Remote Education Software for “Wubi” Typewriting
--for elective course of elementary school

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Abstract

This master thesis design and implement new software which can help children learn and practice “Wubi” Chinese typewriting. The purpose of designing this software is to effectively reduce the phenomenon in China known as “forget how to write while taking pen”, so-called character amnesia. First we interviewed two experienced teachers and one class of pupils from an elementary school to collect data. Based on the data we collected, we built a set of prototypes by using PowerPoint on computer and evaluated it by three invited children who belonged to our target user group. After we modified our prototype, we implemented it on a computer using the Java programming language. When the process came to the evaluation part, we invited four students who had background knowledge on the field of HCI and its evaluation methods, to help us finish a cognitive walkthrough evaluation. Although some part of our software, such as certain interfaces and sequences, should be improved in the future work, the opinions of the evaluators were mostly positive.

Keywords

“Wubi” typewriting, education software, Java RMI.
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Statement

This project work is completed by Qian Li and Wei Wu together. In which Qian Li is mainly responsible for user investigation part, GUI design and implementation, and evaluation part. Wei Wu is mainly responsible for software implementation.

Chapter 1 is the introduction part of the thesis. Completed by Qian Li and Wei Wu together.
Chapter 2 is method and research part. Mainly completed by Qian Li, modified by Wei Wu.
Chapter 3 is the design of REWT. Mainly completed by Wei Wu, modified by Qian Li.
Chapter 4 is the implementation of REWT. Completed by Qian Li and Wei Wu together.
Chapter 5 is the evaluation of REWT. Mainly completed by Qian Li, modified by Wei Wu.
Chapter 6 is the conclusion of thesis. Completed by Qian Li and Wei Wu together.
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1. Introduction

This chapter will introduce the background of character amnesia in China, why “Wubi” typewriting is helpful to solve this problem, and explain the goal of this thesis, which is to develop a “Wubi” education software. Related works will also be reviewed.

1.1 Background

The character amnesia phenomenon has received more and more attention in China. A poll commissioned by the China Youth Daily in April 2010 found that 83% of the 2,072 respondents admitted having problems forgetting how to write traditional Chinese characters – literally, “take pen, forget character”. [1]

Researchers claim that character amnesia happens because most Chinese people use computers with Latin character keyboards, and enter each word by using “Pinyin” typewriting, which translates between the Chinese characters and the Roman alphabet. [2] Users of “Pinyin” typewriting can input whatever they want as long as they know how to pronounce in a national standard way. However this easy-used input method brings a non-negligible problem here: users may ignore the Chinese character itself. Instead, they will use those basic wrong words to take place of right words, which have the same pronunciation. The consequence is that the majority of people might forget which character is the right one and how to write it.

In China, there are about 190 Chinese input methods for computers, which could also be basically separated into two classes and seven subclasses. “Pinyin” and “Wubi” are two basic typewriting methods in China. Among those 190 input methods, about 67% are based on the “Pinyin” method, and 26% are based on the “Wubi” method. [3]

“Wubi” is designed based on Chinese character writing. It separates each Chinese character into small simple elements, called “Wubi Etymons”, which are matched to each key on the Latin computer keyboard. Take “答” as an example, it has four parts: “竹”, “人”, “一” and “口”. The user needs to type the corresponding keys: “T”, “W”, “G” and “K” to type this character. Users of “Wubi” typewriting have to know how to write what they want to type first. What is more, “Wubi” actually has faster typing speed and higher rate of accuracy than “Pinyin”. [4] As a result, we believe that this kind of typewriting will be helpful in the writing of Chinese words and its popularity will solve character amnesia.
1.2 Problem Discussion

In fact people are reluctant to learn “Wubi”. They complained that “Wubi Etymons” are much more complex than “Pinyin” letters. [5] There are 130 “Wubi” etymons in total, distributed across the 25 keys on the keyboard, and users have to remember all of them. So the problem is how to make the learning of “Wubi” as simple as “Pinyin”.

Actually, the reasons that some people consider “Pinyin” as a better way for typewriting is not only because it is easier to remember, but also because they have to learn it, even take exam about it in kindergarten and elementary school. [6] Many people think it is unnecessary to learn “Wubi” since they have already learnt “Pinyin”. [7]

Physiologists and educators believe that children in elementary age, especially 6-9 year old children tend to have verbally accessible memories from very early childhood. [8] Chinese educators also indicate that childhood, especially 3-9 years old, is the best time for humans to learn language. [9] The remembering processes of “Pinyin” and “Wubi” are similar, remembering a “Wubi” etymon will not be such a suffering experience if it has been taught when children learn how to read. Thus we believe if people can learn “Wubi” when they are children, they can handle it as well as “Pinyin” after they grow up.

1.3 Related Work

There are already tutorials, small online games and software to practice Wubi” typewriting. “Wubi Typewriter”, “Jinshang Typewriter”, and “Best Wubi” are the top 3 ones in the popular “Wubi” software list in www.skycn.com (the main software download website in China). We downloaded them, tried them and made the comparison as follows:

“Wubi Typewriter”, this software provides a standard fingering animated tutorial, and gives “Wubi” coding rules on time during practice.

“Jinshang Typewriter”, this software helps users learn the input method from simple letter or etymon and slowly transition to phrases and articles exercise. Besides, users can check their results through speed test.

“Best Wubi”, this software is to train professional “Wubi” typewriter in short time.

The above three software does have individual advantages, but the user groups of all them are adults. We need software which target on children, so “Wubi” can be learned from childhood. However, we learned the layout of the software window, the operating process and a set of practices from the above three softwares.
1.4 Goal

Based on what we discussed above, the goal of our project was to design and implement education software to help children learn “Wubi” breezily, named “Remote Education Software for ‘Wubi’ Typewriting” (REW). REWT can be used in the elective course of elementary school; the users will be both teacher and children.

Children, as everyone have experienced, are hard to concentrate especially while they are learning. Only interesting challenges can get their attention. So, REWT has three games about “Wubi”. Children can play the games, do practices and complete homework. Teachers can assign homework according the progress in the class to support that children learn “Pinyin” and “Wubi” at the same time.

We hope REWT is helpful to solve the character amnesia by encouraging people to learn “Wubi” in their childhood.
2. Method and Research

This chapter will present work we did before we started to implement the real software. This work includes data collection, function specification, prototype creation and its evaluation.

2.1 Data Collection

As David Benyon mentioned in his book Designing Interactive Systems:

“Before creative design can start it is essential that the designer develops a clear and thorough understanding of the people who will be involved with the system, the activities that are the focus of the design, the contexts in which those activities take place.” [10]

User study is such a necessary design section which related to the success of our software. As a result, the very first step of our work was to find out the requirements of the users, which were children and teachers in our case. The method we choose to collect data and its results will be given respectively.

2.1.1 Method

Basically there are two main methods for data collection: questionnaire and interview. Advantages of the former are: first, it can gather information at a distance, second, it provides a large number of people as quantity data, and third results of closed questions are easily summarized. However, results from open questions are generally less specific and lack details or even more, can be ignored by respondents.

Different from questionnaire, the interview is more focused on qualitative data collection. When combined with observations, the interviewer does not only take down what the interviewee says, but also what he/she does if there are any problems.[11] Based on interviewee’s answer, the questions from the interviewer can be flexible and so can follow up and get more details. Although when compared to a questionnaire, an interview seems more time-consuming, the feedback during it is opportune and results are thorough. That is why “one of the most effective ways of finding out what people want and what problems they have at the moment is to talk to them.” [10]

Through the comparison above, we choose interview as our main method to gather information. In addition, while we communicated with one of our teacher interviewee, he suggested that children might take questionnaires more serious, like an exam. For this reason, the group interview is more suitable for children. As a result, the following two sections are the summarization of our interviews with teachers and pupils.
2.1.2 Interview with Teachers

First of all, we interviewed two experienced teachers. One was a 45-year-old headmaster of an elementary school; the other was a class teacher with 15 years experience who was also teaching Chinese on grade 5. (There are 6 grades in elementary school; student of grade 1 is beginner.)

First, from this interview we got a general conception about the teaching process of children. Generally, children begin to use a computer from grade 3, which is about 9 or 10 years old. At that time, they have basically known around 1,000 common Chinese characters. The sequence of learning how to use a computer is to get familiar with the operating system first and then learn how to input on the computer. Until grade 5, half of the children know how to input the Chinese on computer well.

Second, these two interviews confirmed our background that character amnesia is a general phenomena and that even these two teachers sometimes forgot how to write a character. As for children, most of them just use input while chatting online, and no one will notice whether or not they picked a correct character.

After we explained the goal of our project, one of the interviewee showed big interest. When we asked if he thinks “Wubi” can somehow improve the phenomena of character amnesia, he said “Yes of course. At least they have to think about how to write before automatically type.” Then he suggested us to connect this software with a Chinese textbook. He believed it can help children remember Chinese character during play. Consequently we asked about children’s knowledge of Chinese characters, how he teaches his class and assigns homework. Information about psychology and praxiology were also crucial for us. Both of these two teachers confirmed that appropriate competitions between children can cause more interest and so could have positive consequences. Of course, a child who always loses in competitions will definitely feel dispirited. But compared to a younger group, their experiences indicate that children in 9 to 10 years age have better ability to deal with challenges and adjust their attitude after failure. In addition, appropriate frustration education will be more benefit for children's psychology health. [12]

2.1.3 Interview of pupils

In order to get direct information from children, we contacted one class of pupils in China. We found the results were great and children were enjoying and lively taking part in our conversation. Two main uses of computer by children were chatting online and play computer game in their leisure time. The most popular mini games were Picture Matching and Spelling Shooting from girls and boys respectively. The most popular animation among children is Pleasant Sheep, which originated in China from 2009, and then a craze swept the country.
This animation tells stories which happened between a group of clever sheep and a couple of hapless wolves.

The majority of children choose “Pinyin” as their input method. When about if they noticed wrong Chinese characters they typed while chatting online, all pupils chose yes but only some of them consider it to be a problem. When asked about why they choose “Pinyin” as their input method, all pupils answered because they started to learn it from 5 or 6 years of age, and it is easy for them now. After we explain what “Wubi” is and the rules of it, the children showed big curiosity in that and wanted to try.

2.2 Functions’ Specification

Requirements were clearer after our interviews. Based on the results, we mainly separated our software into two parts: the student part and the teacher part. Then we specified functions for each.

2.2.1 Functions for Pupil

From the children’s point of view, they need functions that teach rules about “Wubi” and offers practice after that. Yet a tedious teaching-practice model cannot attract the pupil and keep them sitting down to learn. As a result, at the very first time, we decided to set two activities for the pupil. There were “Wubi” practice and game. Children can decide which activity they want to do after login to their pupil page.

The practice part is created for pupil to learn rules about “Wubi”. Since there are too many rules and etymons need to be remembered by pupil, we then changed practice into two different levels: primary and advanced, so pupils can learn step by step.

In the game part, three mini games were designed to connect “Wubi” to assistant the pupil’s remembering process. The purposes of these games are to help the pupil remember the rules and how to match Chinese etymons to keys on the keyboard. This was the most important part of our software. We hoped that children would be skilled as well as inspired from the games.

A homework function was highly recommended by one of our teacher interviewees. He believed that this function could be helpful in both typewriting practice and Chinese learning. So we decided to set this function similar to the “Wubi” practice part. The only difference is that what the pupil practice all come from their textbook.

What is more, user interfaces should be designed children-friendly, so lots of animations and colorful pictures should be used as decorations to make the interfaces more eye-attractive.
2.2.2 Functions for Teacher

As we mentioned before, teachers hoped that we linked this software with a textbook, so pupils can review what they learned while playing. So we added two functions, assign homework and check homework, which let the teacher assign optional homework to their pupils and check if their pupils finish them. In the assign homework part, teachers are allowed to choose different lessons and questions for different classes. In the check homework part, teachers are enabled to view all pupils’ state to their homework.

Different from pupils, teachers preferred tidy and clear interface, in which information can be found immediately.

2.3 Prototype Creation

When the design process from operative image to specification, the accuracy of the requirements “can only be judged when users review the requirements”. [10] There are many good methods that can contribute in this very first step of design, such as prototype, persona, scenario or storyboard. In which “prototypes are widely recognized to be a core means of exploring and expressing designs for interactive computer artifacts”. [13] Prototypes can easily reveal designer’s ideas and products’ features. It “stimulates reflections”, so could be used to “frame, refine, and discover possibilities” in a design space. [14]

There are two main kinds of prototypes: hi-fi prototype and lo-fi prototype. Hi-fi prototypes have high similarity with real products. However, this kind of prototype takes too long to build and change and people believe it as a real product during evaluation process. Different from hi-fi prototype, lo-fi prototypes are easy to build and change in a short time. Testers, on the other side, will concentrate more on the big issues, such as the flow of the conversation or the general layout of the controls, rather than the choosing colors or the prettiness. Thus it will “effectively educate developers to have a concern for usability and formative evaluation”. [15]

Following the analysis in the previous paragraph, we choose a lo-fi prototype to initialize our idea. While observing pupil interviewees’ computer class, we found that it is a little bit hard for those children to imaging paper user interface into a real computer interface. As a result, based on our data collection and function specification, we decide to use a series of PowerPoint slides, which contains basic interface outline and functions, instead of paper prototype as our UI and to do the evaluation. This prototype can be found in the appendix.

2.4 First Term Evaluation

Whether or not software is user friendly is associated with its usability. The most effective technique to find the usability problems is a usability test. One of the most favored, low-cost, high-effective technique usability test is a “Think-aloud test”. [10]
In our test, we invited three children who are 10 years old to be our potential users, one female and two male (Figure 1). During the test process, they were asked to explain what he/she is doing and why. We as test team observed and recorded his/her action, behaviors and speech. Some usability problems were found during this test, such as unclear and ambiguous words.

![Figure 1. Children are doing our test](image)

Also this test still has some short comings. First, the three participants were selected by their teacher, so their daily behaviors and score must be considered. Second, we intended to use video to record this test process and help our analysis. Unfortunately, the children’s parents did not allow us to do so.

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This picture is owned by Qian Li
3. Design of REWT

This chapter will present the tools we used to develop REWT, and the main function of REWT.

3.1 Requirement of REWT

Based on our goal and the results of research, REWT must have the following functions (Figure 2):
1) Users log in
2) Beginners do primary practice
3) Pupils do advance practice
4) Pupils play games and compete with their scores against others
5) Pupils do homework
6) Teachers assign homework
7) Teachers check homework

![Function tree of REWT](Image)

3.2 Tools

3.2.1 Language—Java

We decide to choose Java because of 3 properties Java has: easy to use, reliability and platform independent. [16]
3.2.2 IDE—Eclipse
The Eclipse platform is an open-source (free) IDE that is fully extensible. [17] The main reason we choose it is its SWT (Standard Widget Toolkit) which can make GUI more beautiful.

3.2.3 Database— Microsoft Office Access, JDBC
The Microsoft Office is installed in the computer room of most Chinese elementary school, so we choose Access to store user information, and we use JDBC to operate database.

3.2.4 RMI
The Java RMI is a useful mechanism for invoking methods of remote objects. The Java RMI allows one Java Virtual Machine to invoke methods of another, and to share any Java object type, even if client or server has never come across that object type before. [18]

3.2.5 Libraries
For GUI, we use java.awt, javax.swing, org.eclipse.jface, and org.eclipse.swt.
For RMI, we use java.rmi.
For sound, we use sun.audio.
For database, we use java.sql.
For other data processing, we use java.io and java.util.

3.3 Other Assets
3.3.1 Sound
We picked some sprightly sounds which style are suitable for REWT, edited their time to suit our software using the GoldWave sound editor software. The formats of sounds we used were .au, .wav, and .mid.

3.3.2 Graphics
We chose some pictures from our photo galleria and then edited them to what we needed with Photoshop. The formats of the pictures we used were .jpg, .gif, and .png.
4. Implementation and GUI of REWT

REWt has two main parts: client and server. The server side is used to manage the database and homework file, and communicate with client side. It has a database: WubiSoftware.mdb, a file folder: txt_server, an interface: ServerInterface and two classes: Server class and Rejected class. The client side offers eight activities to the user: login, logout, check homework, assign homework, do primary practice, play game, do advanced practice and do homework. It has 34 classes which will be described in 4.2, 4.3 and 4.4, and three folders: txt_client folder to store question thesaurus, sound folder and picture folder.

4.1 Server
There are two classes to implement server side, Rejected class, and Server class.

4.1.1 Rejected Class
The Rejected class extends java.rmi.RemoteException, and its main purpose is to help us program. It throws specific error information designed by ourselves.

4.1.2 Server Class
The Server class extends UnicastRemoteObject, and it implements ServerInterface. ServerInterface includes eighteen methods which can be invoked by client. These methods will be described together with client side in 4.2, 4.3 and 4.4

4.1.3 Database
There are 10 tables in WubiSoftware.mdb now. “信息 (information)” table stores basic information (ID, name, profession, status, class and password) of users. “射击正确率 (shooting accuracy)” stores the best record of Shooting game. “拼图得分 (jigsaw score)” stores the best record of the Jigsaw game. “连连看效率 (linking rate)” stores the best record of the Linking game. The other six tables store the homework condition of pupils in six classes.

4.1.4 File Folder
On the server side, a homework question thesaurus and all the saved homework is put in the “txt_server” file folder.

4.2 Client
The classes of the client side will be described in the order of user activity.

The Client class implements the login activity. It extends UnicastRemoteObject, and implements ClientInterface, which includes the “receiveMsg” method to receive a message from the server.
4.2.1 Login Activity

The GUI for the login activity is shown in Figure 3. In this activity, the user first chooses his/her profession, and then input username and password accordingly. Finally the user press the “login” button to finish this activity. The right of Figure 3 is the GUI when the user can not login successfully. It may have two reasons that user can not login. One is wrong ID or passport, the other is that the user is already logged in.

As shown in Figure 4, a client requests to login and transmits ID, password and profession (pupil or teacher) to server through “login” method of Client class. The Server checks the information in the database, determines whether the client can login and updates the user status (online or offline) in the database through the “login” method of Server class, and gives feedback to the client through the “callbackMsg” method of Server class. The client receives this feedback through “receiveMsg” of Client class, and changes to the window according to the user’s role (teacher or pupil).
After login, there are two different kinds of home page as shown in Figure 5. The TeacherStart class implements the Home page (Figure 5_top) after a teacher logs in successfully. The teacher can select three activities: assign homework, check pupils’ homework and logout. Details will be given in section 4.3.

The welcome class implements the Home page (Figure 5_bottom) after a pupil logs in successfully. The pupil can select four activities: do primary practice, do advance practice, play game and do homework (Figure 6) matched with four different buttons at the bottom of

\[ ^2 \text{All this two background pictures are owned by Qian Li} \]
the screen. While the user uses the mouse to enter each button area, introductions will show to
tell the user what will happen after they push that button. Details will be given in section 4.4.

Figure 6. Pupil Home Page

4.2.2 Logout Activity

![Logout Activity Diagram]

The “logout” method of the Client class will be called if the user clicks the “logout” link (to
the Login page) or closes the window (exit system). As shown in Figure 7, the “logout”
method of the Client class transmits the logout request to the server, and then the “logout”
method of the Server class updates the user’s online status in the database.

4.2.3 File Folder

On the client side, the question thesaurus used in advanced practice is put in the “txt_client”
file folder.
4.3 Teacher
This section will introduce two functions: Check homework and Assign homework, designed for teacher.

4.3.1 Check Homework Activity

![Check Homework Page]

The GUI of checking homework is shown in Figure 8. The teacher selects a class he/she wants to check, then he/she will see the homework status (completed, uncompleted or unpublished) of pupils in that class. Besides, the teacher can return to the homepage or logout in this page.

![Check Homework]

The Hwcheck class implements this activity on the client side. As shown in Figure 9, the “creaModel” method of the Hwcheck class sends the check request and class name to the server. The “checkHw” method of the Server class gets the pupils’ homework information from database, and returns a table model to the client.
4.3.2 Assign Homework Activity

The GUI of assigning homework is shown in Figure 10. After the teacher selects a class, he/she can edit homework and publish it to pupils. Teachers add questions in two ways: from a thesaurus, or write by themselves in the specific format. Teachers can delete or save as many questions as they want, but once the homework is published, it cannot be changed. Besides, teacher can return to the homepage or logout in this page. The wrong homework format, wrong number of homeworks or an attempt to publish a homework which has
already been publish will all cause errors. The bottom one of Figure 10 is the notice of errors when the operation is wrong.

The Hwassign class implements the GUI of the assignment activity, and the Homework class implements the function part of this activity. The “addFromDataword” method of the Hwassign class calls the “addFromD” method of the Homework class to complete the “add” activity. The “delete” method of the Hwassign class calls the “delete” method of the Homework class to complete the “delete” activity.

Figure 11 shows the process if the user wants to publish homework. The “saveHw” method of Hwassign class calls the “saveHomework” of Homework class, which sends the homework array to the server. The “savehw” method of Server class creates a new txt file in txt_server file folder to store homework. This part is the activity of “save” homework. If user wants to publish homework, despite the “save” homework part, the “assignHw” method of Server class will also be called to update the database.

4.4 Pupil
This section will introduce four functions: Primary Practice, Advanced Practice, Play Game and Homework, which are designed for pupils.

4.4.1 Do Primary Practice
After choosing to do primary practice in the home page, the pupil comes to the page which is shown in Figure 12 (Etymon_Group_Choose Page). The TypeExecCh class implements this page. The pupil can select five activities:

Return to home page: by press “homepage” link, the user will go back to the home page (Figure 5-bottom).
Logout: by pressing the “logout” link, the user will go back to the login page (Figure 3).

Choose etymon group: the user can choose from one to five etymon group(s) they want to learn in Primary Practice. These etymon groups are defined by “Wubi Rules”. This “Wubi Rules” is like the alphabet in English or numbers in Mathematics.

Figure 12. Etymon_Group_Choose Page

Figure 13. Etymon_Rhyme
**Read etymon rhyme:** as shown in Figure 13, after successfully having selected etymon group(s), the user can learn rhyme which could help them remember etymons distribution on the keyboard. The TypeExePre class implements this page. The pupil can select four activities: return to home page, logout, choose etymon group again, and do primary practice.

Do primary practice: as shown in Figure 14, eight etymons from selected group(s) will be shown in this practice to test if the user matching different etymons with their keys. The pupil can select seven activities: return to home page, logout, review etymon rhyme, do primary practice, choose etymon again, try again and do advanced practice. The pupil is expected to type the corresponding right “Wubi” keys. The accuracy will be given once this exercise is completed. The last three activities can be selected only when one exercise is completed. If the pupil want to read an etymon rhyme, a window filled with the etymon rhyme which is implemented by the ExePrePop class will pop up. The TypeExe class implements this page.
All of these activities have nothing to do with the server side.

### 4.4.2 Do Advanced Practice

After choosing to do advanced practice in the home page or in the primary practice page, the pupil comes to the advanced practice page (Figure 15). The TypeExeAd class implements this page. The pupil can select five activities: return to home page, logout, do advanced practice, try again, and return to primary practice. The last two activities can be selected only when one exercise is completed. There are four Chinese words in one exercise, and the pupil is expected to type the corresponding right “Wubi” keys. The accuracy will be given once this exercise is completed. If pupil wants to read “Wubi” rules, a window filled with the “Wubi” rules will pop up, which is implemented by the ExeAdPop class. Questions in the advanced practice are taken from the txt_client file folder.

All the activities of advanced practice have nothing to do with the server side.
Figure 15. Advanced Practice
4.4.3 Play Game

There are three games: Jigsaw game, Linking game, and Shooting game. After choosing to play a game in the home page, the pupil comes to the page which is shown in Figure 16 (game_choose page). The GameCh class implements this page. The pupil can return to home page, logout, play one of three games, and check best record of three games.

---

*All background pictures are owned by Qian Li*
The Jigsaw game makes the pupil remember which etymon is on which key unconsciously. In this game, there are twenty five pictures with all the “Wubi” etymons corresponding to the A-Y keys on the keyboard. Music and sound can be turned on or turned off in the music set panel. Score=500- the number of steps- the used time/5. When the game completes, the “jigsawRecord” method of Server class is called to check the record in the database. If a new score breaks the record of this pupil, it will be written to “拼图得分(jigsaw score)” table in the database. The GUI of the Jigsaw game is shown in Figure 17. The Canvas class and the Frame_jigsaw class implement this game.

Figure 17. Jigsaw Game

*Background picture is owned by Qian Li*
The Linking game is to make the pupil more familiar with the distribution of etymons and distinguish them at the same time. In this game, the three most used etymons are chosen from each one of the A-Y keys. Each etymon is made into a picture. The pupil can erase two pictures if these two etymons belong to the same key. Music and sound can be turned on or turned off in the music set panel. The pupil can select the amount of the pictures in the beginning (level 1, level 2, level 3 and random level). The score of the Linking game is the number of erased pictures per second. When the game completes, the “llkRecord” method of Server class is called to check for a record in the database. If new score breaks the record, it will be written to the “连连看效率(linking rate)” table in database. The GUI of the Linking game is shown in Figure 18. The Control class, GamePanel class, ImageLoader class, MainFrame class and Model class implement this game.
In the Shooting game, each etymon is made into a picture; the pupil is to clear up the pictures dropping from the upper side of the screen by typing the corresponding key before the picture disappears from the bottom of the window. The pupil can select the speed of the pictures dropping (1, 2, 3 or random) before the game starts. Music and sound can be turned on or turned off in the music set panel. The time of one game is 60 seconds. When the game completes, the “keyTestRecord” method of Server class is called to check for a record in the database. If the score breaks the record, it will be written to “射击正确率(Shooting accuracy)” table in the database. The GUI of the Shooting game is shown in figure 19. The GamePanel_keyTest class, ImageChar class, and KeyTest class implement this game.

---

5 Background picture is owned by Qian Li.
When the pupil wants to check a game’s record, as shown in Figure 20, the “checkLLK”, “checkKeyTest” or “checkJigsaw” methods of the Server class are called to check the record in the database, then return the corresponding record table to the GameRecordPop class, which implements the pop-up window showing the table (Figure 21). The top picture is the game record of the Jigsaw, the middle is the Linking Game, and the bottom one is the Shooting Game.
Figure 21. Game Record

<table>
<thead>
<tr>
<th>name</th>
<th>grade</th>
<th>level random</th>
<th>level 1 to level 3</th>
<th>level 1 to level 3</th>
<th>level 1 to level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>珍妮</td>
<td>2年3班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小红</td>
<td>2年4班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
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<td>2年5班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
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<td>2年6班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小明</td>
<td>2年7班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小丽</td>
<td>2年8班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小强</td>
<td>2年9班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小刚</td>
<td>2年1班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小伟</td>
<td>3年2班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
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<td>3年3班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小云</td>
<td>3年4班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
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<td>1.02</td>
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<td>0.0</td>
</tr>
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</table>

<table>
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<th>grade</th>
<th>speed random</th>
<th>speed 1-3</th>
<th>speed 1-3</th>
<th>speed 1-3</th>
</tr>
</thead>
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<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小红</td>
<td>2年4班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小亮</td>
<td>2年5班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小慧</td>
<td>2年6班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小明</td>
<td>2年7班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小丽</td>
<td>2年8班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小强</td>
<td>2年9班</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小刚</td>
<td>2年1班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小伟</td>
<td>3年2班</td>
<td>2.0</td>
<td>1.02</td>
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</tr>
<tr>
<td>小军</td>
<td>3年3班</td>
<td>2.0</td>
<td>1.02</td>
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<td>0.0</td>
</tr>
<tr>
<td>小云</td>
<td>3年4班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>小刚</td>
<td>3年5班</td>
<td>2.0</td>
<td>1.02</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
4.4.4 Do Homework

After choosing to do homework in the home page, the pupil comes to the page which is shown in Figure 22 (homework_choose page). The AssChoice class implements this page. The pupil can select three activities: return to home page, logout, and choose the lesson of homework. Homework has three statuses: finished, unfinished and unpublished. The unpublished homework cannot be chosen in this page. Figure 23 shows the process of checking homework status. The “iniAss” method of AssChoice class first sends the request of checking which class this pupil belongs to and the pupil’s name to the server. The “checkClass” method of the Server class checks in the database, and returns the class name to the AssChoice class. Then the “iniAss” method of the AssChoice class sends the check homework request to the server. The “checkAss” method of the Server class checks this pupil’s homework status in the database, and returns results to the AssChoice class.

Figure 22. Homework_Choose Page

Figure 23. Get Homework Status
Figure 24 shows the homework page, which is implemented by the Assignment class. The pupil can select three activities: return to home page, logout, and try again. There are 8 questions in one exercise, and the pupil is expected to type both the corresponding right “Wubi” keys and “Pinyin” keys. The accuracy will be given once this exercise is completed. If the accuracy is 100%, a congratulation window will pop up, which is implemented by AssPopup class. At the same time, the “completeHw” method of the Server class will change the homework status to “finished” in the database.

Figure 24. Homework Page
Figure 25 shows how the Assignment class gets the homework question from the server. The “iniAssignment” method of the Assignment class sends the homework request to server. The “getExistHw” method of the Server class gets the homework question array from the folder of txt_server, and then returns it to the Assignment class.
5. Test and Evaluation of REWT

Evaluation means reviewing, trying out or testing REWT to discover whether it meets criteria, such as learnable, effective and accommodating. [10] In this chapter, we will introduce the second evaluation after we implement REWT. Our evaluation method and results will be given.

5.1 Evaluation Method

Evaluation can be involved in nearly every different design process to guide and correct its direction. There are two main types of evaluation: participant-based methods and expert-based methods. An expert-based method is a simple, relatively quick and effective method which just needs to get experts to look at the system and try using it. “Experts will pick up common problems based on experience and will identify factors that might otherwise interfere with an evaluation by non-experts”. [10]

Cognitive walkthrough is one of the expert-based methods when experts examine the design by a rigorous walk through a list of cognitive tasks to check the detailed design and logic of steps. Processes of Cognitive Walkthrough are listed below:

- **Defining the Input to the Walkthrough**
  
  *Who will be the users of the system?*
  *What task(s) will be analyzed?*
  *What is the correct action sequence for each task?*
  *How is the interface defined?*

- **Walking Through the Actions**
  
  *Will the users try to achieve the right effect?*
  *Will the user notice that the correct action is available?*
  *Will the user associate the correct action with the effect to be achieved?*
  *If the correct action is performed, will the user see that progress is being made toward solution of the task?“*

----Cognitive Walkthrough [19]

We choose this method for two main reasons. First expert-based evaluation can be carried out by designers whereas participant-based evaluation need users involved. Second, compared with other expert-based evaluation, such as Heuristic Evaluation which is more suitable to evaluate a set of interfaces rather than a whole system [20], principles of this method are easy to follow. Thus it is easy to find usability problems of REWT while finishing tasks.
5.2 Evaluation Result

Limited by time and lack of experts, we invited four students from the Program of Interactive Systems Engineering at KTH to help us finish this evaluation. These four participants were all Chinese so they understood our software purpose better than other nationalities. All of them were asked to analyze four tasks below based on the principle of Cognitive Walkthrough:

1. Try to finish primary practice and advanced practice as a pupil.
2. Try to play games as a pupil.
3. Try to finish homework as a pupil.
4. Try to assign and check homework as a teacher.

The results are presented with their respective tasks in the following sections.

5.2.1 Task 1

In this task, the pupil will be the intended user. Participants were asked to try to finish primary practice and advanced practice. The correct action sequence was:

- login in → click primary practice button → choose group(s) of Wubi Etymons → click to rhyme button → learn rhyme → click to primary practice button → finish primary practice → click to advanced practice button / back to homepage and click advanced practice button → finish advanced practice

The function of this part is to help the user remember etymons several times with different levels of practice. In this part, all of the four participants agreed that the user can achieve the mainly right effect efficiently. However, some usability problems were pointed out by our participants:

1. Three of four participants thought that it lacks an introduction before primary practice. Thus for the beginners of learning "Wubi" input method, the complicated rules might confuse them.
2. All four were participants confused by the button “go to advanced practice” at primary practice. However, if the child has not learned all etymons in primary practice, they should not be allowed going to advanced practice. This is because what is tested in advanced practice is designed for users finished with all primary practice.
3. In advanced practice, typing rules can only be opened while practicing but do not appear automatically for the one who first enters this part. All of four participants considered it as a big problem, because without the lacking of rules or introduction, a first-time-user may not know what to do after they came to this page.

All four participants considered that the interface is visible and clear and the user knows how to run the process correctly. The user can associate the correct action with the effect to be
achieved. After the correct action is performed, feedback like accuracy is given, so the user sees that progress is being made towards the solution of the task.

Some other usability problems found during this evaluation:

1. Two of our participants thought that the “Try again” button in both primary practice and advanced practice does not exactly tell the user if the system will let the user try the same questions again or a new group of questions.
2. Four of our participants thought that the “Homepage” link in every page should be changed into “Back to Homepage”.

5.2.2 Task 2

In this task, the pupil was the intended user. Participants were asked to try to play three games. The correct action sequence was:

login in → click game button → choose one game → play it

The four participants are all thought it is clear for the user how to achieve the right game they want. The propose of the three games was well defined. The user could see that the correct action is available and associate it with the effect. However some usability problems were noticed:

1. Jigsaw: one participant thought that it is better to have a notice between “choose a picture” and “start” the game. The meaning of the replay button was clear.
2. Linking Game: All four participants found that “Start” button and “Refresh” button did not have big difference. The “Refresh” button did not tell if it went back to the beginning of the turn or provided a new start.
3. Shooting: All of our participants pointed out that it lacks a feedback after the user type buttons and shooting icons on the screen. The user did not know which one he shots.

The interface was clear but not unified, such as the appearances of button and menu. One participant considered it as a problem. Some other function design problems were found during this evaluation:

1. One of our participants indicated that the system cannot remember the settings of a user. For example, the user has to turn the background off every time he starts a new game.
2. One of our participants tried to found a quick solution function for Jigsaw which is not available in our system. This participant believed that children might lose their patient if they cannot successfully finish this game.
3. Two of our participants pointed out that etymons cannot be chosen in Linking Game and Shooting Game. They believed that for the children who have not learned all the five groups of Etymons, they cannot play these two games.

5.2.3 Task 3
In this task, the pupil was the intended user. Participants were asked to try to finish homework. The correct action sequence was:

    login in → click homework button → choose an unfinished homework → finish homework → get result of homework.

All participants thought it was mainly clear for the user to finish their homework in this part. The user could notice that the correct action is available and associate it with the effect. However, some usability problems were found:

1. One participant thought that the description in the homework page was not clear. “Phrase” should change into “word”.
2. The “Back” button went back to the homepage directly and not to the page where the user could choose another lesson. All four participants considered it a big problem.

5.2.4 Task 4
In this task, the teacher was the intended user. Participants were asked to try to finish task about assigning homework and check pupil’s state of homework. The correct action sequence was:

    login in → click assign homework button → choose one class → add questions to homework → publish homework → back to homepage → click check state button → choose one class → check state

All of four participants thought it is mainly clear for the user to assign homework and check the pupil state in this part. The user can basically notice that the correct action is available and associate it with the effect. However, some usability problems were noticed:

1. All four participants pointed out that there was not a clear notice to tell the user about the question number limit.
2. All four participants indicated that the example of the homework format did not tell the user word limit.
3. All four participants thought that there was no feedback after publish or save.
4. All four participants found that questions in the thesaurus can be added repeatedly, which do not conform to custom.
5. Three of four participants pointed out that the wrong action notice did not disappear.

All four participants believed that the interface was clear. Yet some other function design problems were found during this evaluation:

1. All four participants doubted about the limitation of 8 questions for each lesson. They thought that it is not necessary. Users should have more freedom on this part.
2. One of our participants thought that the pupil state check page lacks some more details from the pupils.

5.3 Evaluation Summary

Through these four evaluation tasks, all of our participants looked through the main functions of REWT. They got a general understanding and considered it a children-friendly software. Basically the interfaces were clear and simple enough for children to operate. Colorful and attractive pictures, practice functions, especially games were special designed, and that probably provide more fun for children in the learning process. Still as described in the last section 5.2, this software needs to be polished and modified in several places.

First of all, there are some ambiguous and unclear descriptions needed to be renamed. Such as “try again” and “homepage” found in task 1, “Phrase” and “Back” in task 3. These unclear descriptions confused users which may make them lost in the system.

Second, some serious usability problems need to be remade carefully. An introduction page is found to be necessary before advanced practice (task 1). Pupils should not able to do advanced practice unless they learned all groups of primary practice (task 2). What is more, functions of the “Start” button and “Refresh” button in Linking Game need to be combined (task 2).

Third, some system settings need to be modified. For example, Linking game and Shooting Game could be designed to have different levels matched with different etymons groups. After children learn new groups of Etymons, new levels in these two games are appeared. This could inspire children’s interest (task 2). When a teacher assigns homework, there should be no limitation on the number of questions (task 4).

Last but not least, some user-friendly settings will make the interaction process smoother. Such as let the system remember users’ settings (task 2), add a feedback after the user types in Shooting Game (task 2), add a quick solution for the Jigsaw game so the pupil would not lose
their patience, and add more notices and feedbacks while the teacher assigns homework (task 4).
6. Conclusion and Future Work

To help the phenomenon of character amnesia in China, we started this thesis work. The goal of this thesis work was to design and implement an education software to help children learn "Wubi" breezily. The software was named “Remote Education Software for ‘Wubi’ Typewriting” (REWT).

In the beginning, we did a lot of research work, such as data collection, function specification, prototype creation and evaluation. Based on the goal and the suggestion we got from our research, we decided to let REWT software have seven main functions: Users log in, Teachers assign homework, Teachers check homework, Beginners do primary practice, Pupils do advance practice, and Pupils do homework and Pupils play games (jigsaw, linking and shooting game) and compete with their scores. During the implementation process, we learned some new Java libraries we never used before, such as AWT, SWING, and SWT. We also reviewed different investigation and evaluation methods. After REWT completed, we made test and evaluation. The result can be regarded as good, all the above seven functions run well, so we can say the goal of this thesis work is achieved. But we also found some places which need to be improved in future work.

Limited by time and funds, we did not do the comparison between REWT and other “Wubi” teaching software after we implement. This work is still necessary. As to the effect of REWT, it can be seen only when it is used widely for a long time, so we will also observe its use in future.

There are four works which will be done in the future. First of all, modify REWT depending on the evaluation. Second, REWT will have more functions, and one of the ideas is to create an online game competition area. In this area, children can complete their game and view other classmates’ game panel at the same time. We believe this function will be more eye-catching. Third, a monitor will be used in the implementation of REWT to make every thread run more effectively. Last but not least, we will invite more participants to do evaluation about system performance like fault-tolerance.
Reference


[3] **1300 kinds of typewriting method, how many have you seen?**: googlelab, last viewed at 13th December 2011, http://googlelab.net.cn/?p=1496


[9] **Function of Bilingual Education**: Weidong Guo, Newspaper of Xinjiang Normal University, 2004, (3)


Appendix – Prototype of REWT

Figure 26 Login Page

Figure 27 Welcome Page for Student

Figure 28 Choose Wubi Etymon groups in Practice Page
Figure 32 Advanced Practice Page

Figure 33 Game Page

Figure 34 Choose Homework Page
Figure 35 Do Homework Page

Figure 36 Welcome Page for Teacher