

Using Adaptive Learning Theory and a Schedule-based Flashcard to Enhance the Quality of Online Self Learning

Hsing-Kuo (Tom) Lee^{a*}, Chun-Hung Lu^b, Wen-Lian Hsu^c
Ching-Ching Lu^d, Wan-Chun Tang^e

^{abc}Institute of Information Science, Academia Sinica,
128 Academia Road, Taipei, Taiwan 115

^{de}National Hsinchu University of Education, Taiwan

*Corresponding Author: doraemontl@iis.sinica.edu.tw

ABSTRACT

In this paper, we describe how to apply Adaptive Learning and a schedule-based flashcard in an e-learning system to enhance the quality of online self learning. Adaptive Learning is an important component of e-learning, as it offers flexible solutions to learners to fit their real-time learning needs. Meanwhile, the flashcard concept provides learners with a more efficient way to learn a foreign language. A set of online learning tools was developed to demonstrate the approach.

Keyword: Adaptive Learning, flashcard, online self learning, e-learning, Chinese Learning

1. Introduction

This paper describes how to apply Adaptive Learning and the concept of a schedule-based flashcard in an e-learning system to enhance the quality of online self learning. We developed an online self-learning system, which combines educational theory and Internet technologies, so that users can learn Chinese words and conversations by themselves. Specifically, the system implements Adaptive Learning theory and the concept of a flashcard in an online-based self learning system.

Adaptive Learning is an important component of e-learning because it offers flexible solutions to fit users' real-time learning needs. The theory focuses on individual preferences and the traits of learners (Wolf 2002). The proposed system uses flashcards as learning tools. A flashcard usually has a question on one side and the answer on the other side, and is used to help the student memorize learning materials, such as vocabulary and formulae.

In this paper, the flashcard concept is implemented on a schedule based foundation. When a student learns new Chinese words, the system generates a study schedule based on the importance and difficulty of the words. Then, the student can review the words he/she has just learned before by following the schedule. The system enables users to learn Chinese words more efficiently.

2. Theoretical Foundation and Background

2.1 Adaptive Learning Research

Adaptive learning is one of the most important components of technology-enhanced learning systems. It has been applied in Adaptive Hypermedia Systems (AHS), which improve the usability of hypermedia and adapt automatically to the characteristics of the individual user (De Bra, 2000). The concept has also been applied in the Web-based Intelligent Design and Tutoring System (WINDS). In the system, an adaptive learning environment (ALE) provides individualized course material for each student based on his/her current preferences, learning style and level of knowledge (Specht, 2002).

Systems based on adaptive learning allow students to customize their learning environments and choose flexible solutions that fit their real-time needs. Since there is no instructor, users can gauge their improvement by their learning experience. In other words, adaptive learning helps users by providing learner-customized paths.

2.2 Social Constructivism

Social Constructivism is a theory that views learner as an individual has his own background and experience. From the point view of psychology for language teaching, social interactionism emphasizes the interplay between teachers, learners and tasks; furthermore, the learning environment or context is another important element. Thus, a social constructivist model includes teachers, learners, tasks and contexts, and Marion Williams and Robert L. Burden identified these four key sets of factors influence the learning process (Williams, 1997).

System was designed by following a social constructivist model allows the learners edit the learning content by their personal needs and experience. Also, the interplay between learner, task and contexts can really give learners a deep impression and help them learning new knowledge more efficiently.

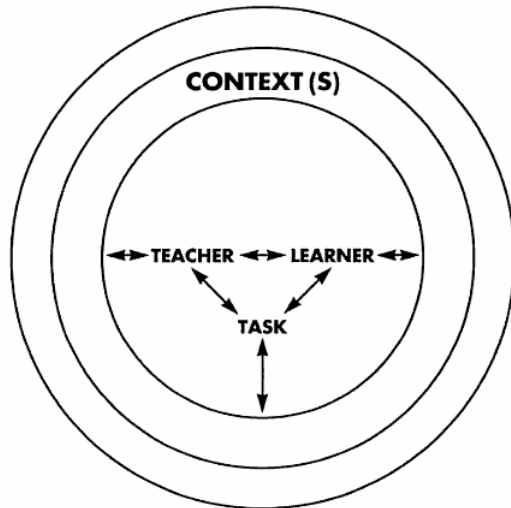


Figure1. A social constructivist model of the teaching-learning process

2.3 Flashcard Research

A flashcard is used as a learning tool. It usually has a question on one side and an answer on the other side. People usually use flashcards to help them memorize learning materials, such as vocabulary and formula, etc.

In 1970, a German researcher, Sebastian Leitner, proposed the Leitner system, which uses flashcards efficiently. The system sorts flashcards into groups depending on how well the learner knows each card. The learner tries to recall the solution written on the flash card. If the answer is correct, learner puts the card into the next group. However, if the answer is wrong, the card is returned to the current group, which means they cannot progress to the next group (Leitner, 1972).

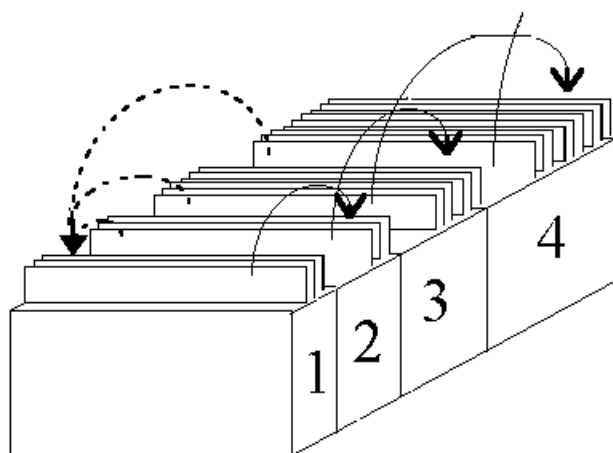


Figure 2. Schematic representation of Leitner's study system

3. Adaptive Learning and the Schedule-based Flashcard Concept

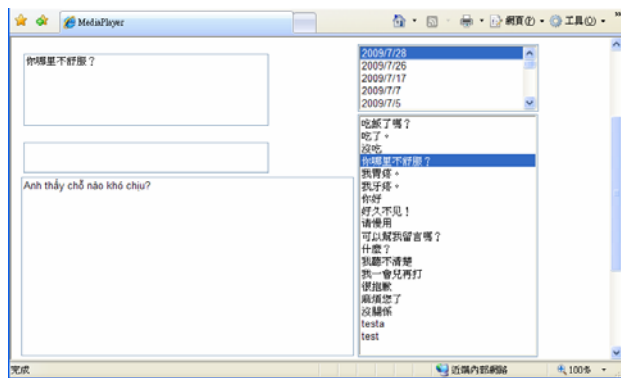
3.1 General

The proposed system, called the Chinese Word Learning System (CWLS), implements Adaptive Learning theory and a schedule-based flashcard to facilitate learning. A student can learn and review Chinese words and sentences by following a schedule, which is generated automatically by the system based on how often the words have been reviewed by the student. For instance, if the student is not familiar with some words, he/she will probably review those words frequently. The system will then generate the words in the review schedule more often in order to help the student learn them efficiently.

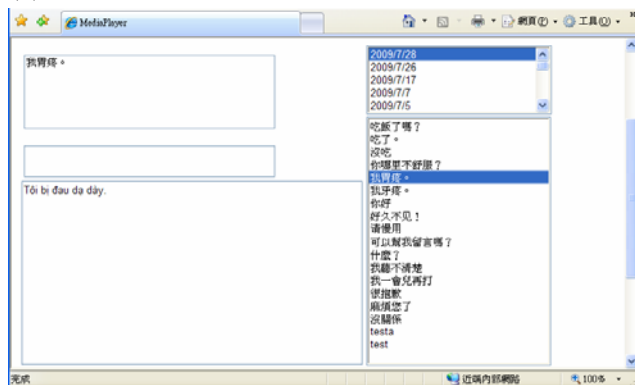
Specifically, the CWLS system is designed for foreign spouses who married to Taiwanese or Chinese and needed to learn Chinese speaking. Therefore, this system emphasizes how to help these foreign spouses improve with their Chinese speaking, and recognizing Chinese words is just a part of purpose. Since the main purpose of CWLS system is to help foreign spouses improve their Chinese speaking, teaching them to pronounce short sentence could be a good idea instead of teaching them to recognize single Chinese word.

Also, a social constructivist model was implemented to the system, and this model allows learners to edit their learning content by their personal preference, needs and experience. For instance, learners can edit a new Chinese vocabulary or sentence they learned from television or media, and add it to the review schedule of CWLS. People not only learn new vocabulary or sentence from the classroom, but also learn them from the environment surrounded. Television, commercial and music all could be the resources of the learning material; by learning new knowledge from the daily life, it can really influence the learning of a learner.

The schedule-based flashcard is used to display words for review. When the learner clicks a date on the schedule, the system will display the words for that date automatically on a flashcard. After a certain time, each word will be refreshed, and the system will explain the meaning and the pronunciation. The words are refreshed automatically, as shown in Figure (a) and (b). Although the system displays works like a flashcard, it actually displays the words to be learned on the date selected by the user. For example, as shown in Figure (a), the system may display 18 words and the user can choose those that he/she wishes to learn.



(a) After users select the word and select the AutoPlay option



(b) After 5 seconds, the CWLS auto plays the next word

3.2 Logical Concept

The Chinese Word Learning System uses a simple adaptive logic to generate users' study schedule, which is based on users' familiarity with the specific word. For instance, if a user does not know a Chinese word well, he/she will select that word more often in order to practice more. When a word was selected more often, it means that the user needs more practices with this word, and the system will generate more practice for that specific word in the future study schedule date. On the other hand, if the user is familiar with that word, he/she will not need more practice about that word, and the system will not generate more practice opportunities for the user.

Also, the whole system is emphasizing learning on speaking short sentence, which can really improve foreign spouses' communication ability; therefore, it is designed to focus on the short sentence learning and speaking. When a user selects a specific short sentence, he/she can listen to the pronunciation, which is generated by the Text to Speech synthesis, and see its meaning in the user's native language. For instance, if a Vietnamese spouse selects a short sentence, he/she will learn the pronunciation and see the meaning in Vietnamese. Also, the users can select the short sentences they prefer to learn, and these sentences are the sentences they used a lot in their daily life. This can really help a foreigner to communicate well with their spouse in a short

period of time.

In Figure(c), the system contains an “Auto Play” checkbox, and the short sentences can be automatically played if the checkbox is checked. Furthermore, the size 5 for the dropdown list means the duration to play the next short sentence is 5 seconds, and users can select a better time period to fit their own learning needs.

3.3 Picture Card Dictionary Authoring System vs. CWLS

The picture card dictionary authoring system and Chinese word learning system both apply flashcard metaphor in the system. Furthermore, the Chinese word learning system implements similar idea as the picture card dictionary authoring system.

The picture card dictionary authoring system is a system that supports young language learners performing communicative tasks using daily-life words without teaching them the vocabulary. The system applies a flashcard metaphor. The picture cards will be displayed on an interactive whiteboard, and learners can touch them to hear their pronunciation generated by text-to-speech synthesis (Yachi, 2007). From Yachi's research, we can see that young learners can improve their language learning by using the picture card dictionary authoring system, and the picture cards really help young learners learn certain vocabulary easily.

In contrast with the picture card dictionary authoring system, CWLS supports foreign spouses speaking short sentences without learning single Chinese character. Learners can easily learn daily-life Chinese conversation without memorizing the meaning of each word. Since every sentence they learned is short sentences, they can easily communicate with the native speaker, and then learn more about single Chinese characters during the conversation.

In Yachi's research, he points out the importance of collecting the daily-life vocabulary directly from the learner's perspective, and proposed a system for building the vocabulary lists continuously (Yachi, 2007). In the Chinese word learning system, we did not collect daily life conversation directly from the learner, but the learner can choose the short sentences they want to learn by looking at the meaning of sentences in their native language. Thus, Chinese word learning system can really help foreign spouses facilitating Chinese self-learning.

3.4 CWLS vs. Digital Flashcard

The flashcard feature used in the Chinese Word Learning System is more efficient than the traditional flashcard and digital flashcard.

When using a traditional flashcard, as in the Leitner system, the user needs to classify words into groups. If a word is easy for the user, it will be added to the next group; otherwise, it will remain in the first group. The Leitner system does not categorize words into groups for users. In contrast, the proposed Chinese Word Learning System can easily generate a review schedule for each user based on how often he/she has reviewed a particular word. The system arranges the review schedule according to the difficulty of each word for the user.

On the other hand, Lei Jing proposed a digital flash card as an example of U-Learning Digital Artifacts (Jing, 2008). The card contains four vocabularies and one text reference, all of which are displayed on a computer monitor. The only difference is that the vocabulary information is shown on the computer monitor instead of a card. The Chinese Word Learning System has the same functionality as a digital flashcard, but also generates a review schedule automatically for the user based on his/her specific needs.

CWLS is different from digital flashcard; CWLS focuses on the communication and short sentence and digital flash card focuses on single word. The digital flash card is helping users to memorize the vocabulary. On the other hand, CWLS is helping users to improve their Chinese speaking; therefore, the system shows the meaning of short sentence in their native language in order to help them memorizing.

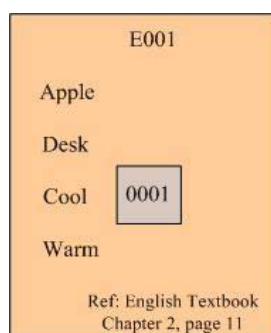


Figure 3. An example of a digital flashcard

4. Implemented Learning Tool

As mentioned earlier, the concept of Adaptive Learning and a schedule-based flashcard are implemented in the Chinese Word Learning System to help students learn words more efficiently.

4.1 Word Editor Tool

The Word Editor Tool helps users organize their learning materials, such as adding new Chinese words to the review schedule, recording their pronunciation, and ranking their level of difficulty.

The Word Editor Tool can be used by learners and instructors. A learner can add or edit any Chinese word he wants to learn to the Chinese Word Learning System, which will then generate a study schedule automatically. Learners can also listen to the pronunciation of words in the review schedule, and organize the learning material based on their needs. Meanwhile, an instructor or native speaker can edit the Chinese words and record their pronunciation.

4.2 Word Browser Tool

The Word Browser Tool is part of the adaptive learning component, and helps users review the learning material. By following the learning schedule, learners can review words that they are not familiar with more often since the Chinese Word Learning System generates the review schedule based on how often words are reviewed by the user. Moreover, the user can review all the words he/she has learned before as well as practice the pronunciation provided by a native-speaker.

Currently, the Word Browser Tool applies the adaptive learning component based on the frequency that words are reviewed by the user. If the user reviews a word frequently, it means that he is not familiar with it and needs more practice and review. Thus, the system will generate more reviews in the schedule. In the future, the system may be able to apply adaptive learning based on some specific details, such as the user's learning style and learning behavior.

4.3 Web-Based Learning Tool

The Web-based Learning Tool is a hybrid of the Word Editor Tool and Word Browser Tool. It allows users to edit learning materials and review Chinese words through the website. Meanwhile, the administrator can monitor the learning style and behavior of each learner in order to improve the functionalities of the system by applying Adaptive Learning theory.

The tool can also be integrated with mobile devices, since mobile communications technology is now well-developed. For example, with 3rd generation devices, users can access the Internet anytime, anywhere. Peter Mellow (2005) observed that “using

the communication media with which the students are most familiar and proficient may be a hurdle for educators and institutions. However, the integration of mobile devices will offer true flexibility for students and fit in with their digital lifestyle.” Mobile-learning can expand the usage of the Chinese Word Learning System because it provides learners with the flexibility to fit their learning style.

5. Conclusion and Outlook

In this paper, we have considered how to enhance the quality of online Chinese self-learning by applying Adaptive Learning theory and a schedule-based flashcard. Specifically, we have proposed CWLS that makes learning Chinese words more efficient by generating a review schedule, which is based on the words that the learner has reviewed previously. The flashcard is implemented in the Chinese Word Learning System as a schedule-based review system; hence, it is easier for the user to memorize the words learned previously.

Specifically, CWLS is originally designed for foreign spouses who married to Taiwanese or Chinese and needed to learn Chinese speaking. Thus, the system emphasizes the learning of Chinese conversation, and we believe that the short sentences can really help these foreign spouses improving their Chinese speaking, compared with learning Chinese characters at the beginning. Short sentence is more efficient because it is easier for foreign speakers to pick up and use it in daily conversation.

Furthermore, the learners can select the short sentences they want to learn depending on their needs, which may be the common conversations they used a lot in daily life, and this system contributes to facilitate self-learning.

On the other hand, the proposed system is implemented in web-form; it can enhance the quality of e-learning. Since mobile technology is now well-developed, people can get online anytime, anywhere to access the learning system, and thereby gain more flexibility to fit their learning styles.

Consequently, CWLS uses flashcard metaphor in the system, and applies adaptive learning theory to enhance the learning. It calculates the frequency of selected words to generate the study schedule, and users can also decide the way they want to practice the pronunciation. Furthermore, the foreign spouses can improve their conversation skills in short period by practicing the short sentences in CWLS, and then reach the goal of facilitating Chinese self-learning.

REFERENCES

- De Bra, P. (2000). Pros and Cons of Adaptive Hypermedia in Web-Based Education, In: *Journal on CyberPsychology and Behavior*, 3(1), (2000), pp. 71-77, Mary Ann Liebert, Inc
- Kennedy, I. G. (n.d.). Simple Web-based Adaptive Learning Technology. Retrieved April 20, 2009, from <http://wit.tuwien.ac.at/people/graf/publications/SWALT.pdf>
- Leitner, S. (1972). So lernt man lernen. *Angewandte Lernpsychologie – ein Weg zum Erfolg*. Verlag Herder, Freiburg im Breisgau, Germany.
- Mellow, P. (2005). The media generation: Maximise learning by getting mobile. Balance, Fidelity, Mobility: maintaining the momentum? (Ascilite 2005) (pp. 469-476).
- Williams, Marion, & Burden, Robert L. (1997). *Psychology for Language Teachers*. Cambridge: Cambridge University Press.
- Wolf, Christian. (2002). iWeaver: Towards an Interactive Web-Based Adaptive Learning Environment to Address Individual Learning Styles. (ICL 2002).
- Lei, J., Xianzhi, Y., & Zixue, C. (2008). *A ubiquitous learning system based on the Digital Artifacts*. Paper presented at the Ubi-Media Computing, 2008 First IEEE International Conference on.
- Yachi, Masahiro. (2007). Cooperative Picture Card Dictionary Authoring System For Communicative Language Learning, In Seventh IEEE International Conference on Advanced Learning Technologies (ICALT 2007).