

Chinese University Students' Learning Styles: Gender and Discipline Differences

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Abstract

It is generally agreed that students have their own preferred ways of learning, contributing to various learning style patterns. The present study explored the learning style preferences of 1701 Chinese University learners in terms of general patterns, gender, and discipline differences. After administering the 44-item Felder-Soloman Index of Learning Styles (ILS) to the participants, the study revealed the following findings: (1) The ILS scales were reliable and valid, (2) Chinese university students tended to be sensing, verbal, global and active learners, (3) male and female students were significantly different on three scales: Visual-Verbal, Sequential-Global and Active-Reflective, and (4) significant differences were observed in learning styles between students of different disciplines. Evidently, gender and discipline had a significant impact on students' learning style preferences. It is thus better to match teaching styles and learning styles.

Introduction

As the language learning process is so complex and it is often not easy to learn a foreign/second language (SL/FL), researchers have always been interested in examining various factors that contribute to the different language learning outcomes. In the fields of applied linguistics and Second Language Acquisition (SLA), many scholars have associated language learning outcomes with an individual aspect of learning called learning style. The term "learning style" has several definitions. Reid (1995, p. 34) defines it as "an individual's natural, habitual, and preferred way(s) of absorbing, processing, and retaining new information and skills". Kinsella (1995) believes that learning style is "an individual's natural, habitual, and preferred ways of absorbing, processing, and retaining new information and skills" (p. 171).

According to Ellis (2005), learning style is "the characteristic ways in which individuals orientate to problem-solving" (p. 4). Despite the differences in expressions, what is common in these definitions are: (1) learning styles focus on "individuals" who are distinct from each other, and (2) learning styles are internally-based. Consequently, studies of learning styles usually focus on cognitive and

psychological aspects of individuals including personalities, traits, characteristics, and information-processing.

Although a multitude of studies have been done on learning styles in different situations (Al-Othman, 2004; Andreou, Andreou, & Vlachos, 2008; Castro & Peck, 2005; Isemonger & Sheppard, 2003; Mulalic, Shah & Ahmad, 2009; Tight, 2010; Wu, 2010; Yong, 2010), the issue has not been adequately researched in Chinese contexts where the largest number of learners in the world is housed. Situated in Chinese university contexts, the present study aimed to examine the learning style preferences by university students in terms of general patterns, gender and discipline differences.

Literature Review

As learning styles are internally-based and related to cognitive and psychological science, the theories and models that current studies rely on are often from these two fields. One influential model, Perceptual Learning Style (PLS) was proposed by Reid (1987, 2000). According to Reid (1987, 2000), PLS comprises six major learning style preferences: visual (to see and read), auditory (to hear), kinesthetic (to participate in activities and field studies), tactile (to learn through hand-on experiences), group (to work with others), and individual (to work alone). According to PLS, learners have their own major, minor and negligible learning styles; discovering the major preference would enable them to have better learning experiences and performances. Negligible learning styles, in contrast, would cause difficulties in learning (Reid, 2000). Furthermore, it is preferable to have more major learning styles than just one, which will contribute to successful learning. For instance, individuals whose negligible learning style is kinesthetic should actively get involved in activities in order to develop it to be a major or minor learning style.

In order to measure these six types of learning styles, Reid (1987) developed the 30-item Perceptual Learning Style Preference Questionnaire (PLSPQ), which has been implemented in a number of empirical studies (Isemonger & Sheppard, 2003; Mulalic, Shah & Ahmad, 2009; Tight, 2010; Wu, 2010; Yong, 2010). In a study of 1,234 university learners, Reid (1987) found that science majors were significantly more tactile than the liberal arts students, but no significant difference was identified in learning styles in regards to gender and cultural background.

On the contrary, in a study of 710 Korean university ESL (English as a Second Language) students, Isemonger and Sheppard (2003) observed significant gender differences in learning styles. Mulalic, Shah and Ahmad (2009) also found that males “favored Kinesthetic and Auditory learning when compared with their female counterparts” (p. 109) in a study of 170 university students from three racial backgrounds in Malaysia.

In addition, cultural background has been found to be closely related to learning styles (Wu, 2010; Yong, 2010). In a study of 113 Malaysian tertiary students, Yong (2010) discovered that Malaysian students preferred kinesthetic and group learning. In Wu's (2010) study of 200 randomly-selected Hong Kong's diploma students in a vocational school, the participants reported to prefer auditory, kinesthetic, and group learning the most but visual learning the least. Furthermore, Yong (2010) found that age had an impact on the kinds of learning styles. Namely, younger students tended to be more tactile and kinesthetic than older students.

Based on Experiential Learning Theory (ELT), Kolb (1984) advanced another widely accepted model, the ELT model. This model (Kolb, 1984) provides a bipolar view of approaches to grasp experiences: Concrete Experience (CE) and Abstract Conceptualization (AC), and transform experiences: Reflective Observation (RO) and Active Experimentation (AE). Four different combinations of these approaches (one from experience-grasping, one from experience-transforming) establish four different learning styles, which are Accommodators (CE+AE), Convergers (AC+AE), Divergers (CE+RO) and Assimilators (AC+RO). Ideally, all four learning approaches should be combined in use in order to achieve efficient learning. However, most learners have their own preferences in two approaches, thus creating the four sorts of learning styles.

With the ELT model as the framework, several learning style inventories were developed such as the Kolb Learning Styles Inventory (Kolb,1984) and the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), which have been adopted in many subsequent studies (Al-Othman, 2004; Andreou et al., 2008; Castro & Peck, 2005; Li & Qin, 2006; Noguera & Wageman, 2011; Poole, 2006). By administering the Kolb Learning Styles Inventory to 53 first-year university students at UIB and English major students respectively, Noguera and Wageman (2011) and Al-Othman (2004) found that learning styles were different between male and female students: males were convergers and females were divergers.

In Li and Qin's (2006) study of 102 science major students and 85 liberal arts students in China, no significant discipline difference was identified. The researchers also found that learning styles might only influence learning strategies and thus regulate "levels of language learning outcomes" indirectly. Castro and Peck (2005) and Poole (2006) examined the learning styles of 99 first year Spanish university students and 13 English major students respectively, both of which revealed that the ability to rely on multiple learning styles instead of one resulted in more successful language learning.

During the process of implementing the above learning style inventories in empirical studies, researchers came to become dissatisfied with them (Isemonger & Sheppard, 2007; Manolis, Burns, Assudani & Chinta, 2013). For example, complicated statistical analyses in Manolis et al. (2013) revealed that only 17 items in the Kolb Learning Styles Inventory were satisfactorily valid. Consequently, more learning style inventories have been developed thereafter, such as the three-factor survey (Isemonger & Sheppard, 2007), a five-dimension instrument (Oxford, 1995), Style Analysis Survey (Psaltou-Joycey & Kantaridou, 2009), and the Felder-Soloman Index of Learning Styles (ILS) (Felder & Soloman, 2001).

Among these learning style inventories, the most frequently used one is the Felder-Soloman Index of Learning Styles (ILS) (Felder & Soloman, 2001). With reference to several models, the Felder-Soloman Index of Learning Styles (ILS) (Felder & Soloman, 2001) was developed to cover four dimensions: Sensing-Intuitive, Visual-Verbal, Sequential-Global, and Active-Reflective, which are interpreted as follows:

1. Sensing-Intuitive: Sensing learners focus more on factual matters, memorization and the connections with the real world, while the intuitive learners are more concerned with abstract and innovative ideas.
2. Visual-Verbal: Visual learners prefer to perceive visual information such as pictures, movies and diagrams, while verbal learners prefer words, both in written and spoken forms.
3. Sequential-Global: Sequential learners would like to follow logical steps and pay more attention to details, while global learners look at the whole picture, preferring logical “jumping”, taking little regard to the connections.
4. Active-Reflective: Active learners prefer group work and love to solve problems with other people, while reflective learners would think about the problems alone quietly.

This instrument, comprising 44 items with 11 for each scale, has been adopted in many studies and achieved high reliability and validity (Felder & Spurlin, 2005; Tuan, 2011; Middleton, Ricks, Wright & Grant, 2013; Yang & Lynch, 2014; Zywno, 2003a, 2003b). For instance, in Tuan’s (2011) study of 168 university EFL (English as a Foreign Language) students in Vietnam, young learners reported to be more active while older learners were more reflective, and most students chose visual as their preferred learning style in the Visual-Verbal scale. In addition, Yang and Lynch’s (2014) study on 141 Taiwanese computer trainees (47 females and 94 males) revealed no gender and degree differences in learning styles, while Middleton et al. (2013) reported both racial and gender differences in their study of 384 American university students of science and engineering. Middleton et al. (2013) found that females were reflective learners, whereas their male counterparts were active learners towards mathematics.

In order to investigate the (mis)match between learning and teaching styles and its consequence, Tuan (2011) administered the ILS to 168 university EFL students of different English proficiency levels and observed 12 teachers in class in the University of Social Sciences and Humanities in Ho Chi Minh City. The study showed that mismatch existed between learning and teaching styles. The mismatch resulted in difficulties in learning and led to terrible learning performances. Thus, the researcher suggested that teaching styles should match students' learning styles, as done by other researchers (Andreou, et. al, 2008; Wang & Jin, 2008; Wu, 2010).

However, Tight (2010) maintained that teaching through "multiple modalities" was better than matching individual learning styles, based on a study of 168 Spanish third-semester university students.

As discussed above, by implementing different models and instruments, the various existing investigations mainly focus on three aspects: how learning styles influence learning outcomes, how other factors (such as gender, discipline) influence learning styles, and the relationship between learning styles and teaching styles, which all shed light on the teaching and learning of different subjects. Although China has the largest number of learners in the world, research on learning styles is far from enough (Li & Qin, 2006; Wu, 2010; Wang & Jin, 2008). In addition, though it is generally acknowledged that students of different disciplines have differing learning styles, not much research has been done on this issue (Reid, 1987; Felder & Spurlin, 2005; Li & Qin, 2006). The categorization of disciplines in most current studies is relatively rough, grouping students into science (engineering) and liberal arts students, regardless of other more specific and distinct disciplines, such as business and management and medicine. For these reasons, the present study sought to investigate the learning style preferences by Chinese university students in terms of general patterns, gender difference and discipline difference. The following questions were of particular interest:

1. What are the general profiles of Chinese university students' learning styles?
2. What is the difference in learning styles between male and female students?
3. What is the difference in learning styles among students of various disciplines?

Participants

The participants of the present study consisted of 1701 (778 males and 919 females) first-year students from five universities in China. With an average age of 18.61 and an age range of 14 to 22, the students were from six major disciplines: business and management (648), engineering (570), social sciences (227), humanity and arts (136), science (77), and medicine (43).

The Felder-Soloman Index of Learning Styles

The participants in the present study answered the 44-item Felder-Soloman Index of Learning Styles (ILS) (Felder & Soloman, 2001). The ILS has 4 dimensions: Sensing-Intuitive, Visual-Verbal, Sequential-Global, and Active-Reflective, with 11 items for each scale. Each item has two alternatives, with a value of 1 assigned to alternative (a) and 0 assigned to alternative (b). Thus, a higher mean score on each scale means the participants are more sensing, visual, sequential and active, respectively.

Methods

About 50 intact classes from five universities in China answered the survey in 10 minutes during class in the middle of an 18-week semester. A total number of 1920 questionnaires were collected, of which 1701 were used for further statistical analyses and the others were discarded because of incompleteness.

Statistical analyses were conducted on the ILS scales in terms of Cronbach Alpha and inter-scale correlation to determine their reliability. The mean and standard deviation of each ILS scale were computed to determine the students' preferences of learning styles. Independent samples t-tests and one-way ANOVA were then run to explore the differences in learning styles between male and female students and among students of different disciplines, respectively.

Results

Reliability of the ILS scales in the present study

In order to examine the reliability of the ILS scales in the present study, the internal consistency reliability for the ILS scales and inter-scale correlations were computed, the results of which are reported in Tables 1-2.

Table 1

Internal Consistency Reliability for the ILS Scales-Cronbach's alpha
(N = 1701)

	Standard a	Item variance	Inter-item covariance	Inter-item correlation
Sensing-Intuitive	.549	.207	.020	.100
Visual-Verbal	.398	.231	.013	.057
Sequential-Global	.471	.243	.018	.075
Active-Reflective	.520	.210	.019	.090
All ILS items	.631	.223	.008	.037

As shown in Table 1, the ILS scales achieved a reliability score range of .398 to .548, similar to but lower than those reported in Felder and Spurlin (2005) and Zywno (2003). In addition, the inter-scale correlations (see Table 2) show that the ILS scales were significantly positively correlated with one another ($r = .116 \sim .218$, $p \leq .01$) except sensing-intuitive and visual-verbal ($r = .022$), similar to though lower than the coefficients reported in Felder and Spurlin (2005). These findings clearly indicate that the ILS enjoyed a moderately high reliability in the present study.

Table 2

Inter-scale Correlations (N = 1701)

	Sensing-Intuitive	Visual-Verbal	Sequential-Global	Active-Reflective
Sensing-Intuitive	1	.022	.218**	.116**
Visual-Verbal		1	.121**	.287**
Sequential-Global			1	.127**
Active-Reflective				1

Notes: ** = $p \leq .01$

General profiles of the students' learning styles

In order to know the general pattern of the students' learning styles, the mean and standard deviation of the ILS scales were computed. As shown in Table 3, the participants scored 7.27(66.1%) on Sensing-Intuitive, 5.26(47.8%) on Visual-Verbal, 5.26(47.8%) on Sequential-Global and 6.46(58.7%) on Active-Reflective. This means that in general more than half of the students in the present study were sensing, verbal, global and active learners.

Table 3

Statistics of Scale Scores for the ILS (N = 1701)

	Mean	Standard Deviation	Std. error mean	Kurtosis	Skewness
Sensing-Intuitive	7.27	2.12	.051	-.240	-.425
Visual-Verbal	5.26	1.99	.048	-.114	.194
Sequential-Global	5.26	2.16	.052	-.154	.192
Active-Reflective	6.46	2.09	.051	-.201	-.250
All ILS items	24.25	5.03	.122	1.574	-.025

Gender difference in learning styles

Meanwhile, the same pattern was observed for both male and female students. As noted in Table 4, male students scored 7.29(66.3%) on Sensing-Intuitive, 5.12(46.5%) on Visual-Verbal, 4.92(44.7%) on Sequential-Global and 6.22(56.5%) on Active-Reflective; and their female counterparts scored 7.25 (65.9%), 5.37 (48.8%), 5.56 (50.5%) and 6.67 (60.6%) on the four ILS scales respectively. This demonstrates that more than half of the male respondents were sensing, verbal, global and active learners, while more than half female students were sensing, verbal, sequential and active learners. The differences between male and female students in Visual-Verbal ($t = -2.55$, $p = .011$), Sequential-Global ($t = -6.11$, $p = .000$) and Active-Reflective ($t = -4.41$, $p = .000$) were statistically significant, although all the effect sizes were small, as indicated by the independent sample t-tests reported in Table 4. Alternatively, female students in the present study were significantly less verbal or more visual, more sequential, and more active than their male peers.

Table 4

Gender-related Statistics of Scale Scores for the ILS

	Male (= 778)		Female (= 919)		Results of t-test for gender		
	Mean	SD	Mean	SD	t	p	Effect size (Cohen's d)
Sensing-Intuitive	7.29	2.21	7.25	2.03	.434	.664	/
Visual-Verbal	5.12	2.00	5.37	1.99	-2.55**	.011	0.12 (small)
Sequential-Global	4.92	2.12	5.56	2.15	-6.11**	.000	0.297 (small)
Active-Reflective	6.22	2.22	6.67	1.95	-4.41**	.000	0.214 (small)

Notes: SD = standard deviation effect size of Cohen's d: small = $d \leq 0.2$; medium = $d = 0.5$; large = $d \geq 0.8$ (Cohen, 1988)

Discipline differences in learning styles

In order to explore the differences in learning styles in students of different disciplines, the mean and standard deviation of the ILS scales for students of a specific discipline were computed. As shown in Table 5, engineering students scored 7.29(66.3%) on Sensing-Intuitive, 5.19(47.2%) on Visual-Verbal, 4.92(44.7%) on Sequential-Global and 6.20(56.4%) on Active-Reflective; science students scored 7.47(67.9%) on Sensing-Intuitive, 4.68(42.5%) on Visual-Verbal, 4.94(44.9%) on Sequential-Global and 6.18(56.2%) on Active-Reflective; students of social sciences scored 6.93(63%) on Sensing-Intuitive, 5.28(48%) on Visual-Verbal, 5.60(50.9%) on Sequential-Global and 6.48(58.9%) on Active-Reflective; students of humanity and arts scored 7.14(64.9%) on Sensing-Intuitive, 5.19(47.2%) on Visual-Verbal, 5.48(49.8%) on Sequential-Global and 6.50(59.1%) on Active-Reflective; students of business and management scored 7.38(67.1%) on Sensing-Intuitive, 5.40(49.1%) on Visual-Verbal, 5.46(49.6%) on Sequential-Global and 6.74(61.3%) on Active-Reflective; and medical students scored 7.02(63.8%) on Sensing-Intuitive, 5.16 (46.9%) on Visual-Verbal, 4.81(43.7%) on Sequential-Global and 6.14(55.8%) on Active-Reflective.

Thus, it is clear that in the present study, the engineering students were sensing, verbal, global and active learners; science students were sensing, verbal, global and active learners; students of social sciences were sensing, verbal, sequential and active learners; students of humanity and arts were sensing, verbal, global and active, students of business and management were sensing, verbal, global and active; and medical students were sensing, verbal, global and active.

Table 5

Discipline-related Statistics of Scale Scores for the ILS

		Sensing- Intuitive	Visual- Verbal	Sequential- Global	Active- Reflective
Engineering (N = 570)	Mean	7.29	5.19	4.92	6.20
	SD	2.13	1.93	2.08	2.09
Science (N = 77)	Mean	7.47	4.68	4.94	6.18
	SD	2.23	1.89	2.02	2.39
Social Science (N = 227)	Mean	6.93	5.28	5.60	6.48
	SD	2.15	2.01	2.21	1.96
Humanity & Arts (N = 136)	Mean	7.14	5.19	5.48	6.50
	SD	2.17	2.00	2.13	2.23
Business & Management (N = 648)	Mean	7.38	5.40	5.46	6.74
	SD	2.05	2.02	2.22	2.03
Medicine (N = 43)	Mean	7.02	5.16	4.81	6.14
	SD	2.21	2.39	1.82	2.16

Note: SD = standard deviation

Also, as shown in Table 5, the students of different disciplines scored differently in the four ILS scales. The differences in Visual-Verbal ($F = 2.199, p = .052$), Sequential-Global ($F = 6.098, p = .000$) and Active-Reflective ($F = 4.54, p = .000$) were statistically significant, as indicated by the ANOVA results presented in Table 6. As noted from Table 6, science students were significantly different from their peers of social sciences and business and management in Visual-Verbal, and students of business and management were significantly different from Science, Medical and engineering students in Active-Reflective. In regards to Sequential-Global, medical students were significantly different from those of social sciences, humanity and arts, and business and management, and students of social sciences were significantly different from engineering, science and medical students. Alternatively, science students were significantly more verbal than their peers of social sciences and business and management; medical students were significantly more global than their peers of social sciences, humanity and arts, and business and management; students of social sciences were significantly more sequential than their engineering, science and medical counterparts; and students of business and managements were significantly more active than their science, medical and engineering counterparts.

Table 6

ANOVA Results

	F	p	Place of significant differences ($p = .05$)
Sensing-Intuitive	1.93	.087	/
Visual-Verbal	2.199	.052	Science students & those of SS and BM
Sequential-Global	6.098	.000	M students & students of SS, HA and BM; Students of SS & those of Engineering, Science and Medicine
Active-Reflective	4.54	.000	Students of BM & those of Science, Medicine, & Engineering

Notes: M = medicine, SS = social science; BM = business and management
HA = humanity and arts

Discussion

Reliability of the ILS scales

The ILS scales achieved relatively moderate reliability scores and were significantly positively correlated with one another in the present study, as happened in other studies (Felder & Spurlin, 2005; Zywno, 2003). This was not unexpected, as claimed by Felder and Spurlin (2005). Since one of the intentions of developing the ILS is to accomplish a “balanced teaching styles” (Felder & Spurlin, 2005; p.108) for the instructors, the positive correlations indicate that modifying teaching style for a certain scale is also beneficial to the other. Thus, the findings of the present study further support the validity of the ILS. Nevertheless, the internal consistency reliability scores for the ILS scales and the inter-scale correlations in the present study were lower than those reported in other contexts (Felder & Spurlin, 2005; Zywno, 2003), and need to be further examined in other Chinese contexts.

General profiles of the students' ILS scales

The participants in the present study tended to be sensing, verbal, global and active learners, slightly different from the western students. According to, while Felder & Spurlin (2005) engineering students were generally sensing, visual, sequential and active (see Table 7). The possible explanation for this might be the differences of teaching pedagogies between China and the West. Prior to the present century, the great majority of Chinese students had been receiving oral instructions from the teachers since primary school or even kindergarten. Teachers did not use images or slide shows frequently in class nor were there many pictures in textbooks until recently. Understandably, the verbal style was preferred by most Chinese university students. In addition, as the exam-oriented teaching and learning had been dominant in China, the teachers and students might have become used to making general outlines to review for upcoming exams, especially for the liberal arts students, leading to a global preference. Nonetheless, it should be noted that compared with other studies, the general mean scores of all four scales in the present study were lower and closer to the average. It could be a result of the large number of participants (N=1701), yet it might also be true that Chinese teachers had been incorporating various styles into their classroom teaching allowing students to had accustom themselves into a more balanced way of teaching and learning. Nevertheless, the case needs further investigation.

Table 7

Reported Learning Styles in Percentages

Research population	S	Vs.	Sq.	A	N	
Chinese university students	66%	48%	48%	59%	1701	The present study
Computer trainees	76%	83%	45%	45%	141	Yang & Lynch (2014)
Ryerson Univ. Engr.	63%	63%	89%	58%	132	Felder & Spurlin (2005)
Iowa. States. Engr.	63%	67%	85%	58%	129	

Notes: S = sensing; Vs = visual; Sq = sequential; A = Active; N = number

Gender difference

The present study revealed significant differences in three ILS scales between male and female students, contradictory to the finding in Yang and Lynch (2014) which found no gender differences in Taiwanese students. The contradiction justifies further research in gender differences. Moreover, the present study showed that female students preferred group work than their male counterparts, which might be due to the Chinese culture that focused on collaboration among women while regarding working on one's own as more a symbol of masculinity. In addition, females' preference for details and males' preference for the "jumping" of logic revealed the possible distinction of personality between men and women with females being more careful, yet more conservative. Meanwhile, these findings suggest that female students might tend to perceive images and pictures more, whereas male students prefer words and oral instructions.

Discipline difference

The present study revealed significant differences in learning styles in students of different disciplines. As found in the present study, the students of business and management were the most active learners among the five disciplines, which might be attributed to the fact that they were often required to participate in collaborative activities, such as seminars and group discussions, because interpersonal relationships played an important role in the field. In addition, because liberal arts and social science students generally needed to memorize more, they tended to have a global view of the materials instead of the logical steps and details, which in contrast were essential in natural sciences and engineering. Furthermore, though no significant difference was observed on the Sense-Intuitive scale, students of engineering, science, business and management scored higher than the other students, which might be because they often deal with more realistic problems, such as the production of electric parts and the stock market, whereas students of liberal arts and social science are more concerned with abstract matters.

Conclusions

The present study explored the learning styles of Chinese university students by administering the Felder-Soloman Index of Learning Styles (ILS) (Felder & Soloman, 2001) to around 30 intact classes in five universities in China. Statistical analyses revealed the following findings:

1. The ILS scales were reliable and valid.
2. Chinese university students tended to be sensing, verbal, global and active learners, in contrast with their counterparts in the West on Visual-Verbal and Sequential-Global scales.
3. Male and female students were significantly different on three scales: Visual-Verbal, Sequential-Global and Active-Reflective, possibly suggesting the differences in thought patterns and personality across gender (Costa, Terracciano & McCrae, 2001).
4. Significant differences were observed in learning styles between students of different disciplines. For instance, business and management students were more active than students of other disciplines.

As evidenced, both gender and discipline had a significant impact on the students' learning style preferences. Therefore, in the face of diverse learning style preferences, it is better for both instructors and students to shape their teaching/learning styles to meet the match between them. For teachers, it is necessary for them to provide students with more than one way of teaching, in order to fulfill the needs of students with contrary learning preferences, thus creating more balanced teaching styles. Students, at the same time, should try to learn in their less preferred ways. For example, an active student should also try to reflect on his or her own, so that they may have better learning experiences and learn more.

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