The Effects of Explicit Semantic Radical Instruction on Beginner Level CFL Reading Comprehension

Long He

(lhe@iastate.edu)
Iowa State University, USA

Abstract

The present study examined the effects of explicit semantic radical instruction on beginner level Chinese foreign language learners' overall comprehension by descriptively translating a given Chinese text. The study also investigated how the participants would perceive the effects of instruction of semantic radicals and how their motivation level in learning Chinese would change because of the explicit instruction on Chinese semantic radicals. The participants were asked to translate the same Chinese text before and after receiving explicit instruction of ten semantic radicals. The results demonstrated that the explicit instruction on Chinese semantic radicals helped participants significantly enhance their descriptive translation (indicating improved overall comprehension) of a given Chinese text. Overall, the participants recognized the facilitative role of semantic radicals in learning Chinese, and their intention to continue learning semantic radicals suggests their willingness to improve their Chinese proficiency.

1 Introduction

Reading in a foreign language is more challenging than reading in one's native language, especially when they are not of the same language family. Unlike English, written Chinese, a non-alphabetic language, is represented by characters, which are typically written with strokes in square-shaped symbols instead of letters in linear forms. For instance, in the character 木, which means tree, there are four strokes. In terms of pronunciation, each character contains only one syllable. However, different from alphabetic systems, graphemes in Chinese do not map onto individual phonemes (Mattingly, 1992). Pinyin, the Chinese national standard alphabetic system, is used to teach children the pronunciation of Chinese characters but does not appear in daily reading texts (Liu, Wang, & Perfetti, 2007). In terms of meaning, each character represents a free morpheme or a combination of morphemes.

As to the structural complexity, Chinese characters are composed of radicals and can be categorized as simple and compound characters (Kim, 2010). Shen (2010) defined Chinese radicals as the smallest meaningful orthographic units in Chinese characters. There are about 200 semantic and 800 phonetic radicals (Hoosain, 1991). The former gives a cue to the general meaning of a compound character and the latter cues the pronunciation of the character. Radicals that are characters by themselves are simple characters, while a compound character contains more than one radical. Over 90% of Chinese characters are compound characters (D. Li, 1993, cited by Chen, Wang, & Cai, 2010, p. 141).

According to Hanley (2005), compound characters can be further divided into two types: sematic compounds and semantic-phonetic compounds. A semantic compound has two or more semantic radicals, and the meaning of the compound is derived from both radicals. For instance, the character 明 （bright) consists of 日 (sun) and 月 (moon). The derived meaning is bright, because it is the light released by both the sun and the moon. On the other hand, a semantic-phonetic character contains a semantic radical and a phonetic radical. For about 75% of the semantic-phonetic characters, the former is located on the left side and the latter on the right side (Feldman & Siok, 1999; Hanley, 2005). For instance, the left side of the character 清 (clear), 氵 (water), is a semantic radical. It suggests that 清 is related to water. The right side of that character, 青 (qīng), serves as a phonetic radical for 清 (qīng). It is noteworthy that when tone is not considered, the proportion of semantic-phonetic characters having the same pronunciation as their phonetic radicals is about 40% (Shu, Chen, Anderson, Wu, & Xuan, 2003). The predictive accuracy of sematic radicals for the meanings of semantic-phonetic characters is estimated to be much higher than the accuracy of using phonetic radicals to cue the pronunciations.

A Chinese word can be a character or a combination of several characters to render the meaning of a single word in English. In a Chinese text, words are arranged in a grammatically appropriate way and there are no boundaries between words.

It is obvious that the intrinsic differences between Chinese and English pose enormous barriers for readers of CFL. However, the heterogeneous structure of Chinese characters can also be turned into an advantage.

Considering the meaning-cueing function of semantic radicals, many researchers found a positive correlation between semantic radical knowledge and character recognition, resulting in the teaching of semantic radicals just as a means to remember characters in some classrooms. However, there is minimal empirical research conducted to examine whether the explicit instruction of Chinese semantic radicals can assist readers of CFL to better understand the meaning of a given Chinese text.

Before they are equipped with a sufficient amount of characters and words, the CFL learners are intimidated by the idea of reading in Chinese and are hesitant to take the first step. Without understanding the meaning of the text, reading can be frustrating (Zygouris, 2009). If semantic radical knowledge can directly facilitate reading comprehension in Chinese, the beginner level CFL learners, after learning the semantic radicals, can be exposed to and learn from the Chinese reading texts, elevating their overall Chinese language proficiency. This, in turn, will increase CFL learners' willingness to read in the L2 for various purposes (Grabe, 2014). In other words, students who are reading well will read more, learn more word meanings, and read even better (Stanovich, 1986). Hence, it is imperative to investigate possible effective teaching strategies, such as the instruction of semantic radicals, to improve reading comprehension of beginner level CFL learners.

The present study aims to investigate whether adding a third dimension, explicit semantic radical instruction, to CFL teaching, would improve beginner level Chinese L2 reading comprehension performance. The purpose of this study is threefold. The first is to explore the effects of explicit semantic radical instruction on beginner level Chinese L2 reading comprehension. The second is to solicit CFL learners' opinions of the effects of semantic radicals in reading comprehension. The third is to examine how the teaching of semantic radicals will change CFL learners' motivation level in learning Chinese.

1.1 Research questions

1. Will explicit teaching of semantic radicals significantly improve beginner level CFL readers' descriptive translation (indicating improved overall comprehension) of a given Chinese text?

2. How do CFL learners perceive the effects of instruction of semantic radicals on their ability to translate text, thereby improving their reading comprehension?

3. How will explicit instruction on Chinese semantic radicals change CFL learners' motivation level in learning Chinese?

2 Review of the literature

2.1 *The role of semantic radicals in Chinese reading comprehension*

Few studies have addressed the question whether the knowledge of semantic radicals could lead to increased level of reading comprehension of Chinese texts in CFL. However, the following three studies shed light on how the knowledge of semantic radicals influenced the reading comprehension of native Chinese speakers.

Ho, Ng and Ng (2003) designed a study to examine Chinese children's development of semantic radical knowledge and the relationship between children's semantic radical knowledge and their reading development. The study included 60 Chinese children, of whom 20 were first graders, 20 were third graders, and 20 were fifth graders. The experimenters measured the children's knowledge of positional and functional regularities of semantic radicals through various tasks. Then the students at each grade received a Chinese sentence comprehension test with appropriate difficulty according to their grade levels. Containing 30 incomplete sentences, the test required children to choose the most appropriate character from four alternatives to complete the sentences. Half of the correct characters had transparent semantic radicals, and the rest had opaque semantic radicals that were not able to cue meaning of characters. The experimenters found that children's knowledge of semantic radicals improved with their grade levels, and fifth graders did significantly better with sentences needing characters containing transparent semantic radicals. The results of the sentence comprehension test suggested that fifth graders utilized the semantic radicals for meaning cues when processing sentences.

Based on the assumption that children would attempt to understand a Chinese text by taking advantage of the meaning-cueing function of semantic radicals, Cheung, Chan and Chong (2007) studied whether having knowledge of semantic radicals could predict Chinese children's reading comprehension. In the study, the participants' knowledge of functional regularities of semantic radicals was tested by a novel object-labeling task. Then, the participants were asked to read four Chinese texts, each of which was followed by four multiple-choice questions to assess the children's understanding of the comprehension passage. The results showed a correlation between children's semantic knowledge and their passage comprehension performance. The study has confirmed the assumption that the meaning-cueing function of semantic radicals plays a role in interpreting the meaning of Chinese texts.

Zhang and colleagues (2012) carried out a one-year longitudinal study to investigate the associations of vocabulary knowledge, character knowledge, and semantic radical awareness to reading comprehension of Chinese children (7 and 8 years old) at the sentence level. The findings of the study highlighted the importance of semantic radical awareness in Chinese reading comprehension at the sentence level. It was also pointed out that a higher level of semantic radical awareness enabled children to guess the meaning of novel characters and relate background knowledge and context to the current information. Thus, developing children's semantic radical awareness could give them a distinct advantage when it comes to Chinese reading comprehension.

The three studies mentioned above displayed that the knowledge of semantic radicals could be important for native speakers to comprehend Chinese texts. The results of the three studies implied the necessity to teach children semantic radicals explicitly so as to improve their character decoding skills and reading comprehension. However, the role of semantic radicals in Chinese reading comprehension of CFL learners has not been thoroughly investigated. Based on these findings, the current study hypothesized that there would be positive effect of semantic radical knowledge on CFL learners' Chinese reading comprehension.

2.2   The explicit instruction of semantic radicals

Based on the growing evidence that radicals are important to both native and non-native readers in recognizing Chinese characters (Shen & Ke, 2007; Shu & Anderson, 1997), some studies were devoted to examining the effect of explicit instruction of radicals on Chinese learning.

Wang, Liu and Perfetti (2004) carried out a study to investigate the effect of explicit instruction of semantic radicals on CFL learners' meaning inference capabilities of Chinese characters. Before the study, the students were not explicitly taught the visual-orthographic structure of characters, or knowledge of radicals. After the participants received explicit instruction of the function of the semantic radicals and were explained the relation between semantic radicals and the characters that were known to them, they performed significantly better in visual identification and making appropriate meaning inference of novel characters. In addition, they did better with characters containing high-frequency semantic radicals than characters containing low-frequency semantic radicals. The results indicated that the explicit teaching of semantic radicals, even for only a short period of time, could contribute to the CFL learners' ability to make appropriate meaning inference of novel characters, thereby facilitating CFL learning.

Liu and Fang (2014) investigated the short-term effectiveness of teaching beginner-level CFL learners declarative knowledge of Chinese radicals and compound characters. In the intervention group, the students were taught the skill to analyze the structure and components of unknown characters and how to exploit the meaning clues of semantic radicals. The results of the study did not show a significant difference in the memory retention test between the intervention group and control group. However, the ability of students in the intervention group to correctly decode the meaning of unknown characters was significantly stronger than that of students in the control group.

The results of this section support the facilitative role of explicit teaching of semantic radicals in learning Chinese, thus providing rationale for the treatment in this study. Moreover, previous studies have lent inspiration to the way in which explicit instruction of semantic radicals should be carried out in this study.

2.3   Language competence and motivation in L2

Voluminous research findings have suggested that motivation was the primary impetus and determining factor to achieve success and sustain the learning of a foreign language (Dörnyei, 1998; Nicholson, 2013). Self-determination theory (SDT), introduced by Ryan and Deci (2000), has been one of the most influential mainstream psychological paradigms of motivation, and it has been incorporated into L2 motivation research. SDT postulated that self-motivation and mental health could be enhanced when three innate psychological needs, namely competence, autonomy, and relatedness, are satisfied. Competence refers to learners' feelings of content mastery. Autonomy refers to choice and opportunities for self-direction. Relatedness means the feeling of being accepted by and receiving relational support from others. Supporting the three innate psychological needs could promote intrinsic motivation. According to Kohn (1993), intrinsically motivated students are more likely to be life-long learners.

Linguistic self-confidence, learners' perception or judgment about their own competence and ability to accomplish tasks successfully, plays an important role in motivating students to learn a foreign language, because it affects the amount of effort they are willing to devote to language learning (Dörnyei, 2005). After surveying the motivational strategies used by 387 Taiwanese teachers of English, Cheng and Dörnyei (2007) agreed that satisfying students' needs for achievement and fostering their self-confidence had positive influence on academic motivation and performance.

Having examined predominant motivational theories in foreign language learning and identified certain key factors that motivate students to put more effort in learning a foreign language,

Nicholson (2013) proposed that bolstering learners' competence, confidence, and autonomy could boost levels of motivation in students. Providing tasks that ensure students regularly experience a sense of achievement to increase learners' confidence would be a case in point.

Based on the motivational theories and empirical studies, it is reasonable to believe that promoting learners' competence, self-confidence, and autonomy can greatly improve their intrinsic motivation. To stimulate students to direct their efforts into language learning and sustain sufficient levels of devotion, language teachers should endeavor to make sure those psychological needs are met.

3   Methodology

3.1   Research design

Both quantitative and qualitative data are critical for answering the research questions of this study. Johnson and Turner (2003) argued that mixed-method research combines the strengths of quantitative and qualitative methods, and provides insights not possible when data are collected using only one method. Therefore, a mixed-method approach was deemed most appropriate for this study. The quantitative part aimed to evaluate the performance of CFL learners in translating the Chinese text, thereby assessing their overall reading comprehension. The qualitative part was employed to triangulate the quantitative data and reveal more detailed information about the results, learners' perceptions towards the effects of instruction of semantic radicals, and the change of motivation level in learning Chinese.

3.2   Participants

There were 1 male and 4 female participants (age range=19-21; mean age=20.3) in the study, all of whom were attending the second year Chinese language program at a Liberal Arts college in the Midwest. All the participants have English as their first language and Chinese as their second language. All 5 participants had taken and passed the first year Chinese courses at the same college. Because Chinese was not used outside the classroom, the two courses were the major sources of exposure to the Chinese language. After examining the textbook and interviewing instructors and students, it was certain that none of the participants had received explicit instruction on Chinese semantic radicals.

3.3   Instruments

Two instruments were used in this study to collect data: A Chinese-to-English translation task (see Appendix A) and a questionnaire containing open-ended questions.

Chinese-to-English Translation Task: The purpose of the translation task, conducted both before and after the explicit instruction of ten Chinese semantic radicals, was to find out whether the intervention would influence the participants' performances in translating the Chinese paragraph into English. To evaluate the participants' performance change more accurately, the same Chinese paragraph was used in the translation tasks before and after the intervention. In order to align the translation task with the investigative purpose of this study, the researcher developed the Chinese paragraph. There were 186 Chinese characters in the paragraph. The participants should be familiar with over 90 percent of the characters, because they had encountered them and had been tested on those characters in their first-year Chinese language classes.

Within the Chinese text, ten Chinese semantic radicals were embedded in twelve characters that had never appeared in the Chinese textbook used by the participants (see Appendix B). All ten semantic radicals selected were unknown to the participants and could provide transparent meaning cues for the whole characters. In addition to the twelve characters, there were nine extra new characters (see Appendix B) in the text that they had never seen before this study. The purpose of

this was to evaluate the effects of explicit instruction of semantic radicals on the students' ability to utilize context to improve their comprehension of those extra new characters.

Simplified Chinese characters were used in the Chinese paragraph since the participants were taught with simplified characters. Another native Chinese speaker, an instructor of Chinese from the same college with the researcher, was invited to proofread the Chinese paragraph and she rated the text as authentic and confirmed that the target semantic radicals provided transparent cues for the twelve whole characters.

Questionnaire: The purpose of the questionnaire was to triangulate the quantitative data, solicit the participants' perceptions toward the explicit instruction of semantic radicals, and find out the change in their motivation level in terms of learning Chinese. There were six open-ended questions that fell into the following four categories of information.

Category 1: Impact of semantic radical knowledge on the posttest: Question 1: Did you use your semantic radical knowledge in comprehending the Chinese text in the posttest (second translation task)? Question 2: In what ways do you think your semantic radical knowledge influenced your comprehension of the Chinese text in the posttest? Please give some examples if you could still remember.

Category 2: Useful elements of explicit instruction on semantic radicals: Question 3: Which part (meaning, sound, shape, etymology, etc.) of the explicit instruction of semantic radicals do you think is the most useful in your comprehension of the Chinese text in the posttest?

Category 3: Further learning and utilization of semantic radical knowledge: Question 4: In terms of CFL learning, how would you further utilize your semantic radical knowledge? Question 5: Do you want to learn more about Chinese semantic radicals? Why?

Category 4: Change of motivational level in learning Chinese: Question 6: Has your motivation level in learning Chinese changed after the posttest? (or do you find out that learning Chinese is actually not that difficult?) Why has it changed?

A questionnaire was used to collect qualitative data because the participants might feel less uncomfortable filling out the questionnaire than attending an interview.

3.4 Procedure

The experimental procedure consisted of four steps, namely, pre-test, intervention, and posttest. The four steps were carried out in a 65-minute Oral Chinese class session. The reason to complete the experiment in a single session was to eliminate the effects from outside sources of variability and thus accurately reflect the impact of the intervention.

At the beginning of the session, the participants were given the abovementioned Chinese text and were asked to translate the Chinese text into English. They were asked to hand in the Chinese text and translation before the intervention. For step two, the participants received explicit instruction of the ten semantic radicals (see Appendix B). The method used in this study was in accordance with the instructional method used by Shen (2010) to analyze radical knowledge development among beginning CFL learners. In her study, Shen (2010) found that the following instructional methods were considered effective by the students: a combination of aural, oral, and visual repetition and review; explaining the etymology of the radical along with its origin and its historical development; relating radicals to character learning; taking quizzes and tests on radical knowledge; and using games and activities in learning radicals. In this study, the researcher first explained the meaning, writing, etymology, and meaning cuing function of each target semantic radical. Then, the researcher presented sample characters containing those radicals and explained the relationship between each semantic radical and the meaning of its corresponding character. After that, ten extra sample characters containing those semantic radicals were introduced and the participants were asked to infer the meaning of each character with the help of those meaning-cuing radicals. The students were also made aware that semantic radicals could only help infer the meanings and not convey the exact meaning of characters.

In the post-test, the participants were given the same Chinese text as the one in the pre-test to translate into English. They followed the same instructions. After the post-test, each participant handed in the Chinese text and the translation. After the participants handed in the texts and translations, they were asked to fill out the questionnaire.

3.5 Data analysis

This study adopted the Johnson (1970) system to quantify the participants' translation performance in both pre-test and post-test. Following the Johnson system, the researcher and the Chinese instructor who helped evaluate the authenticity of the Chinese text demarcated the text into pausal units based on normally paced oral reading. For example, the first sentence, 王明的家很贫穷, which means *Wangming's family was very poor*, was divided into 王明的家 and 很贫穷 based on paced oral reading. The researcher and the Chinese instructor discussed to resolve any disagreement regarding the division of the text into pausal units. The reading passage was divided into 29 units.

The researcher and the Chinese instructor scored each participant's translation in the pre-test and post-test based on how many correctly translated pausal units were present. The presence of each correctly translated pausal unit led to 1 point. If the translation was close to the exact meaning of the pausal unit, the participant was given 0.5 point. An incorrect translation or blank space resulted in 0 point. For example, in the pausal unit 没有钱，there is the target semantic radical 钅 (related to metal or gold) in the character 钱. If the participant translates the pausal unit as *has no money*, 1 point will be recorded. If the pausal unit is translated as *has no gold*, 0.5 point will be recorded.

Inter-rater reliability was established between the researcher and the Chinese instructor. The reliability for results of the pre-test was 0.93 and for the post-test performance was 0.89. A paired sample t-test was implemented to find out whether the performance difference between the pretest and post-test was statistically significant.

The qualitative data obtained from the questionnaires were used to detect how the participants perceived the effects of instruction of semantic radicals and how their motivation levels changed in learning Chinese after the experiment.

## 4 Results

4.1 Research question 1 – quantitative data

Research question 1: Will explicit teaching of semantic radicals significantly improve beginner level CFL readers' descriptive translation (indicating improved overall comprehension) of a given Chinese text?

The researcher used the data tools embedded in *Microsoft Excel* to analyze the data. Paired sample t-tests were administered to evaluate the statistical significance of the score difference between the pretest and posttest. The following reveals the quantitative findings regarding the overall score difference, score difference on pausal units containing target characters, score difference on pausal units containing extra new characters, and score difference on pausal units without target characters or extra new characters between the pretest and posttest.

Overall score difference between the pretest and posttest: Figure 1 presents a comparison of scores the participants achieved on the translation tasks before and after the explicit instruction on the ten Chinese semantic radicals. In Figure 1, it is obvious that all the participants improved their scores in the posttest, with the mean pretest score standing at 10.3 and the mean posttest score at 15.4.

Table 1. Paired sample t-test: Scores on translation tasks

Mean		t Critical one-tail	t Stat	p value one-tail	df
Pretest	10.3	2.13	3.74	0.01	4
Posttest	15.4				
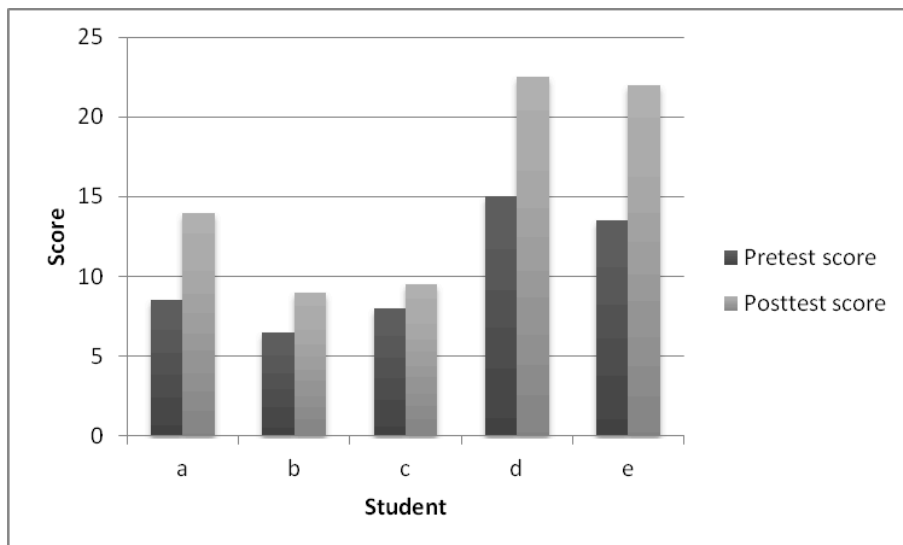
Figure 1. Comparison of overall pretest and posttest scores

To determine whether the improvement in the scores is statistically significant, the researcher administered a paired sample t-test using a significance level of 0.05. Table 1 shows that the difference between the pretest and posttest scores is statistically significant (p value = 0.01). In other words, participants performed significantly better in translating the given Chinese text after receiving explicit instruction of the ten Chinese semantic radicals.

Score change on pausal units containing target characters: Figure 2 displays a sharp increase in the posttest scores on the pausal units containing characters with target semantic radicals that were explicitly taught to the participants during the intervention stage. The mean score on the pausal units containing target characters rose from 0.4 to 3.1. In particular, student d and e made significantly greater progress than the other students.

Table 2. Paired sample t-test: scores on pausal units containing target characters

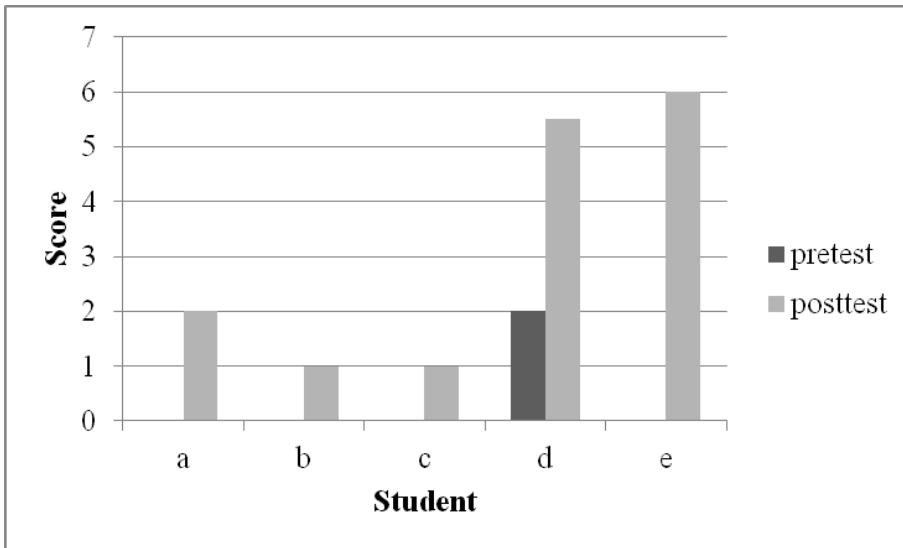| Mean		t Critical one-tail	t Stat	p value one-tail	df
Pretest	0.4	2.13	2.86	0.02	4
Posttest	3.1				

Figure 2. Comparison of pretest and posttest scores on pausal units containing target characters

To determine whether the score change on pausal units containing targets characters is statistically significant, the researcher administered a paired sample t-test using a significance level of 0.05. The t-test result in Table 2 confirms that the participants scored significantly higher in translating the pausal units containing target characters in the posttest than in the pretest (p value = 0.02).

Score change on pausal units containing extra new characters: Extra new characters stand for characters that were unknown to the participants and that did not contain target semantic radicals. Similar to their performance in translating pausal units containing target characters, the participants' mean score on pausal units containing extra new characters changed from 0.3 in pretest to 3.2 in posttest. Again, student d and e made significantly greater progress than the other students.

Table 3. Paired sample t-test: scores on pausal units containing extra new characters

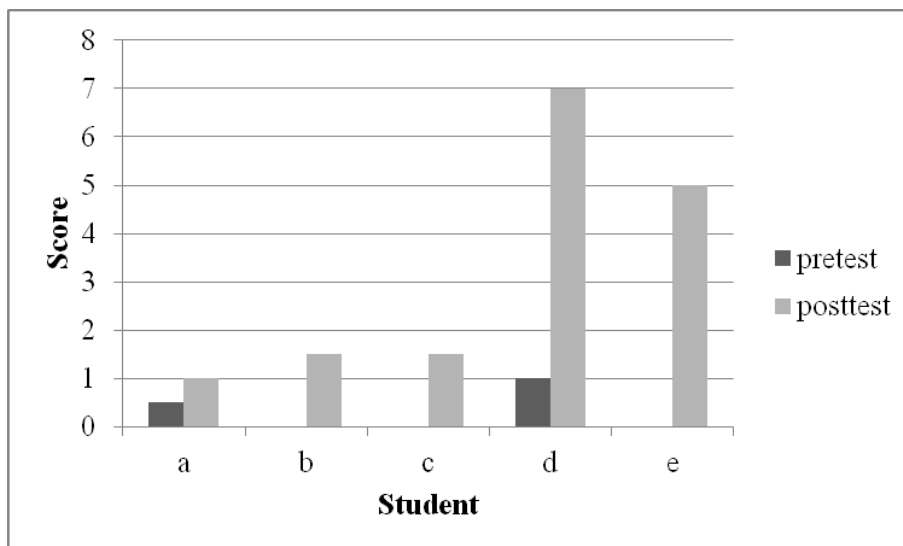| Mean		t Critical one-tail	t Stat	p value one-tail	df
Pretest	0.3	2.13	2.66	0.03	4
Posttest	3.2				

Figure 3. Comparison of pretest and posttest scores on pausal units containing extra new characters

To decide the statistical significance of the score change on pausal units containing extra new characters, the researcher administered a paired sample t-test using a significance level of 0.05. Table 3 shows that the score change from pretest to posttest with regard to the pausal units that contain extra new characters is statistically significant (p value = 0.03). In other words, they improved their performance in translating those pausal units with extra new characters after the intervention.

Score change on pausal units without target characters or extra new characters: Figure 4 demonstrates a slight advancement of the mean score on pausal units containing neither target characters nor extra new characters, changing from 9.6 in pretest to 10.9 in posttest. However, one student maintained the same score on the aforementioned pausal units before and after the intervention.

Table 4. Paired sample t-test: scores on pausal units without target characters or extra new characters

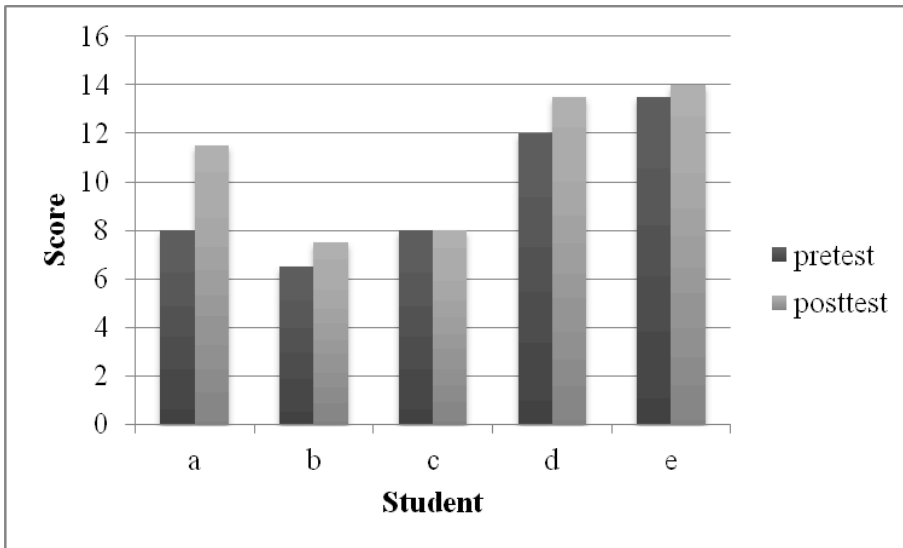| Mean		t Critical one-tail	t Stat	p value one-tail	df
Pretest	9.6	2.13	2.15	0.05	4
Posttest	10.9				

Figure 4. Comparison of pretest and posttest scores on pausal units without target characters or extra new characters

To determine the statistical significance of the score change on pausal units without target characters or extra new characters, the researcher administered a paired sample t-test using a significance level of 0.05. The t-test result in Table 4 attests to the fact that participants did slightly better in translating the pausal units without target characters or extra new characters, but the statistical significance remains in doubt with a p value of 0.05.

According to the paired sample t-tests, the positive change in the participants' overall score, score on pausal units containing target characters, score on pausal units containing extra new characters was statistically significant. In other words, the explicit instruction of semantic radicals significantly improved the participants' descriptive translation (indicating improved overall comprehension) of a given Chinese text.

4.2 Research questions 2 and 3 – qualitative data

Research question 2: How do CFL learners perceive the effects of instruction of semantic radicals on their ability to translate text, thereby improving their reading comprehension?

Research question 3: How will explicit instruction on Chinese semantic radicals change CFL learners' motivation level in learning Chinese?

The copies of the questionnaire completed by the five participants were collected after the posttest. The researcher analyzed the responses to the four categories of questions.

Category 1: Impact of semantic radical knowledge on the posttest: All the participants reported that they used the semantic radicals that they had learned during the intervention stage to help translate the given text in the posttest. This can be supported by the fact that all the participants achieved better scores in the posttest than in the pretest. One of the participants noted that she utilized the semantic radicals to add more context and better guess the meanings of characters containing these semantic radicals. Another participant stated:

> I didn't have the exact translation for some of the words, but I could make a good guess based off the context around the word and what the specific semantic radical meant. For example, one of the first few sentences had an unfamiliar word to me, but thanks to the 贝 radical (the radical means shell and it is related to money) that was in the word, I could guess that it meant poor or something close to it.

Category 2: Useful elements of explicit instruction on semantic radicals: All five participants agreed that the instruction on the meanings of semantic radicals was the most useful element in this research. This is understandable since this research focused on the meaning cueing function of semantic radicals. As one participant stated, "For comprehension, I think that the meaning helps the most. Then you can use the context with the meaning and better understand what is trying to be said."

However, some participants also mentioned the shape and etymology of semantic radicals as important parts of explicit instruction. For instance, a participant said:

> I think for me it was the meaning and the shape of the radical that helped me the most. The meaning helped me with the overall meaning of the new character, and the shape helped me recognize which radical it was.

Another participant claimed that the history of the semantic radicals was more fascinating than she had thought.

Category 3: Further learning and utilization of semantic radical knowledge: After the posttest, all participants expressed their intent to continue learning Chinese semantic radicals. There were three main reasons behind the participants' willingness to enhance their knowledge of semantic radicals. First, some participants believed that semantic radical knowledge could help them better understand and connect with the language. For instance, one participant noted:

> I would love to learn more about semantic radicals because I feel like the knowledge would let me to fully connect with Chinese rather than just memorize the language. I've found that a hands-on learning approach is the best way for me to learn something new and fully understand it.

The majority of the participants emphasized the facilitative role that semantic radicals could play in the Chinese character acquisition process. One participant compared the English and Chinese language and specifically pointed out that semantic radicals could help students better approach unknown characters. She said:

> I do want to learn more radicals because I feel like it could better my Chinese. Since there are so many characters and there is no way of sounding it out like a you could do with words in English since you know the alphabet, it would be nice to have a solid knowledge of radicals so that you could at least have something to recognize in unfamiliar characters.

Another participant regarded semantic radicals as interesting and powerful tools in helping her remember characters. She remarked:

> I would definitely like to learn the meanings of all of them and practice to connect with other characters, because it was not only interesting but also extremely helpful to remember characters and made sense.

As to the further utilization of semantic radicals, two participants claimed that they would try to infer the meaning of new characters with familiar semantic radicals before resorting to dictionaries. One participant said, "If I came across new vocabulary I would see if I recognize any radicals before looking it up to see what it means to see if I could figure it out."

Category 4: Change of motivational level in learning Chinese: Three out of five participants admitted that their motivation level in learning Chinese went up after the intervention and post-test, because they thought semantic radicals could make it easier for them to study Chinese. One of the participants commented:

> I think my motivation has strengthened in learning Chinese after the post-test. Using semantic radical knowledge makes learning Chinese more simple and a bit closer to learning English in the sense that you take pieces of the new word to help figure out what the overall meaning for the word is.

Another participant felt that semantic radical knowledge was conducive to a better understanding of the Chinese language. The participant stated:

I think it does change my motivation because I like learning how the words connect. I feel like Chinese makes more sense when you pick apart the radicals and that excites me! I now want to learn more radicals because maybe it can make my Chinese better!

5   Discussion

It was hypothesized that the overall mean score on the descriptive translation task would improve significantly due to explicit instruction on Chinese semantic radicals. According to the quantitative results, participants did perform significantly better in translating the given Chinese text after receiving explicit instruction of the ten Chinese semantic radicals (p value = 0.01). Therefore, the research hypothesis that explicit teaching of semantic radicals will significantly improve beginner-level CFL readers' descriptive translation (indicating improved overall comprehension) of a given Chinese text is accepted.

In the pretest, the participants either left out or mistranslated the pausal units where there were target characters or extra new characters. However, in the posttest, the participants left fewer blanks and became more accurate in inferring the meanings of those pausal units. When looking at score differences on pausal units containing target characters, pausal units containing extra new characters, and pausal units without target characters or extra new characters between the pretest and posttest, the participants' improvement on pausal units containing target characters (p value = 0.02) or extra new characters (p value = 0.03) was statistically significant. This concurs with previous research (Wang, Liu, & Perfetti, 2004) that demonstrated that the explicit teaching of semantic radicals, even for only a short period of time, could contribute to the CFL learners' ability to make appropriate meaning inference of novel characters.

The improvement on pausal units containing extra new characters suggested that the participants benefited from their improvement on pausal units containing target characters. It might be that the participants' improvement on pausal units containing target characters helped them extract more meaning out of the context, resulting in an increased comprehension of the extra new characters. For example, the sentence 他的眼睛很疼，但是他的爸爸妈妈没有钱给他买药, meaning *His eyes hurt, but his parents did not have money to buy him medicine,* contains the target character 药 which means medicine and the extra new character 疼 which means hurt. In the pretest, the total score on the target character 药 was 1 point and that of the extra new character 疼 0.5 point. In the posttest, the total score on the target character 药 increased to 2.5 points and that of the extra new character 疼 logged 3 points. The cause of this change might be that some participants inferred the meaning of the target character based on the semantic radical, enabling them to get more meaning out of the surrounding context. As a result, they were able to guess the meaning of the extra new character. In their research, Zhang and colleagues (2012) agreed that if students could successfully infer the meanings of new words, they were more able to relate background knowledge or context to the existing information to assimilate it. However, the question whether there is a bi-directional relationship between meaning-inference ability and the understanding of context requires further investigation.

In the following is a description of how the evaluators assessed the thoroughness of the participants' translation of two pausal units. The pausal unit 很贫穷, meaning *very poor*, contains the target character 贫 which consists of two components: the upper part 分 and the semantic radical 贝. The literal meaning of the semantic radical 贝 is *shell,* which was used as currency in ancient China. Thus, the semantic radical 贝 is related to money. In the pretest, none of the participants scored on this pausal unit. Yet the score on this pausal unit increased to 2.5 in the posttest. Two participants translated the pausal unit completely right, and one participant translated 贫 as *inexpensive*, earning half a point. Another pausal unit 他的眼睛很疼, meaning *his eyes hurt*, contains the extra new character 疼 which means *hurt*. In the pretest, only one participant translated the pausal unit as *his eyes aren't good,* earning half a point, and the other four participants just left out the unit. In the posttest, two participants got the right translation, and another two participants scored 0.5 point respectively by translating the unit as *his eyes can't see well* and *his eyes are bad*.

Though students improved enormously in translating pausal units with target characters or extra new characters, it is worth mentioning that they failed to make meaning inferences about some target characters, because the scores on pausal units with those target characters did not change. The reason might be that compared with other target characters in the text, the meaning-cuing function of the semantic radicals in those target characters was less transparent. This is in line with the results of a previous study by Wang and Koda (2013). Their study showed that less transparent semantic radicals could help learners infer character meaning, but students performed better with characters containing more transparent semantic radicals in both isolation and contextual conditions.

In sum, the semantic radical knowledge obtained through receiving the explicit instruction on Chinese semantic radicals helped participants significantly enhance their descriptive translation (indicating improved overall comprehension) of a given Chinese text. In particular, the participants leveraged their newly gained semantic radicals knowledge to boost their performance on translating the target characters and extra new characters.

In general, all the participants acknowledged on their questionnaire responses the positive effects of instruction of semantic radicals on their ability to translate text. Their increased attempts to make meaning inferences about new characters and the enormous overall score change before and after the intervention (p value = 0.01) is reflective of the abovementioned perception.

The students recalled in the questionnaire that they had used the meanings of semantic radicals to better guess the overall meanings of target characters. Some participants mentioned they had sometimes referred to the context surrounding the target characters to infer their meanings. The immense growth of correctly translated pausal units containing target semantic radicals provides a clue as to why participants attached great importance to the meanings of semantic radicals in helping them tackle the translation task. The participants also made more appropriate meaning inferences on pausal units with extra new characters that did not contain target semantic radicals. This indicates the participants might have taken advantage of the semantic radicals to make sense of other new characters.

In short, although semantic radicals do not provide the exact meanings of Chinese characters, the participants considered that the semantic radicals could help them make more meaning inferences about the target characters either by adding more contexts or by relating the semantic radicals to the contexts around the new words.

Three out of five participants reported that they were more motivated to learn Chinese because they thought semantic radical knowledge would make learning Chinese simpler and their Chinese better. They believed that semantic radicals would help them take characters apart and better understand the Chinese language. The other two participants were uncertain whether their motivation changed or not. Interestingly, two of the three participants who reported increased motivation level were the participants, namely students d and e, who registered significantly more progress than the others in translating pausal units with target characters or extra new characters. Their improved performance resulted from explicit semantic radical instruction might explain the increase in their motivation level in learning Chinese, suggesting a potential correlation between achievement and motivation in CFL learning. This is consistent with the results of a meta-analysis study (Masgoret & Gardner, 2003) that documented a high correlation between second language achievement and motivation.

Although not all five participants directly reported that their motivation level in learning Chinese had increased, all of them claimed that they would like to have more explicit instruction on Chinese semantic radicals because of the following reasons. First, semantic radicals help students better understand and connect with the language rather than just memorize the language. Second, semantic radicals give CFL learners something to hold onto when they approach unknown characters. One participant compared the function of semantic radicals in learning unknown characters to the function of letters in helping sound out a new English word. Finally, the interesting history of semantic radicals engages CFL learners and helps them remember new characters.

By and large, the participants recognized the facilitative role of semantic radicals in learning Chinese, and their intention to continue learning semantic radicals suggests their willingness to better their Chinese proficiency level.

6   Limitations and future research

One limitation of the present study was the small sample size. Although the study adopted a within-subjects design to minimize distortions that might have been caused by individual differences, the small sample size made the results of the experiment susceptible to some factors that would not pose a problem, if the sample size were large enough.

In the same vein, only ten semantic radicals were explicitly taught to the participants during the intervention. This poses a threat to the generalizability of the results of the present study. It is possible that with the growth of their semantic radical knowledge, the participants could better infer the meaning of unknown characters that contain meaning-cuing semantic radicals and better leverage the context to figure out the meaning of extra new characters, and thus could extract more thoroughly the overall meaning of a Chinese text.

Though both the pretest and posttest were done in one class session to minimize the effects of outside sources of variability, it could be possible that the participants improved also because they translated the same text in the posttest. Adopting a pre-test/post-test control group design could increase the validity of the conclusion of this study. In addition, since the current study only involved the explicit instruction of ten semantic radicals in a single class session, the results were not able to show the retention effects of explicit instruction of semantic radicals on CFL learners' reading comprehension. It is worthwhile carrying out a longitudinal study to investigate the relationship among the growth of semantic radical knowledge, the improvement of Chinese reading comprehension, and the motivation level in learning Chinese by CFL learners.

Although Masgoret and Gardner (2003) documented a high correlation between second language achievement and motivation, the results of the present study only indicated a potential correlation between achievement and motivation in CFL learning. The uncertainly of this correlation calls for further research into the relationship between motivation of and achievement by CFL learners.

The fact that the participants improved their scores not only on pausal units containing target characters but also on pausal units containing extra new characters prompts further investigation of the question whether there is a bi-directional relationship between meaning-inference capability, determined by semantic radical knowledge, and understanding of context.

7   Conclusion

Previous work (Shen & Ke, 2007; Williams & Bever, 2010) has demonstrated and emphasized the importance of semantic radicals in helping both native speakers and CFL learners acquire Chinese. Despite the limitations, the present study has confirmed the facilitative role of semantic radicals in learning Chinese. This study has also provided support to the research (Cheung, Chan, & Chong, 2007) that showed a correlation between Chinese children's semantic knowledge and their passage comprehension performance.

Although previous research (Cheung, Chan, & Chong, 2007; Zhang et al., 2012) has displayed a strong association between Chinese native speakers' knowledge of semantic radicals and their ability to comprehend Chinese texts, the role of semantic radicals in Chinese reading comprehension of CFL learners has barely been investigated. By focusing on examining the direct impact of explicit instruction of semantic radicals on beginner-level CFL readers' descriptive translation (indicating improved overall comprehension) of a given Chinese text, the present study has enriched the knowledge base in the research of CFL Chinese reading comprehension.

The present study also has pedagogical implications. As previous research (Lu, Koda, Zhang, & Zhang, 2015; Wang & Koda, 2013) has shown the benefit of semantic radicals in learning Chi-

nese characters, many researchers have suggested that CFL teachers should teach components of compound characters and raise CFL learners' semantic radical awareness to help them approach new characters. However, the improvement made by the participants in their overall comprehension of the given Chinese text and their responses to the questions regarding their perceptions of semantic radicals and motivation level have implied that explicit instruction of semantic radicals could play a bigger role in CFL teaching and learning, especially in CFL reading comprehension. It is suggested that CFL teachers explicitly teach CFL learners semantic radicals and how to leverage their semantic radical knowledge to help them better comprehend Chinese texts.

References

Chen, J., Wang, C., & Cai, J. (2010). *Teaching and learning Chinese: Issues and perspectives*. Charlotte, N.C: Information Age Pub., Inc.

Cheung, H., Chan, M., & Chong, K. (2007). Use of orthographic knowledge in reading by Chinese-English bi-scriptal children. *Language Learning, 57*, 469–505.

Dörnyei, Z. (1998). Motivation in second and foreign language learning. *Language Teaching, 31*, 117–135.

Dörnyei, Z. (2005). *The psychology of the language learner: Individual differences second language acquisition*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Dörnyei, Z. (2007). Creating a motivating classroom environment. In J. Cummins & C. Davison (Eds.), *International handbook of English language teaching* (pp. 719–731). New York: Springer.

Feldman, L. B., & Siok, W. W. T. (1999b). Semantic radicals contribute to the visual identification of Chinese characters. *Journal of Memory and Language, 40,* 559–576.

Grabe, W. (2014). *Key issues in L2 reading development*. Singapore: Center for English Language Communication Symposium. Retrieved from http://www.nus.edu.sg/celc/research/books/4th%20Symposium%20proceedings/2).%20William%20Grabe.pdf

Hanley, J. R. (2005). Learning to read in Chinese. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 316–335). Malden, MA: Blackwell Publishing.

Ho, C. S.-H., Ng, T., & Ng, W. (2003). A "radical" approach to reading development in Chinese: The role of semantic radicals and phonetic radicals. *Journal of Literacy Research, 35*, 849–878.

Hoosain, R. (1991). *Psycholinguistic implications for linguistic relativity: A case study of Chinese.* Hillsdale, NJ: Erlbaum.

Johnson, R. (1970). Recall of prose as a function of the structural importance of linguistic units. *Journal of Verbal Learning and Verbal Behavior* 9, 12–20.

Johnson, R. B., & Turner, L. A. (2003). Data collection strategies in mixed methods research. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 297–319). Thousand Oaks, CA: Sage.

Kim, S. A. (2010). *Developmental stages in reading Chinese as a second language* (Unpublished doctoral dissertation). University of Illinois at Urbana-Champaign, Urbana, Illinois.

Kohn, A. (1993) *Punished by rewards: The trouble with gold stars, incentive plans, A's, praise, and other bribes*. Boston, MA: Houghton Mifflin.

Liu, Y., & Fang, X. (2014, April). *An empirical study on teaching radicals to beginners with the character primer*. Paper presented at the Fourth International Symposium on Chinese Applied Linguistics, Iowa.

Liu, Y., Wang, M., & Perfetti, C. A. (2007). Threshold-style processing of Chinese characters for adult second-language learners. *Memory and Cognition, 35*(3), 471–480.

Lu, C., Koda, K., Zhang, D., & Zhang, Y. (2015). Effects of semantic radical properties on character meaning extraction and inference. *Writing Systems Research, 7*, 169–185.

Masgoret, A.-M., & Gardner, R. C. (2003). Attitudes, motivation, and second language learning: A meta-analysis of studies conducted by Gardner and associates. *Language Learning, 53*(1), 123–163.

Mattingly, I. G. (1992). Linguistic awareness and orthographic form. In R. Frost & L. Katz (Eds.), *Orthography, phonology, morphology, and meaning* (pp. 11–26). Amsterdam: North Holland.

Nicholson, S. J. (2013). Influencing motivation in the foreign language classroom. *Journal of International Education Research, 9*(3), 277–286.

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist 55*(1), 68–78.

Shen, H. H. (2010). Analysis of radical knowledge development among beginning CFL learners. In M. E. Everson & H. H. Shen (Eds.), *Research among learners of Chinese as a foreign language* (pp. 45–65). Honolulu: University of Hawai'i, National Foreign Language Resource Center.

Shen, H. H., & Ke, C. (2007). Radical awareness and word acquisition among nonnative learners of Chinese. *The Modern Language Journal, 91*, 97–111.

Shu, H., & Anderson, R. C. (1997). Role of radical awareness in the character and word acquisition of Chinese children. *Reading Research Quarterly, 32*, 78–89.

Shu, H., Chen, X., Anderson, R. C., Wu, N., & Xuan, Y. (2003). Properties of school Chinese: Implications for learning to read. *Child Development, 74,* 27–47.

Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 22,* 360–407.

Wang, J., & Koda, K. (2013). Does partial radical information help in the learning of Chinese characters? In E. Voss, S-J D. Tai & Z. Li (Eds.), *Selected proceedings of the 2011 Second Language Research Forum: Converging theory and practice* (pp. 162–172). Somerville, MA: Cascadilla Proceedings Project.

Wang, M., Liu, Y., & Perfetti, C. (2004). The implicit and explicit learning of orthographic structure and function of a new writing system. *Scientific Studies of Reading, 8*, 357–379.

Williams, C., & Bever, T. (2010). Chinese character decoding: A semantic bias? *Reading and Writing, 23*(5), 589–605.

Zhang, J., McBride-Chang, C., Tong, X., Wong, A. M.-Y., Shu, H., & Fong, C. Y.-C. (2012). Reading with meaning: the contributions of meaning-related variables at the word and subword levels to early Chinese reading comprehension. *Reading and Writing: an Interdisciplinary Journal, 25*(9), 2183–2203.

Zygouris, V. (2009). *Teaching reading comprehension skills.* National Association of Elementary School Principals. Retrieved from https://www.naesp.org/resources/2/Middle_Matters/2009/MM2009v17n4a4.pdf

Appendices

Appendix A

Translation Task

Translation Task (Pretest and Posttest)   **Name:**

王明的家很贫穷。冬天很冷，他们家没有钱买棉袄和被子。但是他觉得他很幸福，因为他的爸爸妈妈都很爱他。他喜欢吃竹笋。王明很喜欢读书，也很喜欢听他的爸爸妈妈讲故事。但是他们家没有钱，所以他不能去学校上学。12 岁的时候，王明生病了。他的眼睛很疼，但是他的爸爸妈妈没有钱给他买药，也没有钱给他打针。12 岁的王明变成了盲人因为王明是一个盲人，他在家摸着墙壁走路，有时候他的脚会踢到地上的东西。

29 pausal units

Please translate the Chinese text into English. You are encouraged to take a guess and write down as many details as possible.

Translation:

Appendix B

Target Semantic Radicals, Target Characters, and Extra New Characters

Target semantic radicals	Meaning	Examples	Target characters	Extra new characters
土	Earth/soil	在、地	墙壁	穷、棉、幸福、故事、病、疼、踢
手/扌	Hand	打、拍	摸	
钅	Gold/metal	铜、铁	针、钱	
衤	Clothes	衬衫、裤子	袄	
月	Meat	肚子、腿	脚	
艹	Plant	花、茶	药	
目	Eye	眼睛	盲	
讠	Speech	请、读	讲	
贝	Money	赊、赢	贫	
竹	Bamboo	竹、篮	笋	