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Effects of the Instruction With *Liushu* on Mandarin Learners' Chinese Character Achievement and Motivation

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***Abstract*—This study examines the effects of instruction with *Liushu* on Chinese character achievement and motivation of Mandarin learners through an experiment. A total of 133 Mandarin beginner learners from Laos were assigned to the experimental group (37 male students, 31 female students) and the control group (42 male students, 23 female students). *Liushu* was used to conduct Chinese character teaching for ten weeks in the experimental group. It was found that instruction with *Liushu* has a positive effect on learners' Chinese character achievement, especially the ability to infer the meaning and pronunciation of Chinese characters. Also, it motivates Mandarin learners' Ideal L2 Self and L2 Learning Experience more than conventional instruction. As a final contribution to this study, we presented a correlation analysis between Chinese character achievement and motivation as well as some insights.**

***Index Terms*—effect, *Liushu,* mandarin learners, Chinese characters achievement, motivation**

I. Introduction

Chinese characters play a significant role in influencing Mandarin learners' confidence, advancement, effectiveness, and level in Mandarin learning since it serves as a starting point for Mandarin learning and supports the Mandarin learning process (Li, 2009). However, Chinese characters are difficult to learn, which has always been a problem that Mandarin teaching has faced since Chinese characters differ from alphabetic characters (Li & Ruan, 2012). In response, more and more research is being conducted regarding the methods for teaching Chinese characters.

Chinese characters, the written symbols used to record Mandarin, are ideograms, meaning that Chinese characters are a combination of sound, meaning, and glyph. The relationship between the glyphs of Chinese characters and their meaning is revealed by *Liushu* (the six ways to create Chinese characters) (Chen & Fu, 2014). The teaching method based on *Liushu* is therefore acknowledged as an efficient method of learning Chinese characters, particularly for the understanding of the pronunciation and meanings of Chinese characters. There have recently been some studies (e.g. Qi, 2017; Su, 2016; Su & Li, 2019; Wang, 2017) aimed at using *Liushu* to teach Chinese characters, showing that *Liushu* can improve Chinese character achievement, which mainly reflects the ability to recognize Chinese character meaning and pronunciation. Also, the theory of *Liushu* can reflect the cultural knowledge carried by Chinese characters (Chen & Fu, 2014), which can enhance the interest and strengthen the learning motivation of Mandarin learners (Li, 2018; Liu 2011). A crucial factor in second language acquisition (SLA) is motivation, which is defined as the effort students make to learn another language out of their needs or desire (Ellis, 1994, p. 509) (Dörnyei, 2005). However, there has been little attention paid to the changes in motivation under the intervention of *Liushu* through experiments.

According to reports, countries in Southeast Asia are becoming more and more interested in studying Mandarin. For instance, with the assistance of the Confucius Institute Headquarters, learning Mandarin has progressively become a significant component of higher education in Laos since the early twenty-first century (Zhang et al., 2021). Nevertheless, Tao et al. (2020) stated Mandarin teaching methods still need to be improved due to the late start of Mandarin teaching in Laos. Thus, this study intends to provide further insight into issues related to Chinese character learning at the moment of performing *Liushu* in the Mandarin learning classroom in Laos.

To make up for the gaps, this study intends to use comparative experimentation to investigate the effect of *Liushu* on Mandarin learners' Chinese character achievement and motivation. Also, in order to recommend the application of *Liushu* in Mandarin classrooms, it provides an examination of the connection between motivation and Chinese character

achievement. As a result, the Chinese character teaching-learning process may be improved in the Laos learning environment.

II. Literature Review

A. Liushu

A more detailed description of *Liushu* is given in " Shuo Wen Jie Zi Xu (Origin of Chinese Characters) ", in which *Liushu* includes pictograms, self-explanatory, ideograms, semantic-plus-phonetic, mutually explanatory, and phonetic loans. The Chinese characters are classified into six categories according to these six rules (Guo & Chew, 2022, p. 1) Pictogram characters depict specific objects like pictures, such as "山(mountain)" and "月(moon)"; 2) Self-explanatory characters illustrate abstract concepts. For instance, to signify "上(up)" and "下(down)", respectively, the symbols are marked above or below the main body of "一"; 3) Ideographic characters meld the interpretations embodied by the elements to produce a particular concept. For instance, "止(foot)" and "戈(a weapon)" are two elements that makeup "武(military)"."止(foot)" means foot while "戈(a weapon)" means a weapon. Therefore, "武(military)" means that a person advances with a weapon; 4) Semantic-phonic compound characters are made by combining a sound element that corresponds to the character's pronunciation with a meaning element that corresponds to the character's meaning. For instance, "氵(water-related)", the meaning element of "湖(lake)", is associated with water, and the sound element "胡(a surname)" has a similar pronunciation to "湖(lake)"; 5) Mutually explanatory characters mean that the reciprocal transformation of synonyms sharing the identical radicals. For instance, the ancient Chinese character "考(the original meaning is elder)" and "老(elder)" both refer to elder. The Chinese character "考" used today has shed the meaning it once had, whereas its meaning and usage have all been transferred to "老"; 6) Phonetic loan characters indicate that using an existing character to convey a new meaning without the addition of a new character. For instance, the "令(official)" of "县令(magistrate)" is employed to indicate the interpretation of the "令(order)" of "命令(order)".

It worth noting that "mutually explanatory" and "phonetic loan" are widely utilized in ancient literature. Although they still contain many traditional cultures, they are difficult to learn and master, and they are not suitable for assisting in teaching Chinese characters (Chen & Fu, 2014). In this research, phonetic loan characters and mutually explanatory characters are also not involved.

B. Motivation

Motivation studies can be classified into three phases in L2 learning. The social-psychological period, which is the social center, is characterized by Gardner's (1985) motivation theory. The cognitive situated period, in educational psychology, is characterized by theories such as Deci and Ryan's (1985) self-determination theory and Weiner's (1992) attribute theory. In the process-oriented period, motivational changes are prioritized, as shown by Ushioda (1996) and Dörnye (2005, 2009). L2 Motivational Self System (L2MSS), proposed by Dörnye (2005, 2009) in the process-oriented phase, defined these three dimensions of motivation: Ideal L2 Self (IL2S), Ought-to L2 Self (OL2S), and L2 Learning Experience (L2LE). L2MSS emphasizes self-guides (IL2S and OL2S), and students' motivation to learn a second language is generated directly by them, rather than from outside sources such as Gardner (1985). Also, it expands the scope of motivation in SLA research by taking learning experience into account as the third element of motivation.

The notion of "integrativeness" in Gardner's motivation theory is defined by Dörnye (2005) as an individual's IL2S, which pertains to the abilities and skills learners imagine they have and who are therefore working toward reducing the gap between their ideal and actual selves. Lamb (2012) further defined IL2S as an individual's ideal image of the language user he or she wants to be, which encourages people to take action toward their goals. IL2S can also be driven by a person's passions, dreams, and values (Boyatzis & Akrivou, 2006). Researchers have found that IL2S is similar to integrativeness but can explain the variance in key standard measures more effectively than integrativeness (Ryan, 2009; Taguchi et al., 2009). Instrumentality-promotion, also called "instrumental motivation" in Gardner's (1985) theory of motivation, is the desire and goal to succeed. As a result, the promotional aspect of instrumentality correlates more highly with IL2S since it leads to positive outcomes.

OL2S refers to the attributes learners believe should be in place to prevent undesirable consequences (Dörnye, 2005). An earlier study, that of Higgins (1998), had already distinguished OL2S from IL2S. IL2S was related to promotion, meaning learners took specific actions to achieve the desired outcome. In contrast, OL2S was related to prevention, meaning learners took specific actions to avoid bad outcomes. Lamb (2012) points out that OL2S represents what others expect a person to become.

L2LE is situation-specific and based on the immediate learning environment (Dörnye, 2005). Different from self-guides, which tend to be future-oriented, L2LE emphasizes the implementation motivation based on the current learning environment, such as the influence of instructors, courses, and textbooks (Moskovsky et al., 2016).

Most previous studies theoretically explored the feasibility of using *Liushu* in Chinese character teaching. In particular, Li (2018) elaborated on *Liushu*'s role in the teaching of four types of Chinese characters (i.e., pictogram characters, self-explanatory characters, ideographic characters, and semantic-phonic compound characters). Chen and Fu (2014) and Liu (2011) believed that the use of *Liushu* would also enhance Mandarin learners' interest and

motivation in Mandarin learning. In some recent studies (e.g., Su, 2016; Su & Li, 2019; Wang, 2017), experiments have been conducted to examine the role of *Liushu* in Chinese character teaching. However, some limitations remain. For example, Su (2016) only examined the role of *Liushu* in the identification of Chinese character glyphs, without considering the function of *Liushu* in the identification of Chinese characters' sounds and meaning. Moreover, previous studies have not, experimentally, looked at the effects of *Liushu* on learners' Mandarin learning motivation.

With the phenomenon of "Mandarin fever" in Laos in recent years, the insufficiency of Chinese character teaching has gradually emerged. Ye (2013) pointed out that Lao students have difficulties recognizing and reading Chinese characters because Chinese characters are not as phonological as phonetic characters. Also, She's (2017) survey results showed that 72% of Mandarin learners in Laos said that Chinese characters are difficult to learn. Hence, effective Chinese character teaching methods are necessary for Chinese character teaching in Laos.

In view of this, this research intends to examine the impact of *Liushu* on Chinese character achievement (i.e., the identification of the sound and meaning of pictogram characters, self-explanatory characters, ideographic characters, and semantic-phonic compound characters) and Mandarin learning motivation among Lao Mandarin Learners. In addition, an analysis of the correlation between motivation and Chinese character achievement will be presented. Therefore, this research aims to respond the questions below:

Are there any differences in Chinese character achievement and motivation between the experimental group and the control group before treatment?

Are there any differences in Chinese character achievement and motivation of the control group between the pre-test and post-test?

Are there any differences in Chinese character achievement and motivation of the experimental group between the pre-test and post-test?

Are there any differences in Chinese character achievement and motivation between the experimental group and the control group in the post-test?

Are there any significant correlations between motivation and Chinese character achievement in the experimental group after treatment?

Then, eight null hypotheses were developed based on the research questions.

Ho1: There are no significant differences in Chinese character achievement between the experimental group and the control group before treatment.

Ho2: There are no significant differences in the motivation between the control group and the experimental group before treatment.

Ho3: There are no significant differences in Chinese character achievement of the control group between the pre-test and post-test.

Ho4: There are no significant differences in the motivation of the control group between the pre-test and post-test.

Ho5: There are no significant differences in Chinese character achievement of the experimental group between the pre-test and post-test.

Ho6: There are no significant differences in the motivation of the experimental group between the pre-test and post-test.

Ho7: There are no significant differences in Chinese character achievement between the experimental group and the control group after treatment.

Ho8: There are no significant differences in the motivation between the control group and the experimental group after treatment.

Ho9: There are no significant correlations between motivation and Chinese character achievement in the experimental group after treatment.

III. Methodology

A. Research Design

Planned research that includes a number of purposeful modifications to procedure elements and observations of the results is known as a quasi-experimental design (Chua, 2016). Data from the control and experimental groups both before and after the treatment were used in this quasi-experimental investigation. The experiment covered six classes (four Information Technology classes and two Accounting classes). To maintain homogeneity between the two groups, human intervention was used. Each group is therefore comprised of Information Technology (IT) students and Accounting students. The experiment design is shown in Figure 1.

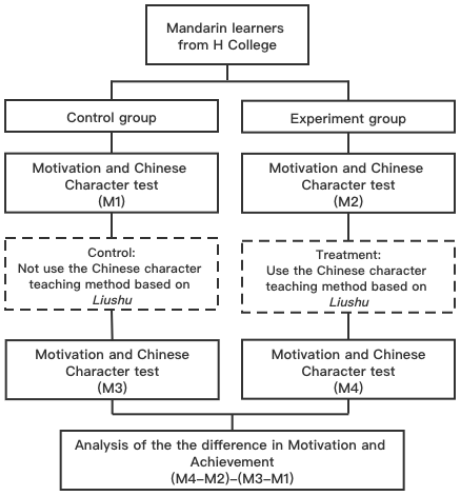

Figure 1 Experiment Design

B. Participants

In Laos, there are 217 Mandarin learners from H College studying Accounting and IT. Nine classes with 10–30 students each are given to these 217 students. While 170 learners (105 boys and 65 girls) majoring in IT were given six classes, 47 learners (18 boys and 29 girls) majoring in accounting were given three classes. Despite the fact that Mandarin was a required subject for them, the majority of Mandarin students are beginner Mandarin learners.

Six classes were chosen for this experiment, including two Accounting classes and four IT classes. A total of 133 students made up the final sample, with 68 (37 boys and 31 girls) in the experimental group and 65 (42 boys and 23 girls) in the control group. 102 learners were studying IT, and 31 learners were majoring in Accounting.

C. Instruments

The Chinese Character Test and L2MSS Questionnaire (L2MSSQ) were employed for collecting the data.

(a). Chinese Characters Test

Chinese Characters Test is designed in this current study to measure the proficiency of Mandarin learners in recognizing Chinese characters they have learned. Pre-test and post-tests were respectively composed of six pictogram characters, six ideogram characters, six semantic-phonetic compound characters, and two self-explanatory characters. The 20 Chinese characters in the pre-test were learned by the learners in the last semester, while the 20 Chinese characters in the post-test were from the Chinese characters learned during the treatment.

Before treatment, the primary purpose of the Chinese character test is to examine learners' recognition of Chinese characters. As a result, the following are the guidelines for choosing Chinese characters for the pretest:

1) Chinese characters that have been taught and learned in the last semester.

2) Chinese characters can be spoken alone because it is trickier to examine the interpretation of Chinese characters if the Chinese characters cannot be spoken alone. For example, "菜(dish)" was selected in place of "了(a modal particle)".

Similarly, the guidelines in the post-test are:

1) Chinese characters that were taught and learned during treatment.

2) Chinese characters must be spoken and form words alone because it would be trickier to examine the meaning of the Chinese character if the Chinese characters cannot be spoken alone. For example, "高(tall)" was chosen instead of the"最(an adverb of degree)".

Additionally, in order to make comparisons easier, the number and type of the selected Chinese characters were kept the same before and after the treatment. They are listed in Tables 1 and 2.

TABLE 1
THE SELECTED CHINESE CHARACTERS IN THE PRE-TEST

Category	No. of Chinese Characters	Chinese Characters
Pictograms characters	6	山(mountain) 心(heart) 大(big) 西(west) 月(moon) 女(female)
Self-explanatory characters	2	七(seven) 九(nine)
Ideographic characters	6	好(good) 见(see) 家(home) 我(I, me) 是(is, are) 有(have, has)
Semantic-phonetic compound characters	6	她(she, her) 菜(dish) 书(book) 说(say) 写(write) 请(please, invite)

TABLE 2
THE SELECTED CHINESE CHARACTERS IN THE POST-TEST

Category	No. of Chinese Characters	Chinese Characters
Pictograms characters	6	高(high, tall) 长(long, grow) 门(door) 鱼(fish) 白(white) 它(it)
Self-explanatory characters	2	上(up) 下(down)
Ideographic characters	6	卖(sell) 送(send) 从(from) 黑(black) 穿(wear) 等(wait)
Semantic-phonetic compound characters	6	懂(understand) 晴(sunny) 玩(play) 近(close) 红(red) 问(ask)

There are two sections in the test paper. The first part is the demographic information (i.e., student ID). This second part offers 15 multiple-choice questions. Questions 1 to 5 test students' ability to distinguish the meaning of Chinese characters, and questions 6 to 10 examine students' ability to identify the pronunciation of Chinese characters. Accordingly, questions 11 to 15 are designed to assess the ability to infer pronunciations and meanings of Chinese characters based on learned knowledge.

(b). L2MSSQ

The L2MSSQ, which was utilized in this research, was modified from a version of the Likert scale with five points used by Taguchi et al. (2009) and Moskovsky et al. (2016) to assess motivation for learning a second language. There are two parts to the questionnaire. Demography is the first part (i.e., student ID). Part 2 is made up of 33 items given to assess IL2S, OL2S, and L2LE as shown below:

1) IL2S (9 items) refers to what a person wants to be, it displays an individual's own desire. IL2S is correlated with integrativeness, e.g., "I often imagine myself speaking Mandarin as if I were a native speaker of Mandarin"

2) OL2S (9 items) is what other people want a person to achieve, which represents the expectations of others, such as peers and parents. It is related to instrumental motivation because it represents an external motivation, e.g., "Learning Mandarin is necessary because people around me expect me to do so"

3) L2LE (15 items) is an individual's experience in the educational setting mostly affected by instructors, subjects, and classmates, e.g., "My Mandarin teachers are better than my other subjects' teachers"

D. Validity and Reliability of Instruments

The test paper and questionnaire were given to three experts for assessment to determine the validity of the face and content of the instruments in this research. To accommodate the study's Mandarin learners, some adjustments were made according to suggestions from the experts. For example, the "please" in the test paper changed to "please, invite" since "请" is a polysemous word in Mandarin. In addition, items with similar meaning to other items in L2MSSQ have also been removed.

This study uses the test-retest method to test the reliability of the Chinese Characters Test. A total of 30 respondents from classes not included in the experimental group and the control group took the first test and the second test with a two-week gap. A Pearson correlation coefficient of not less than 0.65 is considered reliable by Chua (2016). This study's Pearson coefficient is 0.826, which suggests the test paper has a high level of reliability. Furthermore, 39 students who were not taking part in the experiment received and completed the questionnaire. Results demonstrated that the questionnaire had attained internal consistency because the motivation scale's Cronbach coefficient was 0.895, which was greater than the minimum allowable value of 0.60 (Pallant, 2010).

E. Intervention Procedure

According to the Mandarin teacher's introduction, semester 2 of the 2020/2021 session lasts for 14 weeks. In order not to affect students' final exams, the fourteenth week will not be occupied. Mandarin lessons are held once a week and each lesson lasts for 90 minutes. In addition to the time taken to introduce the experiment to the participants in the first week and distribute questionnaires and test papers in the second week for the pretest and the last week for the posttest, there are 10 weeks left. As a result, the treatment will last 10 weeks. As usual, according to the teaching plan, each lesson lasted 90 minutes, and 20 to 30 minutes of that time was devoted to teaching 2-4 Chinese characters. The subjects and Chinese characters covered in every lesson during the treatment process are as follows:

1) September is the best time to visit Beijing——猫(cat) 它(it) 要(want) 最(an adverb of degree)

2) I get up at six every day——高(tall) 忙(busy) 药(medicine) 上(up)

3) The red one on the left is mine——下(down) 红(red) 送(send)

4) He recommended me for this job——给(give) 问(ask) 长(long) 两(two)

5) Take this one——鱼(fish) 衣(clothing) 买(buy) 卖(sell)

6) Why don't you eat more——门(door) 外(a position word) 羊(sheep)

7) Let me think about it and I'll tell you later——等(wait) 白(white) 黑(black) 贵(expensive)

8) There are too many questions, I did not finish all of them——错(wrong) 从(from) 懂(understand) 完(finish)

9) You wear too little——雪(snow) 近(close) 进(enter) 穿(wear)

10) Have you seen that movie——玩(play) 晴(sunny)

There was no treatment provided to learners in the control group. The teaching procedures followed a conventional routine as usual. Specifically, an introduction, reading, writing, and sentence construction are all included in the instructional processes for each Chinese character. Differently, for the experiment group, the researcher developed lesson plans for teaching Chinese characters to assist the Mandarin teacher. Introduction, reading, writing, character glyphs evolution or Chinese character structure analysis, and sentence making are the teaching steps for each Chinese character.

Students were instructed to consider a particular Chinese character associated with the image during the introduction phase (for instance, the image of a fish). With pictogram characters and self-explanatory characters, the instructor was expected to assist students in identifying connections between objects and Chinese characters.

The teacher then guides the class in reading Chinese characters by exercising pronouncing the initials and finals. The teacher instructs the class on how to pronounce the sound components in the case of teaching semantic-phonetic compound characters.

The next step, which is equally crucial for the control group, is for students to practice writing Chinese characters after being treated to a presentation of the writing sequence in animation.

For pictogram characters and self-explanatory characters, students move on to learning Chinese character development and evolution by examining the difference in glyphs from antiquity to the present. By dividing Chinese characters into their constituent parts, students can learn the constructing principles of ideographic characters and semantic-phonetic compound characters.

As a final phase, which is also a regular step in the control group, students construct sentences using the learned Chinese characters based on the prompts.

F. Data Analysis

Data was collected from pretests and posttests. SPSS was used to process and analyze all of the data. Independent sample *t*-tests and paired sample *t*-tests will be used to examine any differences in Mandarin learners' achievement of Chinese characters and motivation before and after treatment to respond to the research questions. In addition, a Pearson correlation coefficient was calculated to test the relationship between motivation and Chinese character achievement.

IV. Findings

An independent sample *t*-test was conducted to determine if a statistically significant difference exists in Chinese character achievement and motivation of Mandarin learners between the two groups before the treatment. The results from the *t*-test are shown in Tables 3 and 4.

TABLE 3
ACHIEVEMENT OF THE CONTROL AND THE EXPERIMENTAL GROUP IN THE PRE-TEST

	Control		Experiment		*t*	*p*
	M	*SD*	*M*	*SD*		
1-5 scores	8.97	1.42	8.53	2.33	1.321	0.189
6-10 scores	9.02	1.43	8.70	2.44	0.940	0.349
11-15 scores	6.80	2.59	6.50	1.78	0.775	0.440
Total scores	24.79	4.32	23.73	5.88	1.185	0.238

TABLE 4
THE MOTIVATION OF THE CONTROL GROUP AND THE EXPERIMENTAL GROUP IN THE PRE-TEST

	Control		Experiment		*t*	*p*
	M	*SD*	*M*	*SD*		
IL2S	30.95	5.95	29.32	5.30	1.671	0.097
OL2S	30.32	6.03	31.03	6.16	-0.668	0.505
L2LE	46.35	5.20	46.72	6.71	-0.351	0.726
Motivation	107.63	13.52	107.07	15.87	0.218	0.828

As shown in Table 3, Chinese characters' achievement didn't show a significant difference at t=1.185, p=0.238>0.05 between the two groups. Additionally, Table 4 indicates that no significant difference exists in motivation (t=0.218, p=0.828) between the two groups. This result indicates that there were no significant differences in Chinese character scores or motivation of the learners in the two groups before the treatment, although the experimental group's Chinese character achievement and motivation were slightly lower than the control group. As a result, the two groups were determined to be identical, and Ho1 and Ho2 were accepted.

We next conducted paired sample *t*-tests to compare the Chinese character achievement and motivation between the pre-test and the post-test of the control group with conventional teaching. The results are shown in Tables 5 and 6.

TABLE 5
ACHIEVEMENT OF THE CONTROL GROUP IN THE PRE-TEST AND THE POST-TEST

Measurement	Pre-test		Post-test		*t*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
1-5 scores	8.97	1.42	8.68	1.99	1.050	0.298	
6-10 scores	9.02	1.43	8.55	2.45	1.584	0.118	
11-15 scores	6.80	2.59	4.92	2.24	4.515	0.000**	0.560
Total scores	24.79	4.32	22.15	5.85	3.252	0.002**	0.403

**p<0.01

The results of Table 5 show that all the scores in the control group were lower on the post-test than they had been on the pre-test. Findings showed there is a statistically significant difference between pre-test for 11-15 scores (M=6.80, SD=2.59) and total scores (M=24.79, SD=4.32) and post-test for 11-15 scores (M=4.92, SD=2.24) and total scores (M=22.15, SD=5.85) of the control group. In other words, the students in the control group scored lower in the post-test compared to the pre-test at t=4.515, p=0.000, Cohen's d=0.560, for the 11-15 scores and t=3.252, p=0.002, Cohen's d=0.403 for the total scores. It appears that a significant negative change in students' Chinese character achievement is observed under regular instruction. Therefore, Ho3 was rejected.

TABLE 6
THE MOTIVATION OF THE CONTROL GROUP IN THE PRE-TEST AND THE POST-TEST

Measurement	Pre-test		Post-test		*t*	*p*
	M	*SD*	*M*	*SD*		
IL2S	30.95	5.95	30.65	5.35	0.469	0.640
OL2S	30.32	6.03	29.54	5.87	1.082	0.283
L2LE	46.35	5.20	47.62	7.74	-1.217	0.228
Motivation	107.63	13.52	107.80	17.01	-0.086	0.932

According to Table 6, the pair sample t-test results did not show a significant difference in motivation in the pre-test (M=107.63, SD=13.52) and post-test (M=107.80, SD=17.01) of the control group at t=-0.086, p=0.932. Hence, the motivation in the control group did not change much before and after they followed the conventional teaching. Ho4 is therefore acceptable.

These paired sample t-tests from the control groups show that conventional teaching did not improve Chinese character performance or motivation. Despite not receiving any treatment, the Chinese character scores in the control group showed a downward trend, which indicates that the post-test was more challenging for students than the pre-test.

To examine whether the effects of using *Liushu* after treatment were significant, paired sample t-tests were performed between the pre-test and the post-test of the experimental group as presented in Table 7 and Table 8.

TABLE 7
ACHIEVEMENT OF THE EXPERIMENTAL GROUP IN THE PRE-TEST AND THE POST-TEST

Measurement	Pre-test		Post-test		*t*	*p*
	M	*SD*	*M*	*SD*		
1-5 scores	8.53	2.33	8.37	2.27	0.856	0.395
6-10 scores	8.70	2.44	8.39	2.91	1.051	0.297
11-15 scores	6.50	1.78	6.26	2.42	0.767	0.445
Total scores	23.73	5.88	23.02	6.44	1.157	0.251

As seen in Table 7, although all mean scores decreased slightly, the pair-sampled t-test results showed that there was no significant difference in the Chinese character achievement between the pre-test (M=23.73, SD=5.88) and the post-test (M=23.02, SD=6.44) of the experiment group at t=1.157, p=0.251. Therefore, the findings indicate that there is no significant change in the Chinese character achievement of the experimental group after they have gone through the *Liushu* instruction. Thus, Ho5 was supported.

TABLE 8
THE MOTIVATION OF THE EXPERIMENTAL GROUP IN THE PRE-TEST AND THE POST-TEST

Measurement	Pre-test		Post-test		*t*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
IL2S	29.32	5.30	31.12	6.73	-2.502	0.015*	0.303
OL2S	31.03	6.16	30.41	5.71	0.775	0.441	
L2LE	46.72	6.71	49.06	8.22	-2.233	0.029*	
Motivation	107.07	15.87	110.59	17.94	-1.593	0.116	0.271

* p<0.05

In Table 8, in the experimental group, the difference in IL2S between pre-test (M=29.32, SD=5.30) and post-test (M=31.12, SD=6.73) is statistically significant (t=-2.502, p=0.0150.05, Cohen's d=0.303). Also, L2LE shows a significant difference between pre-test (M=46.72, SD=6.71) and post-test (M=49.06, SD=8.22) at t= -2.233, p=0.029<0.05, Cohen's d= 0.271. It showed that there was positive progress with a small effect size on students' IL2S and L2LE in the treatment group with the help of *Liushu* instruction. However, the overall motivation did not show significant differences at t=-1.593, p=0.116>0.05. Therefore, Ho6 is accepted.

Before treatment, independent sample *t*-tests showed no statistical significance between the two groups in Chinese character achievement and motivation. In order to further examine the influence of *Liushu*, an independent sample *t*-test was conducted again to compare the results of the control and experimental groups after the conventional and *Liushu* instruction respectively. The findings are shown in Table 9 and Table 10 below.

TABLE 9
ACHIEVEMENT OF THE CONTROL GROUP AND THE EXPERIMENTAL GROUP IN THE POST-TEST

Measurement	Control		Experiment		*t*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
1-5 scores	8.68	1.99	8.37	2.27	0.835	0.405	
6-10 scores	8.55	2.45	8.40	2.91	0.351	0.726	
11-15 scores	4.92	2.24	6.26	2.42	-3.318	0.001**	0.576
Total scores	22.15	5.85	23.02	6.44	-0.813	0.418	

** $p<0.01$

Statistically, though the experimental group scored higher than the control group on the Chinese characters test, there is no significant difference between the control group (*M*=22.15, *SD*=5.25) and the experiment group (*M*=23.02, *SD*=6.44) according to Table 9. This can be summarized as there was no significant difference in the Chinese character scores of the learners in the two groups after the treatment. Therefore, Ho7 was accepted.

However, it is worth noting that for 11-15 scores, the average value of the experimental group (*M*=6.26, *SD*=2.42) is significantly higher than the average value of the control group (*M*=4.92, *SD*=2.24) at *t*=-3.318, *p*=0.001<0.01, Cohen's *d*= 0.576.

TABLE 10
THE MOTIVATION OF THE CONTROL GROUP AND THE EXPERIMENTAL GROUP IN THE POST-TEST

Measurement	Control		Experiment		*t*	*p*
	M	*SD*	*M*	*SD*		
IL2S	30.65	5.35	31.12	6.73	-0.446	0.656
OL2S	29.54	5.87	30.41	5.71	-0.870	0.386
L2LE	47.62	7.74	49.06	8.22	-1.042	0.299
Motivation	107.80	17.01	110.59	17.94	-0.919	0.360

As presented in Table 10, there is no significant difference in motivation after treatment between the two groups at *t*=-0.919, *p*=0.360>0.05. In general, the mean score of the learners' motivation in the experiment group was higher than that of the control group, indicating that *Liushu* may enhance the motivation of learners in all aspects when compared to the convention teaching method, though its effect is not significant. As a result, Ho8 was accepted.

TABLE 11
THE CORRELATION BETWEEN MOTIVATION AND CHINESE CHARACTER ACHIEVEMENT IN THE EXPERIMENTAL GROUP AFTER TREATMENT

	Motivation	Chinese character achievement
Motivation	-	
Chinese character achievement	0.072	-

As shown in Table 11, motivation was not significantly associated with Chinese character achievement at *r*=0.072, *p*>0.05. This result implies that higher motivation toward Mandarin learning is not associated with higher Chinese character achievement. Thus, Ho9 was accepted.

V. DISCUSSION AND CONCLUSION

This research investigated the influence of a ten-week Chinese character teaching instruction by *Liushu* on Mandarin learners' Chinese character achievement and learning motivation in Laos. The paired-sample *t*-test of the experimental group did not show a significant difference in Chinese character achievement between the pre-test and the post-test. In other words, there was no significant change in Chinese character achievement before and after treatment in the experimental group. However, according to the paired-sample *t*-test results of the control group, it can be inferred that the difficulty of the post-test of Chinese characters may be more difficult than that of the pretest because the results of the control group demonstrated a clear downward trend. Both the independent sample *t*-tests before and after treatment demonstrated that there was no significant statistical difference between the experimental group's and control group's achievement in Chinese characters. It is worth noting that the experimental group whose mean score in the pre-test is lower has exceeded the control group in the post-test. On the whole, the findings indicate that *Liushu* is effective in Chinese character achievement, which is consistent with the findings of previous studies such as Qi (2017), Su (2016), Su and Li (2019), and Wang (2017).

Particularly, in this current study, *Liushu* leads to an obvious increase in inferring the pronunciation and meaning of Chinese characters. It reflected that a significant difference was found between the two groups on scores of 11-15 after treatment. As mentioned before, questions 11 to 15 are designed to assess the ability to infer pronunciations and meanings of Chinese characters based on knowledge learned. In a previous study, Su and Li (2019) found that the use of *Liushu* can improve the accuracy of students' dictation of Chinese characters with the help of the meaning elements

and the sound elements. These two results indicate that *Liushu* effectively helps learners identify the sound and meaning of Chinese characters based on the sound elements or the meaning elements. This finding confirms the view of Hao (2019) who believes that the introduction of *Liushu* in Chinese characters teaching helps Mandarin learners expand the depth of learning and enhance the effect of learning. Specifically, *Liushu* can not only help learners memorize the already learned Chinese characters, but also assist learners in recognizing new Chinese characters through the sound elements or the meaning elements.

On the other hand, the independent sample *t*-test in the pre-test revealed that the motivation levels of the control group and experimental group were nearly identical. However, the post-test results revealed little change in the control group's average motivation scores, while the experimental group's average motivation increased from 107.80 to 110.59, though the statistical difference was not significant. It is generally believed that *Liushu* can increase learners' motivation to some degree. Furthermore, it is clearer that IL2S and L2LE had significant differences in the treatment group during the treatment process based on the results of the paired-sample *t*-test.

IL2S means what a person wants to be, representing a person's own desire. *Liushu* combines the cultures during this process to increase the interest of Mandarin learners in learning Chinese characters, which may motivate the student to have a greater wish to be ideal Mandarin learners. L2LE refers to an individual's experience in the classroom affected by the instructors, subjects, and instructional strategies. This outcome is aligned with Chen and Fu's (2014) view, stating that the use of *Liushu* can improve learners' desire for learning Mandarin by deepening their comprehension and memorization of Chinese characters.

An additional finding is that, for Mandarin learners in this study, higher motivation is not strongly related to higher Chinese character achievement, which may challenge our common sense since high motivation is generally associated with high achievement. It was noted that, based on Dörnyei's L2MSS, more and more research (e.g., Lamb, 2012; Moskovsky et al., 2016) have begun taking notice of this phenomenon. Specifically, learners' high learning motivation may prompt learners to put more efforts into learning, which is defined as Intended Learning Efforts (ILEs). However, sometimes, ILEs and actual learning efforts are inconsistent because a person's wishes do not always determine a person's behavior (Moskovsky et al., 2016). In other words, the efforts do not always translate into achievement in language learning, which is also reflected in the current study. Therefore, it should be accompanied by well-implementation plans that detail the particular actions students must take to succeed (Lamb, 2012).

On the basis of this study, it can be demonstrated that *Liushu* can significantly produce favorable effects on the Chinese character achievement of Mandarin learners. At the same time, *Liushu* makes a significant contribution to IL2S and L2LE. Therefore, for beginner Mandarin learners, the Chinese character teaching method based on *Liushu* is supported in terms of improving Chinese characters' performance, especially, reflected in the ability to infer pronunciations and meanings of Chinese characters based on the sound elements and the meaning elements. Also, instructors should focus more on the cultural roles involved in *Liushu* to improve students' IL2S. In addition, instructors may add interest to lessons by analyzing the source and structure with the help of *Liushu*, thereby improving students' L2LE. More importantly, while teaching with the help of *Liushu*, teachers should help students to develop a feasible learning plan so that students' efforts can positively affect Chinese character achievement. In a word, the findings of this research confirmed the feasibility and effectiveness of the Chinese character teaching method with the instruction of *Liushu*. In addition, more qualitative research, such as interviews, is expected to be implemented in future research to further deepen our comprehension of students' and instructors' attitudes toward *Liushu*.

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