RESEARCH ARTICLE

A Study of Oracle Educational Game Development and Its Educational Impact on the Unity 3D Platform

Xiaoyun Duan[*, 1] **& Zhaoxiang Wang**[1]
[1]*Anyang Normal University, China*

Abstract: The purpose of this paper is to explore the feasibility and practical methods of developing a creative game aimed at spreading and popularizing the knowledge of oracle bone script using Unity3D game engine, relying on the elimination game form to dismantle the complex ancient Chinese character culture subject, which is entertaining and unique. It is significantly optimized and improved in terms of interactivity than existing games. Through detailed analysis of game design principles, technical realization paths, and educational value assessment, this paper aims to show how to enable players to master the basic knowledge and cultural connotation of the ancient writing system of oracle bone script through gamified learning in an entertaining way.
Keywords: Unity3D, oracle bone script, creative game, gamified learning, cultural heritage

1. Background

The history of oracle bone writing is about 3600 years ago, most of these oracle bones are the relics of the royal family from Pan Geng's relocation to Yin to Zhou's death, and the current number of unearthed pieces is more than 150,000 pieces. Oracle bone writing is the earliest writing in China, and its discovery has greatly advanced the beginning of the history of Chinese civilization.

Gamified learning is a strategy for incorporating key elements of games (e.g., challenges, rules, feedback, reward mechanisms, etc.) into non-game environments. This concept has been gaining traction in recent years, especially in areas such as education, as an effective means of improving audience experience. With their rich interactivity and immersive experience, games are not only an entertainment tool, but also gradually become an important platform for cultural transmission and education (Zhang, 2021). Innovative technologies and interactive mechanisms in games provide a new perspective for education, enhancing the interest of educational content and audience participation. However, the existing oracle educational resources have the following shortcomings: lack of interactivity: most oracle educational resources are still based on traditional text, pictures and videos, and lack of interaction with users. This one-way knowledge transfer is difficult to stimulate students' interest and enthusiasm in learning (Yue, 2021). Lack of Interest: Oracle education content is often too boring and abstract, lacking in interesting elements and forms, making it difficult to attract students' attention (Li, 2021). In order to improve these shortcomings, we consider introducing the concepts of game-based learning and digital preservation into the development of Oracle educational resources, and using Unity3D and other game engines to create interactive and interesting Oracle educational games or virtual experience projects, so that students can learn Oracle knowledge and feel the charm of Oracle in the game.

2. Game Design

Due to the analysis of the background of the study, young people's understanding of oracle bone culture is generally low, and the design of the game is required to meet the tastes of young people and involve contents that are simple and easy to understand. In the game scene, the Chinese characters can be linked to the Chinese characters according to the shape and meaning of the oracle bones, and the Chinese characters of the oracle bones can be gamified to stimulate young people's interest in learning the oracle bones culture. The game format adopts elimination gameplay and has been optimized and enhanced. In terms of user interface design, the game adopts two color combinations of burnt umber and blue, the cracking effect of the background, and the scene setting of wind and sand blowing over the bone fragments, all of which create a sense of precipitation in the ancient time. In order to reduce the difficulty of learning will be specially each oracle bone corresponding to the modern text to analyze, and give reasonable tips, which can not only reduce

Corresponding Author: Xiaoyun Duan
Anyang Normal University, China
Email: xiaoyun750@126.com

the difficulty of the game, but also make the player in the process of playing more smoothly.

2.1 Game Design

After starting the game, the player enters the game home page, in which the player can set the game-related settings and view the game information (Wan et al., 2006). After clicking the start button, the player jumps to the level selection interface, in which the player can select the level, and after selecting the level, the player enters the corresponding game level, which will be initialized according to the information of the level, and generates the armor pieces with oracle bones, and the player eliminates them by clicking on the same oracle bones, or clicks on the different oracle bones for fusion, and the player can enter the next level when the remaining number of oracle bones meets the level requirements, and then the victory interface pops up, and the game can proceed to the next level. When the number of remaining armor pieces meets the remaining number required by the level, the victory screen will pop up and you can enter the next level. As shown in Figure 2-1.
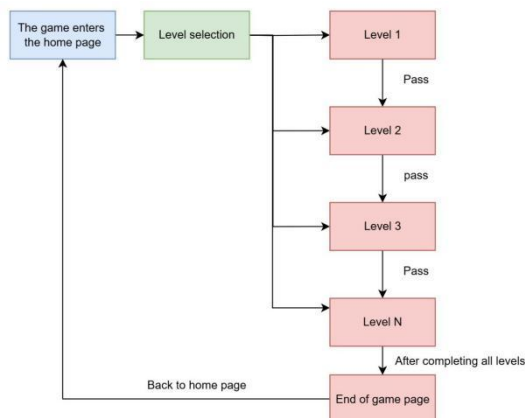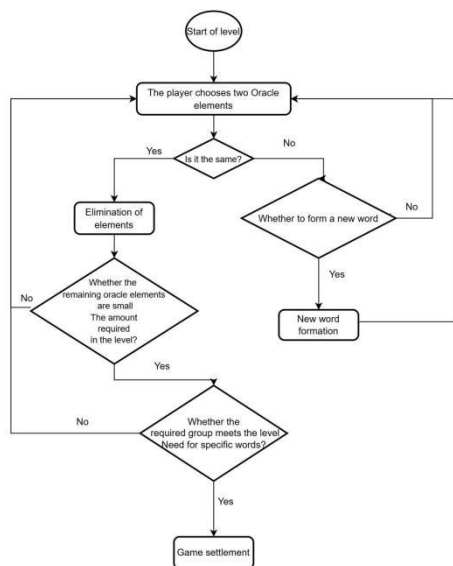

Figure 2-1: Game Flow Design Diagram

Figure 2-2: Level Player Operation Flow Design Diagram

Level Design and Flow: The game design is based on the gameplay of eliminating the same elements in a line, and has been improved based on this. According to the relationship between oracle bones and Chinese characters, it is designed that two different oracle elements can also eliminate each other, and one of the oracle elements can be used as a bias, combined with the other oracle element so as to form a new character, so as to achieve the elimination of different elements from each other, and according to the level's requirements for different characters, it is necessary to form a specific character, and after completing the level's specific requirements and the number of the remaining oracle elements is less than the level's requirements, the level can be passed, as shown in Figure 2-2. When the level is completed and the number of remaining oracle elements is less than the level requirement, the level will be passed, as shown in Figure 2-2.

2.2 Game framework development design

In order to make the development of the game more efficient, the framework design of the game script is carried out. The script framework can make the script association in the game more rule-based, which is more conducive to the realization of various systems and the design of UI in the game. As shown in Figure 2-3.
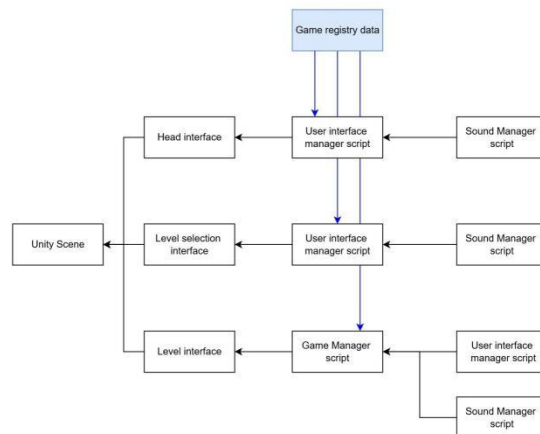

Figure 2-3: Game Script Framework Design

2.3 Game Resource Design

In order to simultaneously retain the historical weight of the oracle bones and the oracle bones in the game in the form of presentation. With the cooperation of oracle bone character shape and light sense, the oracle bone character art resources can achieve a better effect.

Figure 2-4: Oracle Art Resources - Glyphs

In the level, the main object that the player interacts with is the oracle bone armor piece. Based on the retro style, there is no need for too many lines to decorate the level, simple polygons were chosen and decorations were added. As shown in Figure 2-5.

Figure 2-5: Oracle Art Resource - Human Characters

The game interface UI is designed as shown in Figure 2-6.

Figure 2-6: Oracle Art Resources - Interface Resources

Background resource design: Based on the literal meaning of the oracle bone characters, the rain scene and the field scene were integrated with the oracle bone characters, as shown in Figure 2-7.

Figure 2-7: Oracle Art Resources - Background Resources

3. Game Development

3.1 Development Platform and Tools

Unity3D is a professional game engine that can be used to create 3D video games, architectural visualizations and real-time 3D animations and other types of interactive content. Art resources production tools are Photo Shop 2022, game development environment Unity 2021.3.6f1c1 (64-bit), compilation environment Visual Studio 2022 Community, the system running environment for Windows 11, hardware environment, CPU: Intel (R) Core (TM) i5- 9400 CPU@2.90GHz, VGA:NVIDIA GeForce GTX 1050, 16G RAM, 64-bit OS, 2T

RAM.

3.2 Overall development process

Reasonable development process needs to go through the framework development, game resource production and game development at the same time, packaged version released for testing, problems found in the test back to re-development, packaged version of the release process, when the cycle of several times in this process, the final version of the final version to determine the test is error-free. Specific overall development ideas shown in Figure 3-1.
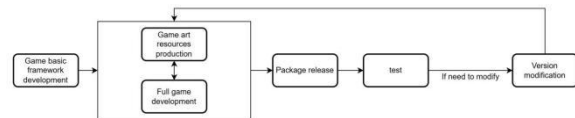

Figure 3-1: Overall Development Idea

Full development requires the realization of all the contents needed for the game, including the realization of game play, the realization of UI interaction, and the production of game art resources. The game's expected full development idea, i.e., the detailed development flow of the game, is shown in Figure 3-2.
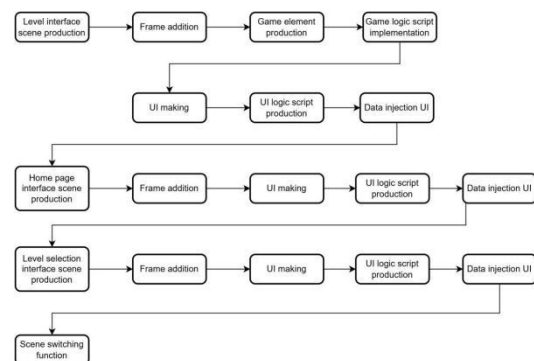

Figure 3-2: Fully Developed Anticipated Ideas

3.3 Code Implementation

3.3.1 Level interface background movement realization

In the level interface scene production needs to realize the 2D game background movement, 2D background movement is generally to control the position of the object as a 2D background movement, in the cell phone platform needs to get to the cell phone gyroscope, according to the cell phone gyroscope movement to realize the level interface background movement, need to call to the cell phone gyroscope interface and get the real-time rotational speed to adjust the background of the object to move in the direction and speed, the key code is shown in 3.3. The key code is shown in 3-3:

```
1  private GameObject Oracle_1 ;
2  private GameObject Oracle_2;
3  private GameObject MainBg;
4  public int MoveSpeed;
5  private Gyroscope Gyroscope;//陀螺仪
6
7  private void Start()
8  {
9      if(SystemInfo.supportsGyroscope)//当前设备是否支持陀螺仪
10     {
11         Gyroscope=Input.gyro;
12         Gyroscope.enabled=true;//启用陀螺仪
13     }
14 }
15
16 void Update()
17 {
18     if(Gyroscope== null)return;
19     floatx=Gyroscope.rotationRate.y;//获取陀螺仪的旋转速度
20     Oracle_1.transform.position +=
21     new Vector3(x, 0, 0) * Time.deltaTime * MoveSpeed;//设置甲骨文甲片1的速度
22     Oracle_2.transform.position +=
23     new Vector3(x, 0, 0) * Time.deltaTime * MoveSpeed;//设置甲骨文甲片2的速度
24     MainBg.transform.position +=
25     new Vector3(x, 0, 0) * Time.deltaTime * MoveSpeed/4;//设置背景的移动速度
26     return;
27 }
```

Figure 3-3: Gyroscope Key Code Map

Figure 3-4: Level Interface Scene Background

3.3.2 Game Perfab Creation

The game OracleElem is the main interactive object, to make OracleElem, create a new Perfab folder under Asset folder, then create an empty object in Layers panel, rename it as OracleElem, add SpriteRenderer component and BoxCollider2D component, drag the good OracleElem picture into the Sprite of SpriteRenderer component, create a RightClick script to hang on it, then drag it into the Perfab of Asset folder. SpriteRenderer component, create a RightClick script to hang on it, and then drag it into the Perfab folder of Asset to make a prefab. In order to realize the click interaction, the RightClick component needs to inherit the IPointerClickHandler interface, as shown in Figure 3-5.

```
1  public class RightClick : MonoBehaviour,
   IPointerClickHandler
```
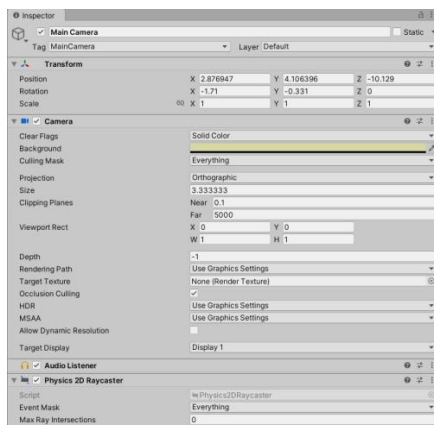

Figure 3-5: Event Receiving

After this is done you need to add the Physics 2D Raycaster component to the MainCamera so that click events on the OracleElem can be picked up by the IPointerClickHandler interface.

After this, create a GameElement script, mounted on the OracleElem object, which controls the behavior of the GameElement. This script controls the behavior of the GameElement, including the click event, the change of the image after selection, and the change of the layer. The key code is shown in Figure 3-6

```
1  public void Click()
2  {
3      if (isClicked== = false)
4      {
5          MusicManager.instacne.PlayMusicinPoint(MusicType.Select, transform.positio20:
6          GameManager.instance.AddElementinClickElementList(this);
7          isClicked = true;
8      }
9      else
10     {
11         GameManager.instance.AddElementinClickElementList(this);
12         isClicked=false;
13     }
14 }
15
16 public void ChangeImagelayer()
17 {
18     print("LayerChanged");
19     transform.Find("Elem New").GetComponent<SpriteRenderer>().sortingOrder =4;
20     transform.Find("Chinese_1").GetComponent<SpriteRenderer>().sortingOrder=5;
21     transform.Find("Chinese_2").GetComponent<SpriteRenderer>().sortingOrder = 5;
22 }
23
24 public void RetruerImagelayer()
25 {
26     transform.Find("Elem New").GetComponent<SpriteRenderer>().sortingOrder * 0;
27     transform.Find("Chinese_1").GetComponent<SpriteRenderer>().sortingorde* 1;
28     transform.Find("Chinese_2").GetComponent<SpriteRenderer>().sortingOrdeer * 1;
29 }
```

Figure 3-6: GameElement Key Code

The completion of the Oracle Prefabrication System is shown in Figure 3-7.

Figure 3-7: Prefabricated body of an oracle blade

3.3.3 Two-dimensional arrangement

Create a two-dimensional array, limit the length and width of the two-dimensional array, use it to store the armor pieces, and then set a variable interval, use it to determine the distance between the armor pieces. At the beginning of the level will be based on the length and width of the two-dimensional array to limit the number of rows and columns of the two-dimensional arrangement of the armor pieces, and according to the index of the two-dimensional array, through the index value and the variable interval multiplied to determine the location of each armor piece, after this according to the location of the armor pieces to generate the armor pieces and stored in the two-dimensional array. The generated

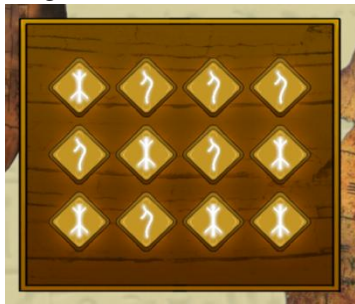two-dimensional arrangement of oracle bones is shown in Figure 3-8.

Figure 3-8: 2D Arrangement of Oracle Fragments

3.3.4 Linking Logic Realization

In order to produce different oracle bone armor pieces and realize the linkage elimination logic, the produced oracle bone armor piece prefabricated body will be copied several times, each copy is produced as a different oracle bone armor piece, according to the different oracle bone characters for the different labels for these pieces, and renamed. As shown in Figure 3-9.

Figure 3-9: Different Oracle Oracle Preforms

In order to realize the elimination logic, it is necessary to distinguish the elimination conditions, firstly the same oracle armor, according to whether the Tag of both GameObjects is the same or not to judge whether it is the same oracle armor, and secondly different oracle armor, by creating a two-dimensional array to store the two Tags that can be combined, according to whether the Tag of both GameObjects is in this array in the the same row, to determine whether a new armor piece can be formed.

Next is the connecting logic, in order to connect the line, the first step is to select the two oracle armor pieces, when clicking on the oracle armor pieces, the oracle armor pieces will be selected, after selecting the two oracle armor pieces, the connecting logic is carried out. If you want to connect two oracle armor pieces, you need a line between them in a two-dimensional array with no oracle armor pieces in the way, in order to realize this logic you need to split the situation.
1) Both are on the same line

Figure 3-10: Two-dimensional table of oracle armor pieces

Both on the same line, then you need both in the x-axis or y-axis between no oracle pieces blocking, such as Figure N.n, (0,0) position on the with (3.0) between if you want to connect the line successfully, the (2.0), (1,0) position can not appear oracle pieces.
2) They are not in the same line with each other

Figure 3-11: Prefabricated body of an oracle blade

This situation is subdivided into two kinds, the first is between the two only with a straight line bend once can be linked successfully, such as Figure N.n (3,1) position Oracle armor and (1,2) Oracle armor, this situation only (3,2) position and (2,2) position without Oracle armor can be linked successfully.

The second case for the two straight line between the two need to be two turns, such as Figure N.n (3,0) position Oracle armor and (1,2) Oracle armor, this case requires (2,0) position, (2,1) position, (2,2) position without Oracle armor can be linked successfully.

According to this principle designed the linking logic. Linking logic to achieve success as shown in Figure 3-12.

Figure 3-12: Successful Oracle Connections

3.3.5 Level Interface User Interface Implementation

The level interface interface implementation includes: pause button, accumulated points, guide, remaining time bar, and the number of remaining oracle pieces available for the level. The realized functions are mainly

（1） Pause menu callout: clicking the pause button will call the OnClick event of UGUI's Button component, which will call out the pause menu.

(2) Updating of accumulated points: points will be acquired for each elimination in the level, and the text of accumulated points display will be updated in

real time by setting the text property of UGUI's Text component.

(3) Remaining time bar update: Using UGUI's Bar component, the length of the remaining time bar is updated in real time by setting the value variable.

The user interface is created as shown in Figure 3-13：

Figure 3-13: Level Interface User Interface Implementation

3.3.6 Level Selection Implementation

The level selection system is implemented mainly for scene jumping and level selection. Scene jumping is realized by using the LoadScene() method of the scene class UnityEngine.SceneManagement. Selecting a level is done by the player actively selecting the unlocked level and injecting the data of this level into the key-value pairs data of PlayerPrefs according to the level selected by the player. After jumping to the level, the key-value pairs data injected into PlayerPrefs is used in the level loading interface to determine the level selected by the player and load the level. The realized interface is shown in Figure 3-14.

Figure 3-14: Level Selection Screen

4. Evaluation of the Educational Value of Games

Enhance learning interest: engaging storylines, vivid visual effects and interesting interactive mechanisms are elements that can stimulate students' interest in learning and keep them highly focused and enthusiastic in the learning process. Reward mechanisms in the game (e.g. points, badges, leaderboards, etc.) can enhance students' sense of achievement, thus further motivating them to learn (Shang et al., 2008).

Promote knowledge mastery: Allowing students to learn and apply knowledge in practice is a way of learning that helps deepen understanding and memorization. The interaction and feedback mechanism in the game can help students correct their mistakes in time and consolidate what they have learned. Diversified learning resources, such as videos, audios, animations, etc., can also be provided to meet the needs of different learning styles so as to enhance the learning effect (Ma & Sui, 2010).

Promote socialization and collaboration: Communication and collaboration among students can be promoted, and communities and forums are also important platforms for students to share their learning experiences and help and motivate each other (Wen et al., 2023).

In order to evaluate the potential value of games in the field of education, especially for the effect of Oracle learning games, the following questionnaire can be designed:

4.1 Questionnaire Survey

The purpose of this survey was to collect feedback from students on their use of the Oracle Learning Game, their interest in learning, their knowledge acquisition, their learning experience, and their learning outcomes through a questionnaire, as detailed in Appendix 1. in order to assess the potential value of the game in the field of education.

4.2 Data collation and analysis

Age distribution: Among the survey respondents, adolescents accounted for a relatively large proportion, 80%.

Gender ratio: the proportion of men and women is basically balanced, with 45% men and 55% women.

Change of interest: 70% of the students said that their interest in Oracle increased or significantly increased after playing the game, indicating that the game can effectively enhance students' interest.

Satisfaction with design: 60% of students were satisfied or very satisfied with the game design, indicating that the game meets students' needs in terms of interface design and operation flow.

Interaction Mechanism: 63% of the students thought that the interaction mechanism of the game was interesting and effective, which helped to enhance the learning experience.

Willingness to continue learning: 65% of the students indicated that they were willing or very willing to continue learning Oracle through the game, indicating that the game has a positive effect in promoting students' continuous learning.

5. Conclusion

In summary, oracle learning games have significant potential value in the field of education. The game can effectively enhance students' learning interest and help them master the knowledge of oracle script while providing a good learning experience. To further enhance the educational effect of the game. It provides new ideas for the inheritance

and dissemination of China's outstanding traditional culture. In the future, we will continue to optimize the innovative application of the game in traditional culture education, and constantly explore new technological combinations, such as the application of Augmented Reality (AR) technology in oracle bone language gamified learning.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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