

Computer Games Improve Learning Chinese

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¹Abstract Due to the differences between the Chinese character and the alphabetic writing system, learning Chinese has always been considered difficult for non-native Chinese. This paper introduces a few computer games developed for research on how computer games can help instructors and students in Chinese classes. Beginner-students participated in this study are divided in two groups with one group using computer games and the other without. The results of the study indicate that the teaching materials with the computer games improved not only short-term learning results but also long-term learning interests.

Keywords: Computer games, Learning Chinese with Computer Games

1. Introduction

Along with the development of the internet and economic globalization, a second language skill is considered necessary in today's business environment. In the United States, there has been a rapidly growing interest in learning Chinese in recent years [1]. According to a recent report, there are 264 K-12 schools offering Chinese classes in the United States (US), and 185 colleges and universities US now have educated programs in China[2]. Based on a most recent enrollment survey of "Foreign Language Enrollments in K-12 Public Schools" provided by the American Council on The Teaching of Foreign Languages, from school year 2004-05 to school year 2007-08, more US K-12 public school students enrolled in foreign language courses than ever before, the enrollment of Chinese language was the largest with an increased enrollment of 195 percent [3].

As more and more students in K-12 public schools and western colleges and universities learn Chinese as a foreign language, research that focuses on how learners deal with different orthographic systems will be of critical importance. In our study as part of research for a Computer-Assisted Chinese Learning System (CACLS), a computer-game-based Chinese learning environment is developed to help instructors and students in learning Chinese efficiently. This environment includes different types of games. The purpose of each game is to improve one or two capabilities of Listening, Speaking, Reading or recognizing, and Writing in Chinese. In this paper, one game will be discussed in detail: Treasure Island Game. Other games will be introduced briefly.

2. Treasure Island Game Design

The beautiful island is in the middle of the sea above an adventure resides. Pirates come to the island from boat in the bay. Pirates stored uncountable treasures on the Treasure Island. The treasures are protected by secret codes. Pirates are cautious and change their secret code often. Pirates whisper the code to other pirates. The adventurer overhears the code and has limited time to use each code to get the treasure. Pirates are smart and can always find the adventurer if the adventurer does not move. The pirates follow the foot

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prints of the adventurer. Therefore, anywhere the adventurer goes, the pirates can find the path and follow. The pirates always use the shortest path [4] to approach the adventurer. Objects such as a hill, trees, even treasures can be obstacles, preventing the adventurer from moving. Multiple levels are used for the game. Advanced players can use the higher level with more challenges due to more and smarter pirates and more treasures.

Each treasure is marked by a secret code, a Chinese character. The pirate can use multiple characters to form a meaningful phrase or sentence as the secret code. The computer background is actually pronouncing the Chinese character. The adventurer (player), based on what is heard, must move quickly to the treasures, the Chinese characters, and fetch them; and in the mean time the adventure must to avoid from being captured by the pirates.



Fig. 1: Treasure Island game interface for lesson one

The design goal of this game is to improve the user's ability of reading and listening of Chinese characters that have been introduced already in the Chinese class. Playing the game can be homework. Once the score reaches a certain number, the player has finished the homework.

In the above Fig. 1, the screen shot is for one version of the game for one lesson. The adventurer (player) is devoted by a panda bear.

3. Algorithm Design

There are two characters in the game, the adventurer and the pirate(s). The main algorithm is the one used for the pirates. For the pirates, a modified shortest path algorithm is used. Because the path has a width, the pirate has to follow one side of the path in order to experience the entire path if necessary to reach the target by shortest path. The direction is adjusted at any point based on the adventurer's current location so that the shortest path can be used. The following steps present the algorithm in design:

Step 1: Initialize

speed = 2;

Step 2: Compute initial direction based on adventure and pirate locations

$dx = (x_m - x_1) / len;$

$dy = (y_m - y_1) / len;$

where x_m and y_m are adventure current location. x_1 and y_1 are pirate current location. Len is line distance from pirate to adventurer.

Step 3: Keep moving until reach the target

For(;;)

{

Pirate.x += dx*speed;

Pirate.y += dy*speed;

If (len <= pirate.width) found the adventurer and break;

else find new direction since both pirate and adventurer may have moved

```

ndx = (xm-x1) / len;
ndy = (ym-y1) / len;
Check if this direction can reach target by
If yes then use this direction {dx=ndx; dy=ndy}
Else {
  Compute new direction searching in 180 degrees
  theta = Math.atan(dy/dx);
  dTheta = Math.PI / 6.0;
  var r = speed; ii=0;
  for(var i=1; i < 7; i++){
    var tx = r*Math.cos(theta + dTheta * i);
    var ty = r*Math.sin(theta + dTheta * i);
    if adventurer is reachable{
      ii = I;
      break;
    }
  }
  if adventurer is reachable, use this new direction incremental {
    dx = Math.cos(theta + dTheta * ii);
    dy = Math.sin(theta + dTheta * ii);
  }
  } else use the other compensation direction incremental {
    dx = Math.cos(theta - dTheta*(ii-1));
    dy = Math.sin(theta - dTheta*(ii-1));
  }
}
}
}

```

The adventurer is controlled by the game player. There are no particular algorithms used for it except checking if the adventurer gets the treasure or is caught by the pirates.

4. Implementation

The Treasure Island game is eventually implemented in Adobe Flash as a 2D animation game.

The treasure as shown in Fig. 2 is marked by Chinese characters as a secret code and implemented as a flash movie clip object.



Fig. 2: Treasure and secret code

These Chinese characters are entered into the game by the Chinese instructors for different exercises. For each session of a game, Chinese characters used are randomly selected from the instructor's inputs. The treasure locations are also randomly arranged on the island by the program for each session. This makes sure that the student player really learns the Chinese character when his or her player score is high enough.

Other objects such as trees, hills, and waterfalls, etc. (see Fig. 3) are also implemented as movie clips.



Fig. 3: Movie clip examples

Each movie clip is controlled by its own procedure and their behaviors are event-driven by actions of the player or the pirate.

Pre-built movie clips are stored on the web server. Chinese characters input by the instructor are stored in a database for each class. When a game session starts, the framework of the game loads the objects and Chinese characters from the web server and stores them in local object arrays. The Chinese characters and their pronunciations are made in sync by naming convention so that appropriate pronunciation is used for each Chinese character. Fig. 4 schematically illustrates the game implementation network architecture.

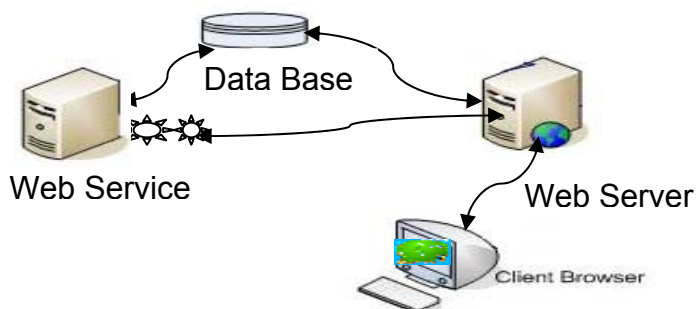


Fig. 4: Treasure Island game implementation network architecture

5. Student Usage Experiences

In order to test if the computer games can help instructors and students improve in teaching and learning Chinese, the computer-game-based Chinese learning environment has been applied into a Chinese classroom. Fourteen students between the ages of six and nine were divided into two groups with seven students in each group: Group G and Group N. Group G was taught within the computer-game-based learning environment; and Group N was taught within a Non-computer game environment. All students are beginners in learning Chinese. The textbook used was Chinese Paradise – the Fun Way to Learn Chinese (2006, 2nd printed) for both groups. Ninety-two Chinese characters across twelve chapters were taught in thirty-eight lessons by the same instructor in Group G and Group N. The only difference was that Group G was taught within the computer-game-based environment while Group N was taught in a non-computer game traditional environment.

During the experiment of teaching thirty-eight lessons in the two groups, each lesson lasts one hour and each textbook chapter was finished in three lessons. In the first lesson of each chapter, the instructor taught new Chinese characters, and in the following two lessons of each chapter, students were tested on the Chinese characters presented in the first lesson. Other class practices were also provided by the instructor.

Test results for all the tests are summarized as in the following Table 1.

Table 1 Test Results for Each Chapters, Midterm Exam, and Final Exam

chapter Scores	1	2	3	4	5	6	Midterm Over first Six chapters
Group G	90%	92%	93%	95%	97%	94%	95%
Group N	85%	85%	87%	91%	90%	88%	90%
chapter Results	7	8	9	10	11	12	Final Over Twelve chapters
Group G	94%	95%	98%	96%	95%	96%	96%
Group N	88%	90%	93%	92%	89%	90%	89.5%

From the above result, it is concluded that Group G with computer-game-based Chinese learning environment consistently shows a better performance than Group N with the non-computer-game-based learning environment.

6. Future Work

Since the student feedback and test result are encouraging, more computer games will be developed in this Computer-Assisted Chinese Learning System (CACLS). The focus will be put on the following areas:

- Computer games that will help students to improve reading comprehension skills. More story contents will be introduced.
- Computer games that will help students to improve speaking skills.

7. Conclusion

This paper presented the preliminary research results on the computer games that can help instructors and students to improve their performance in teaching and learning Chinese, respectively. The preliminary results show that students in computer-game-based learning environment receive better test scores than students in a traditional non-computer game learning environment.

8. Reference

- [1] Sung, H., & Padilla, A. (1998). Student motivation, parental attitudes, and involvement in the learning of Asian languages in elementary and secondary schools. *The Modern Language Journal*, 82(2), 205–216.
- [2] Chinahourly (2010). more schools in the United States, universities offer Chinese courses. <http://www.chinahourly.com>
- [3] Foreign Language Enrollments in K–12 Public Schools: Are Students Prepared for a Global Society? <http://www.actfl.org/files/ReportSummary2011.pdf>
- [4] Dijkstra, E. W. (1959). "A note on two problems in connexion with graphs". *Numerische Mathematik* 1: 269–271.
- [5] I. Yan Liu, Ketao Liu, Dr. G. Scott Owen1, Dr. Rajshekhar Sunderraman, "Design and Development of an E-learning Tool for Children to Learn How to Write the Chinese Words" *Innovations in E-learning, Instruction Technology, Assessment, and Engineering Education* 2007, 401-404, DOI: 10.1007/978-1-4020-6262-9_69