively predicted female students' self-rated English proficiency while learning style ($\beta = -.243$, $p > .05$) did not.

Figure 1(a)

The Whole Sample

Figure 1(b)

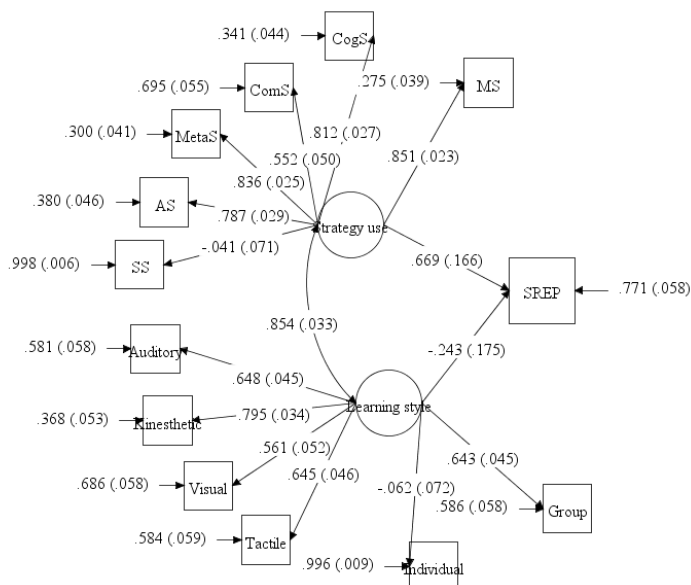*Male Students*

Figure 1(c)

Female Students

Figure 1: SEM results of learning styles and strategy use on SREP

Note. SREP = self-rated English proficiency; MS = memory strategies; Congs = cognitive strategies; ComS = compensation strategies; MetaS = metacognitive strategies; AS = affective strategies; SS = social strategies.

As shown in Table 4, regression analyses yielded one model with the change in R^2 being .255 for the whole sample (CognitiveS) and .292 for male students (CognitiveS), respectively. Namely, CognitiveS significantly positively predicted the whole sample's (β = .505, t = 12.244, p = .000, f^2 = .34) and male students' (β = .543, t = 9.309, p = .000, f^2 = .41) self-rated overall English proficiency, both with a large effect size. Meanwhile, regression analyses yielded three models for female students, with the change in R^2 being .208 for model 1 (CognitiveS), .014 for model 2 (CognitiveS and Tactile), and .016 for model 3 (CognitiveS, tactile and MemoryS). And model 3 seemed to be the best. Thus, CognitiveS (β = .392, t = 4.55, p = .000, f^2 = .26), Tactile (β = –.171, t = –2.564, p = .011, f^2 = .06), and MemoryS (β = .193, t = 2.183, p = .03, f^2 = .069) were good predictors for female students' self-rated overall English proficiency, with CognitiveS and MemoryS being positive predictors, and Tactile being a negative predictor, all with a small to medium effect size.

Table 4

Regression Coefficients and Significance of Predictors for English Achievements

	β	t	p	VIF	Cohen's f^2
	The whole sample's self-rated English proficiency				
CognitiveS	.505	12.244**	.000	1.000	.34
	Male students' self-rated English proficiency				
CognitiveS	.543	9.309**	.000	1.000	.41
	Female students' self-rated English proficiency				
CognitiveS	.392	4.55**	.000	2.209	.26
Tactile	−.171	−2.564*	.011	1.325	.06
MemoryS	.193	2.183*	.03	2.331	.069

Note. ** = $p \leq .01$;   * = $p \leq .05$.
Effect size of Cohen's f^2: small = $f^2 \leq .02$; medium = $f^2 = .15$; large = $f^2 \geq .35$ (Cohen, 1988).

Discussion and Conclusion

The present study examined perceptual learning styles, strategy use and their predictive effects on Chinese undergraduate EFL Learners' achievement in English. Statistical analyses show that both the PLSPQ and the SILL were fairly reliable and generally significantly correlated with each other.

Preferences for Learning Styles

The present study revealed that the whole sample, as well as male and female students, displayed no major preference for any style, but used all styles as their minors on the higher end, indicating that they were multi-style learners, similar to the finding in Gao (2016) but different from that in Melton (1990) in similar contexts. This might be attributed to the different characteristics possessed by the participants of the individual studies, though they were generally Chinese learners of English. Due to the complexity of learner populations, learning styles warrant continuous research in various ESL/EFL contexts.

Meanwhile, the participants in the present research preferred the kinesthetic style the most, followed by tactile, auditory, visual, group and individual styles respectively, partially consistent with the findings in the current litera-

ture (e.g., Akbarian et al., 2019; Liu, 2023; Mozayan et al., 2013; Naserieh & Mohammad, 2013; Peacock, 2001; Reid, 1987). This could be largely attributed to the fact that more than 65.1% of participants were engineering and science students who tended to engage in hands-on projects by themselves or with others in learning. By contrast, liberal arts students might tend to read and listen more frequently in their learning, which often does not involve others as much. Their preferences for auditory and visual styles might result from the fact that, in traditional Chinese educational classrooms, teachers often dominate classes through lectures and presentations in various visual forms such as pictures and powerpoint slides. This was particularly the case during COVID-19, when teaching and learning shifted online and interaction was restricted by online meeting platforms and the Internet. As little was known about the participants' backgrounds except for their ages, genders and disciplines, it was hard to pinpoint what had caused their preferences for different styles and whether their style preferences were consistent across time. This merits attention in future studies on learning styles. Moreover, as learners are categorized differently by different learning style theories, it will be interesting to identify the features of their style preferences when gauged by different instruments. These findings will help better understand the learning style myth.

Language Learning Strategy Use

This study shows that the whole sample as well as male and female students demonstrated a medium to high level of use of the six types of learning strategies, as defined in Oxford (1990). This finding indicates that the participants in the present research tended to have a greater use of the strategies than their peers who normally have a medium level of strategy use, as indicated by numerous current studies (e.g., Magogwe & Oliver, 2007; Tang & Tian, 2015). This was probably caused by the fact that students had to resort to various strategies when learning became more self-dependent due to COVID-19, indicating that they were able to plan, self-regulate and self-assess their own learning and become autonomous learners during the critical time of the pandemic (Lee & Heinz, 2016). This supports the claim in Gao and Hu (2020) that use of language learning strategies is influenced by different resources: community (e.g., a group of people working on the same/similar tasks for similar goals), rules (e.g., time and task requirements), and division of labor (e.g., roles and power relationships).

The study also reveals that the participants used metacognitive strategies the most frequently, followed by cognitive, social, compensation, memory and affective strategies, respectively. This finding was partially consistent with the findings reported in the current literature (e.g., Lee & Heinz, 2016;

Pongsukvajchakul, 2021; Rahman, 2020; Salahshour et al., 2013; Stracke, 2016; Tang & Tian, 2015). This might have resulted from the fact that all the participants were college students, most being engineering and science students, who were generally required to plan and monitor their hands-on projects, especially during COVID-19. When difficulties occurred, they resorted to social, compensation and memory strategies. Affective strategies were the least frequently used, probably because much attention had been given to students' affect and well-being by their universities and parents during the pandemic.

Coupled with the applications of technology in education, students now have a wide repertoire of various forms of strategies (Oxford, 2017). To tackle a task, students may employ a cluster of strategies simultaneously in different orders (Gao & Hu, 2020; Thomas et al., 2022). In the future, more case studies can be conducted to better understand how strategies are used in relation to specific tasks.

Predicting Effects of Learning Styles and Strategy Use on English Achievements

SEM analyses show that strategy use significantly positively predicted the whole sample's, as well as male and female students' English achievements while learning style did not. Regression analyses further show that cognitive strategy use (CognitiveS) significantly positively predicted the whole sample's as well as male and female students' English achievements. In addition, memory strategy use (MemoryS) significantly positively predicted female students' English achievements, while the tactile style (Tactile) negatively predicted them. These results further support the finding that strategy use often facilitates SL/FL learning (e.g., Lin et al., 2021; Salahshour et al., 2013), while learning styles might have complex relations with ESL/EFL learning outcomes (e.g., Ha, 2019; Malsawmkimi & Fanai, 2019). This might be because learning styles, though variable as individual characteristics like gender, education and culture change, are generally more stable than strategy use. Students may be able to choose more suitable strategies to tackle different learning tasks accordingly, but they may not be able to change their learning styles so flexibly. Yet, because of the paucity of research on learning styles and ESL/EFL learning, more similar research is called for.

Gender Differences in Learning Styles, Strategy Use and Their Predictive Effects on English Achievements

Table 1 shows that male students preferred individual learning the least, and that female students preferred group learning the least, despite their preferences for other styles remaining similar. This might be because most female students were liberal arts students who tended to study alone. Male students scored higher on auditory, visual and group styles, but lower on the other three than their female peers, partially consistent with the finding in Melton (1990) and Hyland (1993), but different from those in Mozayan et al. (2013) and Akbarian et al. (2019). In addition, as found in Zokaee et al. (2012), generally, no significant difference occurred between genders in all learning styles, except for group learning. It is worth noting that male students scored higher on affective but lower on all the other five types of strategies than their female peers, though no significant difference was observed in any type of strategies, largely consistent with the finding in McMullen (2009) and Salahshour et al. (2013). And a similar pattern of significant positive correlations between learning styles and strategies existed for male and female students, except that individual learning was significantly positively correlated with compensation strategies for only male students. Nevertheless, since few studies have explored gender differences in learning styles and strategy use, these findings need to be further confirmed in more research in various contexts.

Interestingly, this study shows that of all learning styles and strategies, only cognitive strategy use (CognitiveS) significantly positively predicted male students' English achievements, while for female students, cognitive strategy use, memory strategy use (MemoryS), and the tactile style all significantly predicted their English achievements. Considering that male and female students had similar learning preferences and usage of different strategies, this finding proves especially intriguing and deserves further research.

Implications and Limitations

The findings of this study further attest to the importance of learning styles and strategies in ESL/EFL learning. Hence, it is important for instructors to know their students' learning styles so that they can appropriately match teaching with students' learning styles or scaffold teaching and tasks to stimulate different learning styles (Liu, 2023). Likewise, it is useful for instructors to encourage and train students to use various strategies to handle different tasks. It may also be useful to provide students with adequate resources

(e.g., various use of technology, visual and audio aids, etc.) and instruct them how to use those resources (Thomas et al., 2022) so that they use different forms of strategies more readily and more effectively. As reviewed above, multi-style preference and implementation of diverse appropriate strategies can help students make the most of the learning circumstance.

The present large-scale quantitative study is one of few that uses both SEM and regression analyses to explore predictive effects of learning styles and strategy use on students' English achievements, thus enriching the current literature. Even so, certain limitations existed. First, the findings entirely relied on quantitative data, which could be more generalizable if complemented by qualitative data. Future research can use mixed methods to provide a more comprehensive understanding of learning styles and strategy use in relation to ESL/EFL learning outcomes. Second, due to various constraints, students' English achievements were measured by their self-ratings, which might not truly reflect students' competence in English. A standardized proficiency test could be more reliable and is thus recommended for future research. Moreover, similar research is needed to confirm the findings of the present study, especially those involving SEM and regression analyses. Furthermore, as both learning styles and strategy use vary with age, education, achievement, gender, culture, and other individual characteristics, more internal factors should be integrated into the investigation of the issues in future research.

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