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Applying Encoding and Retrieval Techniques to Chinese Rhyme Reading in Advanced Placement Chinese Instruction

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Abstract

Learning Chinese as a foreign language is increasingly prevalent in public school districts in the U.S. As ACTFL (2011) reported, an increasing number of enrollments of Advanced Placement Chinese courses indicate a growing demand for Chinese language courses in U.S. public school districts (ACTFL, 2011; ACTFL, 2017). AP foreign language exams indicate that students from the mainstream culture in the U.S. do not perform as well as racial minority test takers (Brown & Thompson, 2016). Therefore, implementing appropriate teaching strategies in a student-centered foreign language environment is a desperate need. This is a pragmatic instructional design proposal, which emphasizes the importance of using encoding and retrieval strategies on Chinese rhyme reading in AP Chinese courses at the secondary level. The pragmatic proposal is established based on two primary concerns. First, with the calling for student-centered teaching strategies in primary education, it is necessary for instructors to understand how learners learn, and to apply appropriate strategies accordingly to instruct students' learning. Second, standardized tests are often criteria for evaluating students' learning; it is practical to conduct student-centered teaching, acknowledging an exam-driven educational environment. If the instructor can apply strategies from a cognitive psychology perspective, teachers can then focus on student-centered learning in an exam-driven educational environment. This proposal overviews an instructional design approach that relies on encoding and retrieval techniques to enhance rhyme reading instruction in a secondary AP Chinese class.

Key words: instructional design, encoding, retrieval, rhyme reading, student-centered, secondary, language teaching

Background

Results of Advanced Placement (AP) exams are regarded as indicators of successful college completion rates, and an increasing number of school districts offer AP courses in the U.S. (Dougherty, Mellor, & Jian, 2006). Acknowledging the emerging role of China in the global economy, Chinese language learning is increasingly in demand in U.S. public schools. According to the report of 2011 American Council of Teaching Foreign Languages (ACTFL) surveys, enrollment in Chinese language classes in U.S. public schools has nearly doubled between 2004 and 2008 (Taguchi, 2015). The College Board Advanced Placement Program, which is the administrative organization of AP programs in the U.S., states in *Chinese Language and Culture Course Description (Effective Fall 2015)* that the AP Chinese test aims to evaluate learners' understanding of Chinese society, and their ability to integrate language and culture customs into interpersonal communications.

However, AP foreign language evaluation in the U.S. encounters an inevitable problem, as Brown and Thompson (2016) point out. In their 36-year study of AP exam performance in the U.S., Brown and Thompson note that Caucasian students "lose their ground" to "racial minority test takers" in AP language exams (p. 235). At this point, it is necessary for foreign language instructors to ponder two questions: How do native English speakers mentally process foreign languages? And, what retention strategies can instructors apply to enhance adolescents' foreign language learning? To answer the two questions, this paper states what AP Chinese exam and AP Chinese rhyme reading are, and proposes the instructional design from two aspects. First, the intervention is based on cognitive process in human memory system: cognitive process, encoding and retrieval, and the cognitive process in Chinese reading comprehension. Second, the intervention relies on applying encoding and retrieval strategies to enhance students' Chinese rhyme reading abilities.

AP Chinese Exam

In the AP Chinese test, there were three modes: Interpersonal Mode, Interpretive Mode, and Presentation Mode. See Table 1 for an overview of these three modes.

Table 1

AP Chinese Test Modes （based on College Board, 2015)

Modes	Definition	Question Types
Interpersonal Mode	The Interpersonal mode contains autonomous two-way interaction, such as conversing face-to-face or exchanging written correspondence.	Discourses, listening and one free response speaking
Interpretive Mode	Interpretive Mode aims to let students interpret a wide range of literacy and spoken content.	Listening comprehensions and reading comprehensions such as news broadcasts, fragments of movies and television dramas.
Presentation Mode	Presentation mode aims to test Students' speaking and writing proficiency.	One spoken presentation and two writings e.g. creating level-appropriate speech/report, narrate personal experiences

Among the three modes, the Interpretive Mode is the most difficult section to non-native Chinese speakers because, besides identifying characters in the readings, it also integrates pragmatic usage of Chinese, such as culturally corrected syntax and vocabulary. Therefore, this part requires learners to understand Chinese customs and habits, including spoken announcements, news broadcasts, advertisements, written prose, folk rhyme, and micro-fiction. Thus, it is vital to teach Interpretive Mode strategically in a secondary level Chinese class. Among the readings, folk rhyme reading style is the most difficult, because folk rhyme is usually very short, and it is made up of independent subjective structures. The sample of Chinese folk rhyme reading will be discussed in the segment of *The Introduction of an AP Rhyme Reading Example.* The following discusses what cognitive process is and how it works in Chinese reading comprehension.

The Introduction of an AP Chinese Rhyme Reading Example

This section will introduce the idea of Folk Rhyme Reading, and the ideas to apply encoding methods to secondary AP Chinese instruction: 陕西八大怪 *Shaanxi Eight Big Odd Things*.

Instruction goals should be clear in exam-driven teaching. The aim of exam-driven teaching is to help learners independently answer exam questions correctly. Therefore, instructors need to design each class by clarifying what students can acquire, and what students need to know about test questions. Instructional strategies with encoding and retrieval theories can enhance the ability of learners to answer exam questions. In the Interpretive Mode section, the most difficult part is to comprehend pragmatic Chinese in folk rhyme reading, since the folk rhyme delivers information about a diverse culture with only a few words. Similar to colloquial English conversation, learners are required to understand the cultural context of the reading and adapt it to recognizing Chinese characters as well as their implicit meanings.

陕西八大怪

(Chinese pinyin: Shǎnxī bādà guài, Shaanxi Eight Big Odd Things)

面条像腰带，碗盆难分开，(Miàntiáo xiàng yāodài, wǎn pén nán fēnkāi)
手帕头上戴，唱戏吼起来，(shǒupà tóu shàng dài, chàngxì hǒu qǐlái)
辣子是道菜，大饼像锅盖，(làzǐ shì dào cài, dà bǐng xiàng guō gài)
房子半边盖，吃饭不坐蹲着来。(fángzi bànbiān gài, chīfàn bù zuò dūnzhe lái)

Its English meaning is:
Noodles (are) like belts, bowls (are) difficult to separate,
Handkerchief (is) worn (on) head, singing opera (sounds like) roar(ing) up,
Spicy pepper is a dish, pancake (is) like a lid,
House (is) half covered, (people) do not sit (but) squat to eat.

To enhance adolescent learners' comprehension of the Chinese folk rhyme reading, instructors must be well prepared to develop encoding strategies. First of all, the instructor needs to work from reading questions to decide what encoding strategies can be applied accordingly. There are five questions related to this folk rhyme (Xu, 2009). The original questions are in italics and the suggested encoding strategies are in the parentheses. The categories of encoding methods are bolded in the following questions before making the design:

1. *"What is the rhyme about?"* (Xu, 2009, p. 88) (**Understanding the title- Elaborative encoding**)

As mentioned previously, elaborative encoding establishes the connection between prior knowledge and knowledge to- be-remembered. The instructor reads the title with pauses between words to help learners connect their prior knowledge with the title, "Shǎnxī /bādà/ guài". In this

way, learners can retrieve the meaning by linking up Shaanxi (a province in China) Eight (number) Big (size) Odd Things.

2. *"According to the rhyme, which statement is true about the noodles in the Shaanxi region?"* (Xu, 2009, p. 88) (**Able to tell the hidden verb in the first independent subjective structure-Elaborative encoding**)
3. From the English interpretation, "Noodles (are) like belts, bowls (are) difficult to separate", we can clearly see the difference between Chinese rhyme and its English meaning; the verbs are the key to comprehending the rhyme. Therefore, learners are required to mentally insert the hidden verbs. This skill asks for learners' prior knowledge of Chinese syntax connecting with the ability to interpret rhyme.
4. *"Which of the following is most likely to be true about the local opera?"* (Xu, 2009, p. 88) (**The differences from other Chinese opera-Acoustic encoding & Elaborative encoding)**

The answer is located in the second line, "singing opera (sounds like) roar(ing) up". Compared to the Beijing Opera and the Shanghai Opera (also called Yue Opera), which learners have explored at the novice level in Chinese classes, the notable characteristic of Shaanxi Opera is "roaring". Instructor can play an audio recording of Shaanxi Opera and compare it to Beijing Opera and Shanghai Opera to enhance student understanding of the Shaanxi Opera.

5. *"What is special about the dining customs?"* (Xu, 2009, p. 89) **(Last independent subjective structure-Visual encoding)**

The answer is in the last line of the rhyme, "吃饭不坐蹲着来, chīfàn bù zuò dūnzhe lái", which means "(people) do not sit (but) squat to eat". Visual encoding means learners encode the image and convert the information to store it to their mental pictures. Even though students need to use elaborate encoding methods to connect their prior knowledge of various local cultures in China, an imagery encoding method can also facilitate the understanding of the custom. Therefore, the instructor can present an image of the eight big odd things to enhance the information.

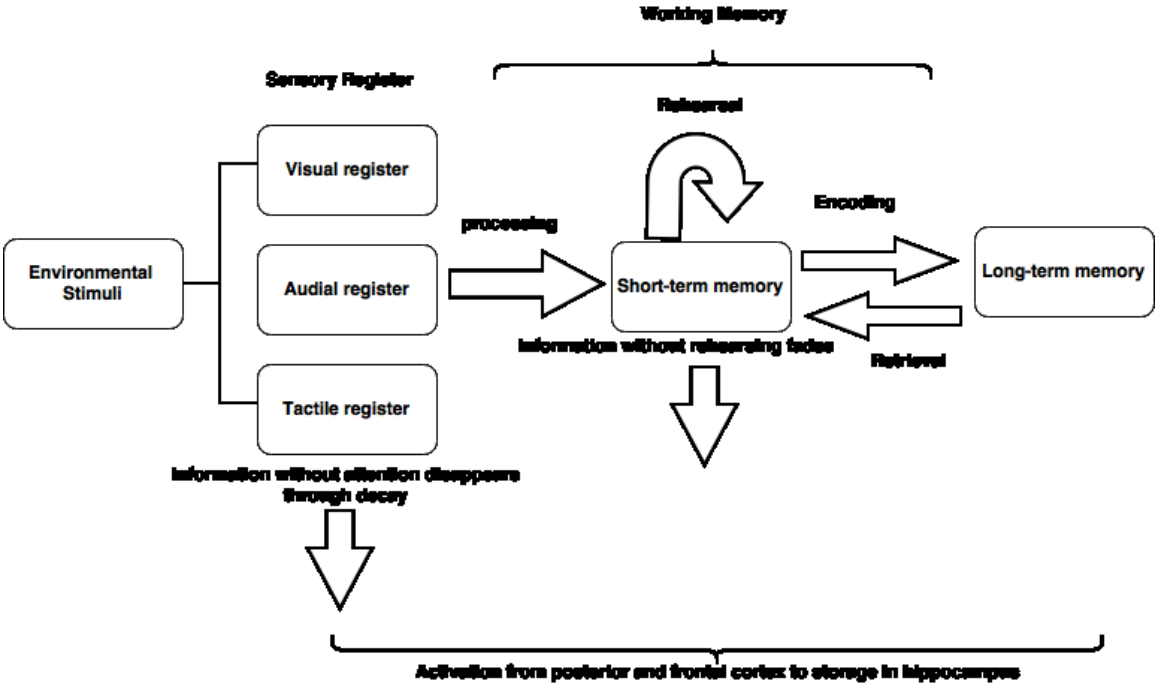
6. *"What is an unusual accessory that local people wear on their heads*?" (Xu, 2009, p. 89) **(Third independent subjective structure-Visual encoding)**

This question is related to Line 2 "手帕头上戴, shǒupà tóu shàng dài" (Handkerchief (is) worn (on) head). An image of the custom can enhance learners to encode the rhyme through visual encoding.

Cognitive Process in Human Memory System

Figure 1

Cognitive Processing Chart



Note: Figure is based on information contained in Bach-y-Rita and Kercel (2003), Baddeley (2003), Bruning, Schraw and Norby (2011), Driver and Noesselt (2008), and Scott (2017)

The cognitive process in human memory systems consists of sensory register, short-term memory storage and long-term memory storage (Atkinson & Shiffrin, 1968). As Figure 1 (modified based on Bach-y-Rita & Kercel, 2003; Baddeley, 2003; Bruning, Schraw, & Norby, 2011; Driver & Noesselt, 2008; Scott, 2017) presents, in the cognitive process, the action of coding information happens from the sensory register and short-term memory to long-term memory. The sensory register receives information from the senses, such as visual sensory register, audial sensory register (Bach-y-Rita & Kercel, 2003; Driver & Noesselt, 2008) and tactile sensory register (Bruning et al., 2011; Watanabe & Iwai, 1991). Information that is paid attention to is processed in the working memory, and some information is forgotten over time (Bruning et al., 2011). In short-term memory storage, information is divided into two types: rehearsed information—which is retained—and unrehearsed information—which disappears. Rehearsed information is stored in long-term memory storage for further retrieval. The working memory is stored in the posterior and frontal cortexes, and long-term memory storage and retrieval are active in the hippocampus (see Figure 1). Scott (2017) found that encoding from long-term memory "produced activities in the hippocampus" but no working memory encoding

activities were detected in the hippocampus (Scott, 2017, p. 116). Thus, there are two types of encoding: encoding in working memory and long-term memory encoding.

In the human brain, the later sensory cortical regions are regarded as the starting point of working memory (Scott, 2017). The working memory (Baddeley & Hitch, 1974) contains short-term information storage, as well as encoding the information needed for a broad range of sophisticated cognitive activities (Baddeley, 2003). Scott (2017) shows that "within working memory's delay period are activities in different regions of the dorsolateral prefrontal cortex" (p. 109); these activities control logical thinking components, such as reasoning, language comprehension and learning (Baddeley et al., 1974). To comprehend information (e.g. written texts and aural information), working memory involves a process of encoding and short-term memory storage. Encoding is the process of converting information according to related events (Friedman & Johnson, 2000), which have a keen demand on human attention (Craik, Govoni, Naveh-Benjamin & Anderson, 1996). By encoding into meaningful parts, short-term memory storage can be increased (Sauseng et al., 2009). When processing information, the brain exploits various components to help encode the information and categorize the information into long-term memory. Magnetic resonance imaging (fMRI) data indicates that long-term memory, such as episodic memory and item memory, is active in the hippocampus (Scott, 2017; Wright, Renoir, Gray, & Hannan, 2017). Mergel (1998) showed that long-term memory has an unrestricted capacity. Mergel (1998) states that deeper levels of cognitive process generate linkages between old and new information, which eases successful retrievals. Retrieval requires cognitive or inhibitory control to select correlated items from memory (Healey, Ngo, & Hasher, 2014), and retrieval is an automatic reaction in long-term memory storage, which is not influenced by external disturbances (Weeks & Hasher, 2016). The next section describes encoding and retrieval, and explains the relationship between encoding and retrieval, and learning the Chinese language.

Encoding and Retrieval

Long-term information storage happens in the hippocampus, which is located in the middle area of the brain. Long-term memory encoding blocks and recall blocks are located in the hippocampus (Zeineh, Engel, Thompson, & Bookheimer, 2003). As Zeineh et al. (2003) point out, encoding blocks use various methods of maintenance rehearsal, imagery, elaborative encoding, semantic encoding, and metacognition (Bruning, et al., 2011, Table 2). Encoding in working memory works on sending a combination of information and its encoding components to memory.

Table 2

Encoding Methods in Memory (Bruning, et al., 2011)

Encoding Methods	Definitions	Examples
Maintenance rehearsal		Students repeatedly speak or think about a piece of information during learning.
Imagery	Including visual encoding and acoustic encoding.	When people looking at a two-dimensional form picture, for example, to memorize the picture of a saxophone performer or a woman, people can encode the image and convert the information to store it into mental pictures.
Elaborative encoding (Lockkhart, 2002)	Establishing the connection between prior knowledge and knowledge to- be-remembered.	
Semantic encoding	Including chunks and mnemonics	Non-native Chinese learners use English letters or words to encode Chinese pronunciation. For instance, 手臂, which means arm in English, in Chinese pinyin, it is Shǒubì, and marked as "show bee" in the text book, *Our Chinese Classroom Primary 1* (Xu, 2011, p.20)
Metacognition	It is a strategy of "thinking about thinking" (Brown, 1980)	A learner writes a reflection to retrieve what s/he has learned and how the learning processed in his/her mind.

The encoding components work as subsequent retrieval cues to help recall blocks in the hippocampus (Zeineh et al., 2003) to retrieve the information. The optimal encoding methods include maintenance rehearsal, imagery, elaborative encoding, semantic encoding, and metacognition (Bruning, et al., 2011). Once the brain detects the encoded information, it

enhances the long-term memory of the information. Encoding specificity is strongly linked to retrieval (Bruning et al., 2011), because people recall information by recalling the cues of the encoding components from encoding methods. When needing the information, the brain subsequently activates re-access of the information in encoding blocks, and sends it to recall blocks, to retain the information. The following part is a brief description of the relationship between cognitive neuroscience and Chinese reading comprehension.

Cognitive Process and Chinese Reading Comprehension

Chinese written text consists of two dominant elements: characters and pinyin (alphabet). Chen (1996) discovered that semantic processing of Chinese reading involves unique cognitive processing of characters and phonological awareness. Unlike comprehending English or other alphabet languages, when people read Chinese characters and pinyin, more areas of the cerebral cortex are involved (Fu et al., 2002). When processing Mandarin, non-native Chinese speakers have "the left and right frontal lobes" active (Tham et al., 2005, p. 579). When people read Chinese, analyzing precise-, vague- meaning characters, and two-character words, the neural system produces extensive activity in the left frontal cortex, and the left frontal cortex is active when conducting semantic retrieval (Tan et al., 2000). Thus, because of the informational challenges to the cerebral cortex, non-native Chinese speakers are more likely to feel mental exhaustion when reading and comprehending Chinese

Some researchers find comprehension is a little different in Chinese rhyme readings. Li et al. (2014) detected that when comprehending Chinese rhyme readings, the right middle frontal gyrus in the cortex is more active. The right middle frontal gyrus, as Japee et al. (2015) explain, influences the control of reorienting attention from external factors. Therefore, comprehending Chinese rhyme reading is assumed to prevent non-native Chinese speakers from exoteric distractions. Rajah et al. (2011) state that middle frontal gyrus impacts retrieval activity and performance, and people can enhance retrieval by modifying activities in the brain. When encountering frequent Chinese characters, people repeat "a process of retrieving, formulating, and coordinating the phonological output" (Kuo et al., 2003, p. 720). Therefore, it is also assumed that strategically encoding reinforces adolescent non-native Chinese speakers to retrieve Chinese folk rhyme readings.

Xiang Lam (2016) proposed that the use of the imagery strategy as a semantic ability predicted better performances for adolescent language learners. Inhoof and Liu (1998) discovered that there were extensive similarities between coding morphological Chinese characters and alphabetic English texts. Zhang and Li (2016) also found that higher proficiency second language learners had a higher awareness of morphological Chinese characters. They comprehend Chinese readings more dependent on characters, and intermediate learners tended to

rely on orthographic information of a new character. With the overlap of Chinese character recognition and alphabet English awareness, elaborative encoding method was recommended in the following instructional design. Additionally, based on the previous studies of cognitive process in Chinese reading comprehension, other encoding methods suggested in the AP rhyme reading instruction are imaginary (e.g. visual encoding) and phonologic awareness (e.g. acoustic encoding).

An Instructional Design of Teaching the AP Level Rhyme Reading

The instruction design of teaching rhyme reading in an AP Chinese class is composed of seven procedures (Figure 2):

- The teacher categorizes possible encoding strategies according to the reading questions,
- The teacher plays audial text to enhance non-native Chinese speakers' sense of rhyme,
- The teacher uses imagines to assist students encode a gist of rhyme,
- The teacher has students create their connection between Chinese characters and English by cooperatively working in Google docs,
- The teacher creates flashcard activities of novel characters,
- The teacher has students using metacognitive writing to retrieve the reading, and
- The teacher has students working on the questions in the reading comprehension.

The details of each procedure are stated in the following part.

This Chinese folk rhyme reading can be divided into eight chunks based on the eight independent subjective structures. The instructor presents one picture of the eight kinds of customs as a general idea of each chunk, to help learners with semantic encoding of the rhyme. Moreover, as Tan et al. (2000) proves that when non-native Chinese speaker analyze Chinese, their left frontal cortex is active. In the auditory word-pair experiment, Petersson, Reis, Castro-Caldas, and Ingvar (1999) found that left frontal cortex is active when it conducted effective encoding and recall. Therefore, the instructor needs to apply the auditory encoding and the elaborative encoding into the comprehending part of this rhyme strategically. To help learners establish a sense of this rhyme reading, the instructor will first play an audio recording of the rhyme.

When learners are engaged into the rhyme of the vowel sound, "ài", it connects their previous knowledge of Chinese characters with the vowel "ài", such as 带(dài, belt/bring), 戴(dài, wear), 菜(cài, dish) and 盖(gài, lid/build). Therefore, a pictorial text can also help learners incorporate the understanding of this rhyme with their previous knowledge. This strategy will also help them produce "cues" to retrieve information in the future.

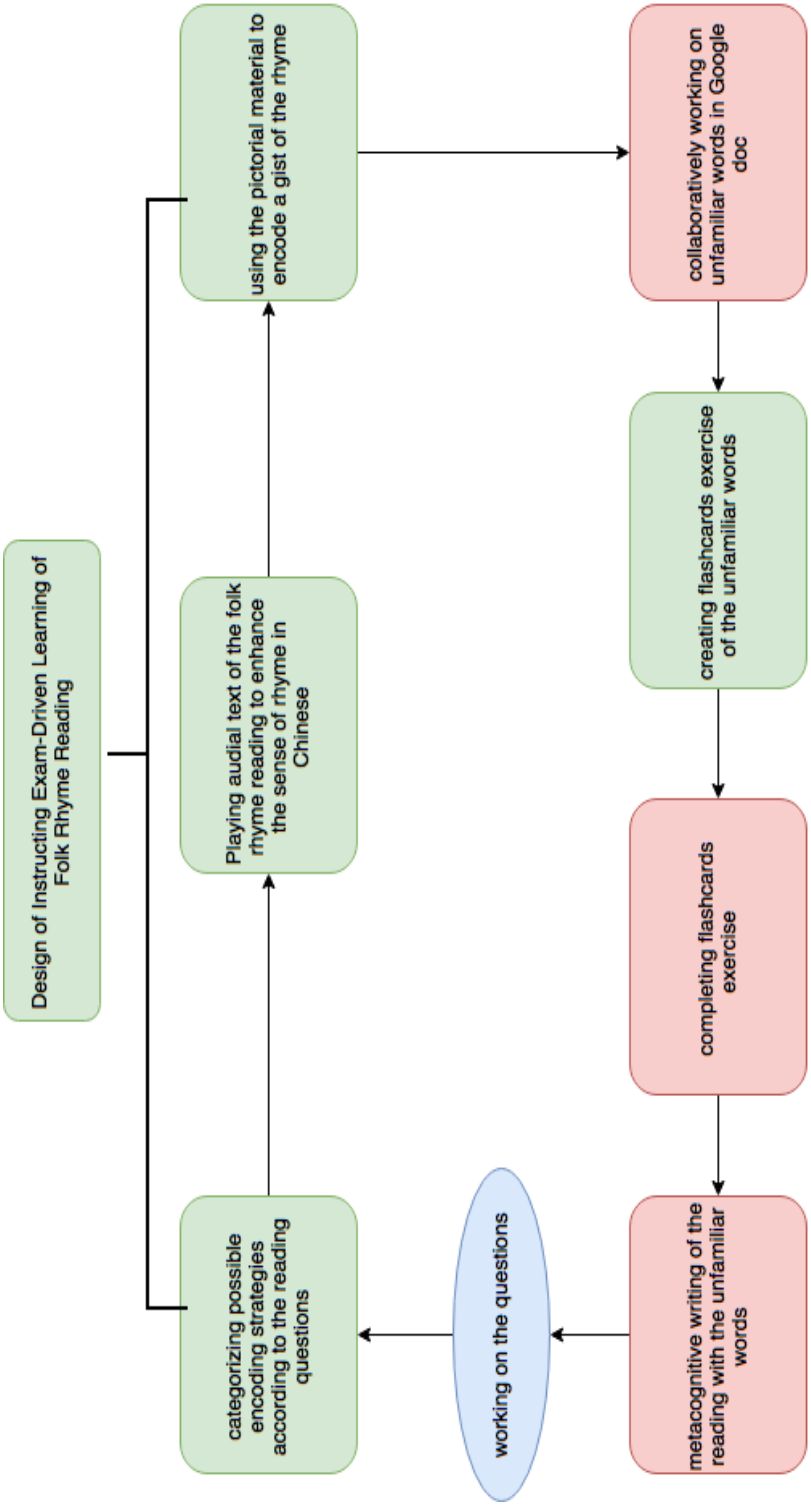


Figure 2

Flowchart of the design (red-students, green-instructor, blue-student and instructor)

After reading and comprehending the rhyme with the auditory encoding and elaborative encoding strategies, learners can work on unfamiliar words by collaboratively working on a Google doc file as a maintenance exercise (Figure 3).

Figure 3

A Google doc File of unfamiliar words from "Eight Odd Things" by students

To enhance the vocabulary memory, the instructor will create a set of recognition tests as low-stakes tests for learners to rehearse the words again. Flash cards are an example of this type of low-stakes test (Figure 4). As Larsen, Butler and Roediger (2008) point out, low-stake tests help learners improve learning by improving information retention. Users can rehearse the words by using the functions of "learn", "speller", "test", and play "scatter" and "gravity".

Figure 4

Flash card Activity on Quizlet

After giving students an exam from the test bank, the instructor will give them a higher stakes assessment, such as a reflective writing exercise. Learners will use the words they accumulated to do a 200-word reflection writing about the rhyme. As Larsen, Butler and Roediger (2008) advocate, promotion tests that ask students to apply knowledge rather than simply recall information help students better establish higher-order retention. Reflective writing is metacognition; thinking about thinking. Learners use reflective writing to recall how they previously processed their learning.

For higher-proficiency Chinese language learners, they will be able to read the questions once they have completed the above-listed activities. At this point, learners will have various encoding strategies, which they can apply. Learners will not only give correct answers, but they

will also discover enhanced learning abilities for other styles of reading; metacognitive writing (promotion test) will also facilitate their writing ability.

Conclusion

Students in an AP language class aim to achieve higher scores in AP exams. It is important for instructors of AP language courses to understand how non-native speakers process comprehension of target languages. Based on student encoding and retrieval characteristics, instructional design should proceed from the exam questions. By categorizing encoding strategies accordingly, instructors can have a clear pathway to applying encoding strategies with multimedia assistance. For advanced learners, reflective writing using an unfamiliar vocabulary is a recommended metacognitive method to enhance retention of advanced language learning. This design aims to focus student-centered advanced foreign language classes through applying appropriate encoding and retrieval strategies. The design can also be implemented into instructions of other exam-driven instructonal designs. For further study of how encoding and retrieval work in secondary instruction, more experimental research is needed to test the efficiency of this kind of design.

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