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To Borrow Arrows with Thatched Boats: an educational game for early years under the background of Chinese Three Kingdoms culture

Hui Liang¹, Fanyu Bao², Yusheng Sun³, Chao Ge⁴, Fei Liang⁵, Qian Zhang⁶

¹ Zhengzhou University of Light Industry, Zhengzhou, China

² Zhengzhou University of Light Industry, Zhengzhou, China

³ Zhengzhou University of Light Industry, Zhengzhou, China

⁴ Zhengzhou University of Light Industry, Zhengzhou, China

⁵ Zhengzhou University of Light Industry, Zhengzhou, China

⁶ Zhengzhou University of Light Industry, Zhengzhou, China

hliang@zzuli.edu.cn

Abstract. In recent years, the significance of traditional Chinese civilization is gradually recognized by us. Many studies have shown that serious games are profitable for learning, but they have not yet exerted their tremendous effect in the field of traditional culture. To disseminate traditional cultural education, improve cognitive skills and promote children's interest in learning, we exploited an application using the Unity 3D Game Engine. In this paper, a shooting game is projected with the background of straws boat borrowing arrows, in which children are worked out to complete the collection of arrows through gesture movement and condition selection. In the end, the player's upbeat test results exhibited that the child's mental capacities are smoothly advanced in the game.

Keywords: Chinese culture, Serious game, Ability training, Four-dimensional framework.

1 Introduction

It is vitally important to promoting children's traditional cultural education to the entire society that Chinese traditional culture, as the source of driving force for social development, embodies the essence of each era in thousands of years. At present, a specified amount of children's learning has an akin characteristic in which the comprehending of traditional culture is merely at the level of memory, rather than deeply understand. They are tough to procure various levels of practice and training such as historical knowledge, cognitive ability, coordination ability, and hence on. In this setting, new forms and means of pedagogy are needed by us.

The dominant position of serious games has brought innovative anticipation to traditional Chinese cultural education. The modality of immersing children in virtual reality games is provided with superior interactive effects on educational games. This paper selects the classic battle of the Three Kingdoms period (错误!未找到引用源。 [1]), *Borrowing Arrows with Straw Boats*, and uses this as a background design to

implement an educational game based on natural gesture interaction, *To Borrow Arrows with Thatched Boats*.



Fig. 1. Three Kingdoms

2 RELATED WORK

Virtual reality technology has been involved in entertainment [2], military [3], medicine [4], film and television [5] and other fields, especially in the education industry with an extensive range of applications.

In traditional geography teaching, books, films and television work are frequently utilized as a medium to demonstrate to students. The evaluation of the science course demonstrated that students who performed VR design activities had preferable learning effects, and improved self-efficacy and critical thinking [6]. The study by *Tüzün H* [7] show that students bear a higher intrinsic motivation for learning in the environment of the virtual reality game.

We comprehend art in an immersive manner with the assistance of virtual reality thereby get over art's abstract and obscure. The 3D Museum is also used as learning means to grasp more about art-historical facts [8]. We also hold software that teaches to sing like Sing Master [9].

History will not reemerge until virtual reality technology emerges. Photo-realistic Byzantine church models generated using VR technology can be applied for scientific analysis, preservation-restoration and conservation purpose [10]. Etruscanning 3D is a gesture-based interface project that tells users the history and importance of archaeological discoveries through storytelling [11].

3 SYSTEM DESIGN

Our game design focuses on three aspects, one is the comprehension of history, the remaining two are the training of children's strategic ability and motor coordination ability. There are diverse indicators for testing in allusion to these three aspects of training.

Granting to the design focus, we will depart from the following aspects:

1. To train comprehension of history:

a. At present, the Chinese historical story is an infrequent mold of game development, which can also slim down the threshold of learning history.

b. Children will not only contact the synopsis of the story before the game but also deepen their understanding in the process of the game if taking historical stories as the background of the game

2. To train strategic ability:

a. Have a clear thread of the game's tasks and know how to win the game by manipulation.

b. The player is trained to achieve the objective by choosing the applicable game object. On that point are no unique criteria for these choices, nevertheless, different choices contribute to different scores.

3. To train motor coordination ability:

a. Complete the game by manipulating gestures precisely.

b. Children are required to cooperate with their hands and brain to avoid obstacles and receive the arrow.

Training target of our game is shown in Fig. 2.

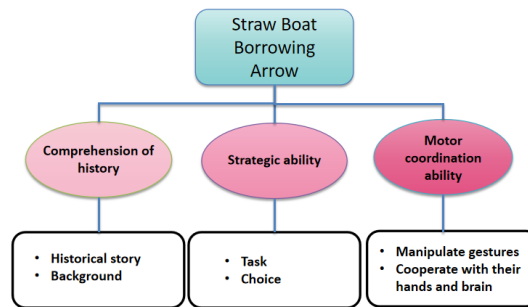


Fig. 2. Training target of Borrowing Arrows with Straw Boats

Virtual environments are used as media for games. The complete VR system is composed of HTC Vive and Leap motion as perception device and tracking device. The children's coordination ability is examined the following three aspects: motor performance, sensory performance, and cognitive performance [12].

The investigation of strategic capability is from the following three angles: favourable climate, geographical position, and support of the people. The ability to interpret and analyze the causal relation boat of things is acquired by the choice of the different game objects. It left a concept in their mind: every "outcome" will be affected by the "choice" he once did. This part is designed to train children's tactical and strategic abilities. Set a certain amount of energy to prevent children from indulging in games. When the energy is exhausted, you need to wait for enough time to continue the game.

The training of Chinese traditional culture runs through the whole game, not embodied in a certain link. The story as background suggestions provided to players before the game. During the game, players appreciate the story details which is used as the framework. Capacity improvement framework is shown in Fig. 3.

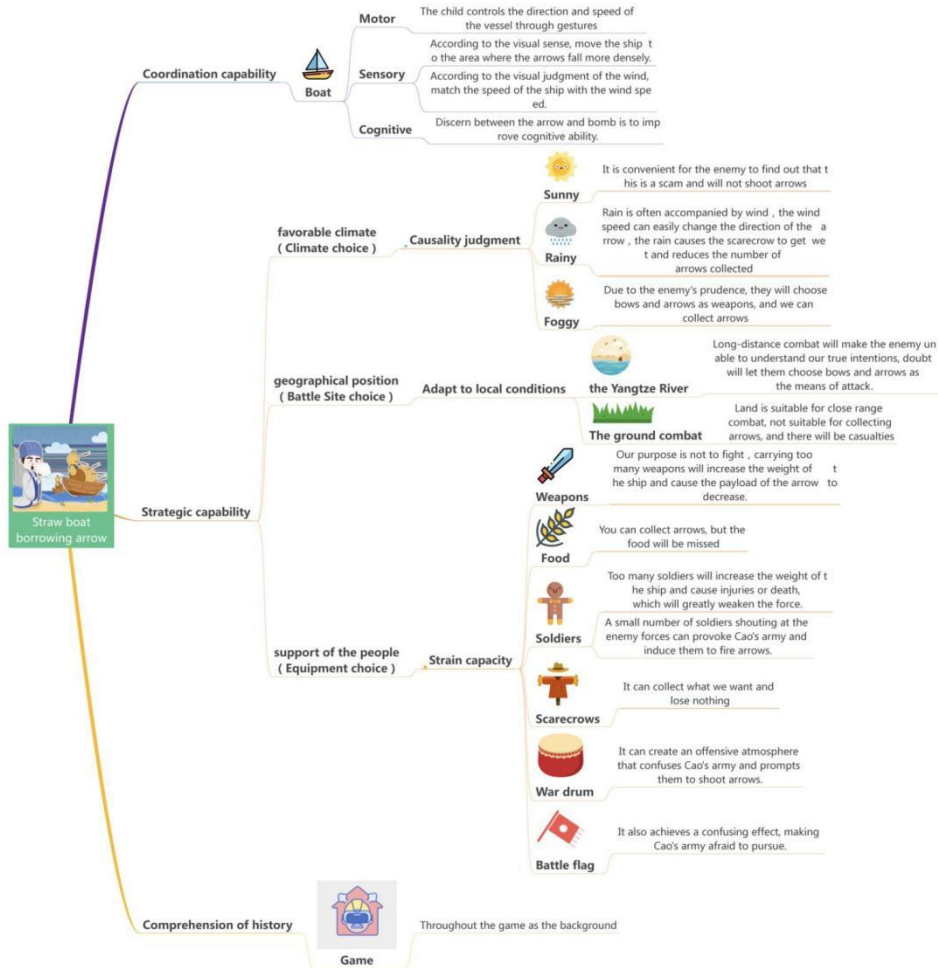


Fig. 3. Capacity Improvement Framework

4 SYSTEM DESIGN

Combined with four types of interrelated sets of activities of *Klabbers* [13] and the use of the four-dimensional framework [14] proposed by *de Freitas, S*, a new education framework is proposed which interaction, presentation, schemas. According to the design focus of the game and the new education framework (Fig. 4) to implement game details.

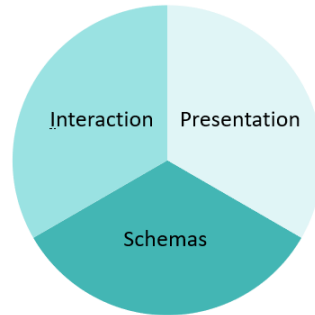


Fig. 4. The education framework

First, teacher-student interaction is one of the important components of the framework. The autonomous manipulation interactive game (Fig. 5) as a medium for teacher-student communication, based on depth-sensing technology, not only helps teachers show knowledge points that intuitive, fascinating and operable, but also presented *the Battle of Chibi* to students in the novel form.



Fig. 5. Game selection interface

The second dimension is primarily for the style of presentation that learners interact with the game by some extraordinary expression tool to immerse in learning. The game combines various elements through Unity to build a realistic and interesting game interface (Fig. 6).



Fig. 6. Collect arrows interface

The schema is a combination of design themes and suitable tools. Chinese traditional culture is irreproducible and untouchable, so we can only observe history through text descriptions. Virtual reality technology has advantages of immersive, conceptual, and interactive. Learners can obtain a new teaching environment combining virtual reality

technology with traditional Chinese cultural education. Learners understand the substance of the game expressions due to the lifelike scenes bring an immersive experience.

These three dimensions construct a framework for this game design, each latitude in this framework is inseparable. They are related and interact with each other, providing more possibilities for learning from multiple perspectives. Game-based learning designed by this framework considers from the perspective of both students and teachers, reducing the risk of losing sight of each other, also has the ability to stimulate students' potential.

5 EXPERIMENT AND DISCUSSION

Twenty students whose age is 6-12 were recruited to assess the effectiveness of our educational game in improving historical comprehension ability, strategic ability, and motor coordination ability. We set some indicators and record the indicator data which are reflected the impact of the game on the children for each round of the game. The results are shown below using the average data of the five rounds of experiments (Fig. 7) and the scoring criteria (Table 1).

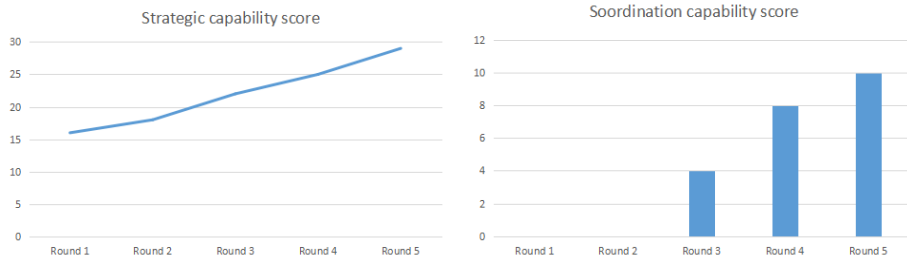


Fig. 7. The average data of strategic capability and coordination capability

TABLE 1. THE SCORING CRITERIA

Choice	Result	Score
Climate	Sunny	5
	Rainy	8
	Foggy	10
Battle Site	The Yangtze River	10
	The ground combat	5
Equipment	Scarecrows	8
	Food	6
	Soldiers	4
	Weapons	3
	War drum	3
	Battle flag	3
	Scarecrows+ (drum, flag, weapons)	10
	Scarecrows+ food/soldier	7
	drum/flag/weapons + (drum, flag, weapons)	3

	others	5
Time	<50s	10
	50s ~ 60s	8
	60s ~70s	6
	> 70s	4
	fail	0

In the game, as long as the player collects 500 arrows to be considered as winning. The test results demonstrate that the children have stepped forward their ability in the following areas.

Strategic capability development: correctly understanding the characteristics of each thing can make an accurate choice in different situations, which is also an amelioration in strategic ability.

Coordination capability development: the brain, hand, and eye need cooperative together to move the boat follow the player's thoughts.

In addition to the training of strategy and coordination ability, it also aids students to deepen their comprehending of the story. We used the same questionnaire which relating to straw boats borrowing arrows to the two groups which the training and active control group. The first group was taken after game which uses the questionnaire and another group did it directly that ten people in each group. Fig. 8 shows that the educational game leads to significantly improve the ability to comprehend history.



Fig. 8. Two group scores

6 CONCLUSION

Educational gamification is a common teaching method nowadays. It is no longer limited to the boring teaching mode in books and classrooms and brings children a new experience in a fun and vivid way. This game involves coordination, thinking, and cultural knowledge. After a series of tests, we can get from this result that children can improve their ability in many aspects while playing. This article just selected a small story from the Three Kingdoms period as an example. I hope that in future research, more traditional culture can be introduced to contribute to the inheritance of Chinese culture.s

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