

A Review of Research on Learning Style

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Abstract

“Learning style” was proposed in the study of English as a native language by American scholar Thelen in 1954, and then developed into the study of English as a second language. In China, learning style started to be studied relatively late, which was developed on the basis of referring to the concept of learning style in western educational psychology. Chinese experts in the field of education have devoted themselves to investigating the individual differences of learners. In 1994, studies were carried out on learning style, focusing mainly on its classification, the relationship between learning style and language learning performance, etc. Studies have shown that the learning efficiency of learners can be promoted by providing them with appropriate learning content organization methods according to their different learning styles. These studies are of great significance for future research on the acquisition and teaching of Chinese as a foreign language.

Keywords

Learning Style, Cognitive Style, Language Acquisition, Review

1. Introduction

The traditional school education cannot really teach every child without class and teach them according to their aptitude. In recent years, online education has broken the limitations of time and space, making the best educational resources at your fingertips. The mainstream trend of education is to give students accurate personalized learning guidance. Learning style focuses on students' personalized learning.

Learning style refers to the way in which learners absorb, process and store new information and master new skills. Natural and habitual, this way will not change with teaching methods or learning content (Reid, 1987). Since the 1960s,

the focus of language teaching has shifted from teachers to students. Accordingly, the research focus of language (especially foreign language) educators and researchers has shifted from teaching methods and processes to the language learning process and the characteristics of language learners themselves. Therefore, the individual differences of learners have increasingly attracted the attention of researchers studying second language (L2) acquisition (Li, 2021). The academic community has basically reached a consensus that the learning efficiency of learners can be improved by offering them proper learning content organization methods according to their different learning styles and guiding their personalized learning styles during learning. Research on learning styles in foreign countries began early. Nearly 70 years have passed since American scholar Thelen (1954) put forward the term “learning style”. In this paper, relevant research studies in different countries were taken as main reference materials, including the research results of L2 acquisition, English teaching, psychology and teaching Chinese as a foreign language (TCFL). Besides, studies on the learning style of learners were sorted out. In addition, a summary was made of previous research results and the consensus reached, providing some references for future research on language acquisition and teaching.

2. Definition and Theoretical Basis of Learning Style

2.1. Definition of Learning Style

Opinions on the definition of learning style vary. At present, it has no unified concept. Reid (2002), an influential foreign scholar, believed that learning style is a natural and habitual method and skill of personal preference for learners to absorb, process and store new information and master new skills. In China, Tan (1995) provided a generally accepted definition of learning style: Learning style is a study method a learner uses consistently with characteristics of personality and the summation of learning strategy and inclination. After research, it is found that learning style has a consistent definition despite lacking a unified concept in the academic circle. First, learning style is the learning way of learners with personal habits and preferences in the learning process. Second, it is formed by individuals in their long-term study life, with strong stability. The learning style of everyone is different and unique due to the influence of the environment, culture and other factors.

In the current research, learning and cognitive styles as well as learning strategy are usually used as synonyms. The study of learning style was later than and drew on that of cognitive style. Also known as the cognitive approach, cognitive style refers to the habitual way that individuals often adopt in their cognitive process. Specifically, it is the attitudes and ways that individuals prefer and get habituated to during the process of perception, memory, thinking and problem-solving (Song, Li, & Wang, 2001). Cognitive style primarily studies the way of information processing, while learning style focuses on the differences in the intelligence, emotion, motivation and other aspects of learners, and their prefe-

rences for learning environments, content, strategies, etc. To some extent, cognitive style is a significant component of learning style.

Learning strategy refers to the actions taken by learners to facilitate the acquisition, storage, extraction and utilization of information. In plain terms, it is the methods or behaviors of learners to promote learning and make learning faster and more effective (Jiang, 2000). Learning strategy can be developed through practice and generally change with learning objects and subjects as well as changes in environmental conditions, showing greater flexibility. However, learning style originates from the personality of learners which is different from that of others and has a certain degree of heredity. Moreover, it is gradually formed in long-term learning activities and seldom changes with the change of learning environments and content, with stability (Chen, 2016).

2.2. Related Teaching Theories

Affiliated with educational psychology, learning style has great guiding significance to educational practice. In the 1630s, Czech educator Comenius put forward the class teaching system in his work *Magna Didactica*, and initiated the teacher-centered teaching theory. As emphasized by the theory, teachers are the center of teaching activities and take charge of organizing and monitoring the whole process of teaching activities, while students are the objects of knowledge infusion. This learning theory occupied an important position in the realm of education for a time. By the 20th century, the behaviorist learning theory was affected by the cognitive learning theory holding that students are the subjects of information processing. As a major branch of the cognitive learning theory, the constructivism learning theory proposes that knowledge is acquired through learning, others' help, information query and meaning construction in a specific environment. The construction of meaning is the ultimate goal of this learning process. The constructivism learning theory is conducive to pushing forward the development of student-centered teaching.

Originating in the 1950s, the individualism learning theory underlines that students are the center of teaching. It also maintains that teachers should help students discover their potential in the teaching process and enable them to teach themselves. Additionally, teachers should advocate meaningful and experiential learning, and require students to take responsibility for themselves, set up scenarios, select materials, raise questions, determine progress and pay attention to results by themselves (Yue, 2015).

In his monograph *Personalized Teaching Theory*, Professor Deng East China Normal University put forward the characteristics of personalized teaching in seven aspects: media technology, learning pace, methods, content and objectives as well as evaluation methods and criteria. For instance, learners can learn at their own pace and choose different media technologies and diversified learning strategies and contents. The diversity of learning objectives can adapt to the individual differences of students. Learning tasks, evaluation criteria, etc. can be

freely selected. Further, the research equated personalized teaching with adaptive teaching and differentiated teaching with inclusive teaching.

2.3. Related Psychological Theories

Sweller, a famous Australian educational psychologist, and other scholars proposed the cognitive load theory in the 1980s. In light of the theory, people have limited cognitive resources in the cognitive process. A high cognitive load will be brought to learners if the resources to be occupied in a link of information processing exceed the total amount of cognitive resources owned by learners per se, thereby influencing the learning outcomes of learners.

“Schema” has already appeared in the philosophical works of Kant. In 1932, psychologist Bartlett formally brought up the concept of “schema” in psychology and formed a quite systematic schema theory referring to the theory of knowledge representation and storage mode organized on a topic. In brief, it is necessary for people to learn and master a lot of knowledge in their life. Such knowledge is not stored randomly in the brain but divided according to different topics. The related contents under the same topic constitute a knowledge unit which is a schema. Knowledge is schematically stored in long-term memory, which thus reduces the cognitive load of learners.

As a cognitive theory, the dual coding theory was formally put forward in the book *Imagery and Verbal Processes* in 1971, with a central assumption that verbal and imagery information is stored separately in the long-term memory of people. The theory states that people possess separate visual and auditory processing channels where respective cognitive resources are also independent of each other. The separate visual image channel is used to process materials of visual representation such as videos, pictures, animations and texts, while the separate auditory/verbal one is utilized to process materials of auditory representation like voice commentaries and background music. Learning efficiency can be better improved when people process information through two independent channels, which is more in line with the characteristics of human information processing. The limited capacity hypothesis holds that people’s visual and auditory processing channels are limited in information capacity and unable to present too much information simultaneously. Otherwise, it will lead to information overload and hence affect learning outcomes.

3. Related Research on Learning Styles in China and Abroad

3.1. Foreign Research Results

3.1.1. Elements of Learning Style

The elements of learning style are classified into different types, which are directly related to the classification and measurement of learning style. The most representative elements of learning style have the following several explanations.

The elements of learning style were divided by the Dunns into five categories:

environmental, emotional, social, physiological and psychological elements, with a total of 27 specific elements. Keefe (1979) claimed that learning style is composed of 32 elements in cognitive, emotional and physiological categories.

By combining the characteristics of the educational system and culture in China, Chinese scholar Tan pointed out the inappropriateness of western research on the elements of learning style in China. Apart from that, he segmented learning style into 23 elements in physiological, psychological and social categories, and conducted detailed research on them in *On Learning Style*. Furthermore, the scholar categorized the measurement of the elements of learning style into comprehensive and individual measurements. Comprehensive measurement means that a set of test scales measure multiple elements, which is characterized by strong comprehensiveness. Representative scales are the Learning Style Inventory (LSI) of the Dunns and the Learning Style Profile (LSP) of the National Association of Secondary School Principals. Individual measurement carries out analysis on physiological, psychological and social elements, among which psychological elements mainly include cognitive and emotion-conation factors, and social elements mainly contain personality types and gender perspectives.

Tan summarized the elements of learning style in *Learning Style* as follows: Physiological elements chiefly comprise intuitive response, brain function and learning time, sound, light, temperature as well as mobility and sitting posture preferences. The learning styles corresponding to learning time preference are principally morning, forenoon, afternoon and evening types. The learning styles corresponding to perceptual response are mainly visual, auditory and kinesthetic types. The learning styles corresponding to sound preference primarily include the need for silence, the use of background sound to mask the interference of other sounds during learning and the tolerance of a certain degree of noise. The learning styles corresponding to light preference are mainly stronger and darker light preferences. Psychological elements largely consist of cognitive, emotional and conative elements as well as psychological development. Social elements are made up of personality types, gender perspectives, etc., including 16 personality types.

3.1.2. Classification of Learning Style

From the 1950s to the present, learning style theory models have developed into more than 70 types, whose specific types are listed in **Table 1**.

In the 1990s, Felder & Silerman co-created Feler-Silverman Learning Style Model. In 1991, Felder cooperated with Solomon to design the Felder-Soloman Index of Learning Style (ILS) which mainly measures the situation of learners in the four dimensions of information input, perception, processing and understanding.

Compared with other questionnaires of the same type, this questionnaire has a more reasonable classification and measures the learning styles of learners more scientifically. Index of Learning Style (ILS) is listed in **Table 2**.

Table 1. Table of learning style theory models.

Learning Style Model	Learning Style Dimension
Kolb's Learning Style Model	Assimilation, divergence, convergence, compliance
Feler-Silverman Learning Style Model	Vision/verbalism, activeness/contemplation, sense/intuition and sequence/synthesis
Dunn and Dunn Learning Style Model	Environment, emotion, society and physiology
Myers-Briggs Type Indicator Model	Perception/judgment, sense/intuition, thinking/feeling and extroversion/introspection
Pask Learning Style Model	Comprehensive and analytic strategies
Entwistle Learning Style Model	Meaning, copy, completion and non-academic orientation
Grasha-Riechmann Student Learning Styles Scale	Participation/avoidance, collaboration/competition and dependence/independence
Gregoro Learning Style Model	Concrete/sequential, abstract/random, abstract/sequential and concrete/random
Honey and Munford Learning Styles Questionnaire	Activists, reflectors, theorists and pragmatists
Hermann Learning Style Model	Humanitarians, theorists, organizers and innovators

Table 2. Table of Index of Learning Style (ILS).

Dimension	Classification	Description
Information processing	Activeness-type	Do first and think later, like practicing and testing ideas directly, tend to discuss and communicate with peers, and constantly change ideas and trains of thought in team cooperation.
	Contemplation-type	Be fond of working independently and good at carefully combing the acquired knowledge, thinking about and summarizing solutions, and then ruminating over and processing information.
Information perception	Sense-type	Depend more on rote memorization, be scrupulous and like learning facts.
	Intuition-type	Be flexible and innovative, fond of conducting abstract experiments, adept in mastering new concepts and able to understand abstract mathematical consensuses.
Information input	Vision-type	Be skilled in remembering what is seen, such as pictures, icons, flowcharts, images and presentation content.
	Verbal-type	Excel in getting information from written and verbal explanations.
Information understanding	Sequence-type	Be interested in learning discrete knowledge and take small steps to learn linearity and logic.
	Synthesis-type	Tend to get a comprehensive view of knowledge, be suddenly enlightened and take big strides.

3.1.3. Relationship between Learning Style and Language Acquisition

Kogan is the first person to apply the cognitive style to language teaching and published the paper *Cognitive Style and Reading Performance* in 1980. In his view, "compensation strategies can be better sought by studying the cognitive style of individuals in order to overcome the possible obstacles encountered in reading." Chen & Wu explored the learning effects of learners who had visual and verbal cognitive styles and learned three different types of teaching videos (classroom record, three split screens and picture-in-picture types) in an online

teaching environment. The results show that three kinds of teaching videos had no significant effect on the academic performance of verbal and visual learners. However, verbal learners paid more sustained attention to learning teaching videos than visual ones. In addition, the cognitive load generated by visual learners was significantly higher than that generated by verbal learners in the learning of picture-in-picture teaching videos. Chen & Sun confirmed that multimedia materials containing videos and animations are more suitable for visual learners than those containing texts and animations. In contrast to learners with visual preference, those with verbal preference generate lower cognitive load when learning teaching videos continuously presenting teacher images compared with briefly presenting teacher images. Horner et al. found that learners with a low visual preference would produce a higher cognitive load when learning teaching videos with teacher images, whereas those with a higher visual preference would produce a higher cognitive load when learning teaching videos without teacher images.

3.2. Related Research in the Field of Chinese

In China, the early research on learning style mostly discussed its theoretical definition. Learning style has been lacking a unified definition for a long time, whose definition varies by research angle. Most domestic scholars agree with or cite the definition provided by Tan that learning style refers to the preferences of learners with personality characteristics for methods, means, learning content and environments to complete learning tasks. The research on Chinese includes that of Chinese as a first language on the one hand and L2 on the other hand.

3.2.1. Related Research on Chinese as a First Language

The cognitive style was first applied in Chinese teaching in China from the mid and late 1980s. In *Influence of Field Dependence on the Effects of Centralized and Decentralized Literacy*, Zhang and Feng (1985) conducted experimental research and reached the following conclusion: “field-independent children are suitable for centralized literacy, while field-dependent ones are suitable for decentralized literacy. Children in between show no significant difference between the two teaching methods.” In *A Study of the Relationship between Cognitive Style and Language Learning Strategies*, Yao (2006) claimed that learners with different cognitive styles should adopt different language learning strategies. Through the study of learning strategies, it was found that the use and frequency of learning strategies by language learners have a great impact on the learning effect. The study of learning strategies is inseparable from that of cognitive styles. This is because learners can adopt different learning strategies according to their advantages or disadvantages and by understanding their cognitive styles with the aim of improving their language learning ability.

Currently, the domestic research on the relationship between cognitive style and foreign language learning mainly focuses on college English teaching. Zhu et

al. employed the Perceptual Learning Style Preference Questionnaire (PLSPQ) developed by Reid and classified 133 students from six classes in a senior high school into six groups of subjects with different learning styles through the experimental method. It was confirmed that the kinesthetic learning style of senior high school students at different levels has the strongest correlation with English learning performance. Wang et al. applied Kolb's Learning Style Model to verify the significant impact of learning style on fluency in L2 tasks. Zhao made use of Reid's PLSPQ to test the English acquisition level of college students. Experiments show that students of higher vocational colleges under the Sino-foreign cooperative education model have different learning style preferences and students with different English levels are different in learning style.

Little research has been done on Chinese preschool children. Although some studies have investigated the bilingual education and cognitive style of preschool children (Wang, 2001), few have explored the relationship between the cognitive style and the L2 acquisition process of children. Through observing and studying 23 preschool children, Li and Ju probed into the correlations of cognitive style with their L2 learning and classroom performance. The results show that the cognitive style of preschool children has an impact on their performance in L2 class despite being not directly associated with their L2 test performance. Meanwhile, field-independent children tend to be better than field-dependent ones in L2 test performance.

Shi (2003) of Chung Yuan Christian University took 122 freshmen as research objects to examine the influence of different learning styles and methods on the learning outcomes of these students in an online learning environment and studied the interactive effects of learning methods on learning outcomes. It was discovered that learning styles and methods exert an influence on learning outcomes.

Different types of cognitive styles will have a certain impact on the learning effects of learners, which however should not be related to the intelligence of learners. Witkin's Field Cognitive Style Scale represents the measurement and classification of intelligence rather than cognitive style to some degree. In addition, it has been shown that field independence increases with age. Li and Che (2006) revised the verbal-imagery sub-scale in the cognitive style analysis (CSA) system, and analyzed and compared the differences in cognitive style between Chinese and British college students. The results show that Chinese college students prefer the verbal side in the verbal-imagery dimension and the analytic side in the wholist-analytic dimension. Bao et al. (2012) questioned the cognitive style of verbal-imagery division and further distinguished the imagery cognitive style model, thus advancing the research and development of the object-spatial imagery and verbal cognitive style model. Wu (2011) adopted the dividing standards of object-spatial imagery and verbal cognitive style to study and discuss the relationship among the spatial ability, cognitive style and mathematics learning effect of senior high school students. It was discovered that spatial imagery

learners have strong abilities in spatial orientation, rotation and visualization, and can achieve better results in mathematics tests. Additionally, male students with a strong tendency towards verbal learning are more likely to achieve better results in spatial orientation ability than female ones. The above analysis shows that different conclusions will be reached according to the classification of different cognitive styles. As a result, more scientific experiments are needed to support the influence of the dividing standards of cognitive style on the learning effects of different learners.

3.2.2. Related Research on Chinese as L2

Few domestic studies have focused on the learning style of Chinese as L2, most of which are based on questionnaires by foreign scholars, and modified and investigated according to the actual situation of teaching and students. Since the second half of the 1990s, especially after 2000, a growing number of researchers had begun to attach importance to the individual differences of students in the research of L2 teaching. Cognitive style, an important part of the individual differences of students, is extensively applied in the study of Chinese teaching. During this period, Wang, Xu & Wang et al. were rather influential in the independent research of cognitive style in the domain of Chinese teaching.

Wang (2006) included the paper *Research on Learners Learning Chinese as a Second Language and Cognitive Style* in the book *Research on Learners Learning Chinese as a Second Language and Cognitive Style*. The content involved research on the cognition of Chinese phonetics, characters and vocabulary, the individual differences of learners, etc.

Xu (2006) expressed his opinion in the article *Research on the Differences in the Learning Strategies of Chinese Learners with Different Cognitive Styles*. From his perspective, the significance of studying cognitive style is that “cognitive style varies from individual to individual. If learning about the cognitive characteristics of learning objects, teachers can formulate corresponding teaching plans and try to take teaching approaches matching the personality characteristics of learners. During group learning, teachers should properly take into account the personality of learners and mobilize their respective strengths to realize mutual complementarity and render the style of teaching and learning as harmonious as possible”. Wang (2009) believed that “cognitive style is a critical individual difference variable. Putting forward the strategy of TCFL based on the cognitive style theory through exploring the relationship between cognitive style and L2 acquisition is beneficial to optimizing the process of TCFL and improving the implementation quality of the TCF course.”

The research on the application of cognitive and learning styles in Chinese teaching greatly enriches the theory and practice of Chinese teaching and lays a good foundation for the further discussion of cognitive/learning styles in Chinese teaching in the future. Based on Reid’s PLSPQ, Yi and Yan (2009) carried out a study on the perceptual style of 325 foreign students from Central Asia. It was found that the Chinese learning style of Central Asian students presents the

following overall tendency: tactile > visual > group > individual > auditory, and an obvious tendency in tactile, visual and group types. Fang (2013) conducted a survey on 90 Thai learners from Thailand and Shanghai and discovered that auditory > tactile > kinesthetic > visual in terms of sensory learning style and group > individual in terms of social learning style. Zhao (2016) combined this with the actual situation of Chinese teaching in the Philippines and examined the learning style of 440 students in Philippine public secondary schools. The research showed that the learning style of students in Philippine public secondary schools presents the following tendency: group > visual > kinesthetic > auditory > tactile > individual and perceptual learning style shows no significant difference in age and gender. Ye (2017) conducted an investigation on 156 high school students in Italian high schools, and noticed that the learning style of Italian high school students shows the following tendency: kinesthetic > tactile > auditory > visual.

In addition, some scholars used the questionnaire designed by Oxford et al. as a measurement tool for research. Chen (2015) surveyed 85 overseas students from the United States and found that the visual learning style was preferred by the surveyed student most, followed by auditory and kinesthetic learning styles successively. Yang (2016) drew on the design thought of Wang (2014) based on this questionnaire and investigated 74 middle school students from Burma. Statistics show that the Chinese learning style of these middle school students presents the following tendency: visual > auditory > kinesthetic. Wei (2012) took the learning style questionnaire prepared by Xi'an Jiaotong University as the basis, referred to the questionnaires of Reid & Oxford, and investigated the learning style of 62 South Korean students in Shandong Province. The results show that South Korean students exhibit the following learning style tendency on the whole: auditory > kinesthetic > visual, and use auditory learning style as the main learning style. Li (2014) referred to the English learning style questionnaire compiled by Liu & Dai and the learning style questionnaires of Oxford & Reid. Moreover, the specific situation of Chinese teaching for Russian students in Shandong Province was combined to study the Chinese learning style of 150 Russian students. The conclusions drawn are as follows: Russian students show an obvious tendency towards tactile and visual learning styles; Russian students of different genders show significant differences in auditory and visual learning styles, while those of different ages show significant differences in cooperative and individual learning styles.

Studies on the correlation between learning style and academic performance have obtained abundant research results and conclusions. A large number of empirical studies have proved that a certain correlation exists between academic performance and learning style. Many scholars, including Wang and Xu (2005), Lu (2005), Yao, Yan and Liu (2011), Song and Wang (2012), Lu, Liu and Xia (2016), and Zhang (2019), etc., looked into different experimental objects. The results all show that learning style is significantly associated with academic performance.

4. Conclusion and Research Prospect

4.1. Results of Research on Learning Style

From the perspective of theoretical research, the development of learning style research in recent decades has received attention from multiple disciplines. Plenty of achievements have been attained in not only linguistics but also psychology. The vast majority of domestic and foreign studies on first language and L2 suggest that: How learners absorb, process and store new information and grasp new skills is natural and habitual, and will not change because of different teaching methods or learning contents. Concomitant vocabulary acquisition will be affected by learners' L2 level, vocabulary size and word-guessing ability, the number of occurrences of target words, reading tasks, tools, etc. Theories related to teaching and psychology have facilitated the deepening of learning style theories. Nevertheless, the results of research on learning style have not yet been applied to language teaching and acquisition as well as psychological research.

4.2. Future Research Prospects

The study of "learning style" has been developing for decades. Where will it go from here? Simply repeating the classification of learning style and merely investigating its influence factors have been unable to meet current research development. Increasing researchers feel that the learning style of learners plays an increasingly important role in both classroom language teaching and daily language acquisition. For this reason, future learning style research should focus on how to put learning style research into the context of language teaching and acquisition for examination and make a combination of learning style, deep language learning, language teaching and other aspects for discussion.

On the other hand, after investigation and research, we learned from consulting front-line Chinese teachers that, scores of different popular language learning methods are currently suitable for young L2 learners, like learning Chinese through singing Chinese songs, watching films, television dramas and variety shows, cooking Chinese food... In future practice, the following questions can be addressed: How about L2 acquisition through these listening, speaking and other channels? Are these channels appropriate for all L2 learners with different learning styles? How to match multi-channel L2 acquisition with learning style?

Apart from that, Chinese research still has room for further development despite some consensus reached by previous studies. For instance, overseas Chinese students remain the largest number among people learning Chinese around the world at present (Li, 2018). Is the learning style of Chinese learners different from that of European, American, Japanese and Korean learners? Prior research rarely touches upon this aspect. Therefore, it is necessary to conduct related research in more detail and more deeply in the future.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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