

# RESEARCH ON THE GAME MECHANISM OF EDUCATIONAL GAMES

– THINK ABOUT HOW TO CHOOSE THE SUITABLE GAME MECHANISMS WHEN  
DESIGNING EDUCATIONAL GAMES



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## ABSTRACT

With the development of media technology and game evolution, games are endowed with multiple purposes and functions. Some scholars believe that the game is the supplement of the real world, which can affect the players' psychology and behaviour. Numerous studies show that games can make players accept challenges, overcome obstacles, arouse positive emotions and solve problems. Therefore, academia's research on games and related topics in learning has become increasingly popular. In response, different models have emerged to evaluate the design of active educational games.

This research discusses how different game mechanisms affect players. Also, this study used a prototype game as output media to examine the impact of various game mechanisms on learning. The purpose of this study is to explore how to choose a more suitable game mechanism in the design of educational games. The research results include that some game mechanisms promote learning motivation and improve learning outcomes. At the same time, some game mechanisms have the risk of reducing learning motivation. Through these findings, the researcher of this study believes that educational games can bring positive influence and help to players' learning. However, how to choose a suitable game mechanism in the design of educational games is worthy of serious consideration for making design decisions.

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# 1 Introduction

At present, games are one of the most popular interactive entertainment products. In the online gaming community worldwide, there are 200 million players in China, 183 million in the US, 100 million in Europe, 105 million in India, and Russia, Vietnam, Mexico, Central and South America, Australia, and South Korea all range from 10 million to 17 million (McGonigal, 2011). According to the same author's introduction, hardcore players in China, the UK, France, and Germany play at least 20-22 hours a week, and even more than 5 million extreme players in the United States spend an average of 45 hours a week in the game. There is reason to believe that people in contemporary society can naturally access to the game and have the motivation to play it.

Stakeholders such as game companies see the vast benefits generated by the game. According to research, the Asia-Pacific game market value for 2016 is 99.6 billion US dollars, and the growth rate of game market value is expected to increase by 6.6% in 2015-2019 (Andry & Alan, 2016). Driven by the fact that the game is so popular, both academia and business are curious about games. In response, the types of games and the media forms of playing become more abundant and diversified.

Research on games has also become popular. There are studies on why games are so popular with players. There are also studies to think about the impact of games on players' psychology and behaviour. Research shows that games are rules-based activities that people voluntarily participate in (Adams & Dormans, 2012). This activity is often accompanied by a pleasant, intense, or immersive emotional experience. Some scholars believe that games are a supplement to the real world, which can affect players' psychology and behaviour (McGonigal, 2011). Therefore, it is more necessary for game designers to understand what kind of games should be designed and how to let players play them together. McGonigal (2011) advocates that game designers need a set of plans to make design decisions and determine how games will affect real society.

Games is no longer just an entertainment activity. The research believes that the game can stimulate players' positive emotions, stimulate their behaviours, and improve social relations (McGonigal, 2011; Kim, Song, Lockee & Burton, 2018; Mageswaran, Norasykin, Zaleha, Baharuddin, Hasnah & Henny, 2016). The potential capabilities of games have begun to be recognized. Games have gradually entered more and more different fields, including education and learning. More concepts related to learning have evolved from games. It is including game-

based learning (GBL), gamification in learning, learning by play, ubiquitous learning, and intangible learning (Mageswaran et al., 2016; Indrel, 2019; Andrey & Alan, 2016; Chen, Yang, Huang & Fu, 2017; Monteiro, Gomes & Mendes, 2016). There is a common idea among these concepts, that is to use games to promote learning interest and improve learning performance.

## 1.1 The Research Problem Statement

The educational game is regarded as a medium, which becomes a bridge between learners and learning activities. The idea of using games to improve learning and training is not new, which can be tracing back to the Roman era (Mageswaran et al., 2016). In recent years, more game elements and media-forms have been applied to the actual learning environment (Kim et al., 2018). Nevertheless, whether educational games are really useful in promoting learning is still an endless stream issue of research and discussion.

Pivec (2007) pointed out that games are still often regarded as a kind of not a serious activity, while the potential of educational games is usually not taken seriously. Some studies have shown that educational games can cultivate the knowledge, skills, intelligence, emotion, attitude, and values of game users (Mageswaran et al., 2016; Kim et al., 2018; Marchiori et al., 2012; Mcgonigal, 2011; Feldman, Monteserin, & Amandi, 2016). The benefits of games for learners are quite different from other ways, and they are hard to be replaced. Gabriel (2018) claims that one distinct difference is that learners are more active in playing games than in watching movies and reading texts.

However, some scholars think that games will bring a lot of adverse effects on learning. Mageswaran et al. (2016) pointed out that games can make users' attention weak and distracted. Games can also degrade learners' ability to write assignments and reduce users' performance in classroom activities (Chen et al., 2017). At the same time, some studies suggest that educational games frustrate the nature of game design, and also reduce players' experience of stimulation response and immersive emotion (Ruggiero, 2014). The value of the relationship between the game and the player lies in the transfer of players in the delivery process, the rich narration, and the emotional meaning given by the game to the player (Fuchs, Fizek, Ruffino & Schrape, 2014). Most educational games are not as popular as popular games (Adams & Dormans, 2012). Because a large part of educational games focus on learning results and ignore the emotional experience given by the nature of the game (Fuchs et al., 2014). Active educational games

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should have the motivation to make players use it voluntarily. At the same time, educational games achieve the purpose of education and learning (Adams & Dormans, 2012; Song & Zhang, 2008). Therefore, it is crucial to find out which game mechanism can make the game fun and become an active learning environment.

In the existing research, previous researchers have studied the definition and core components of games. Previous scholars have also developed some processes and models for how to design educational games based on the understanding of game definition and components—for example, the guidelines proposed by Doney (2019) for game design in learning. The MDA framework proposed by Alevan, Myser, Easterday, and Ogan (2010), it helps designers think about game design from three aspects of MDA. The EFM model proposed by Song and Zhang (2008) allows designers to clarify the overall design ideas of educational games. In general, these design processes and models guide game designers to contribute to the global framework of how to design educational games. However, there is still no good way to select the game mechanism included in the game. Can there be a way to provide designers to choose a more suitable game mechanism into educational games?

## 1.2 Purpose of the Study

The primary goals of this study are two: first, to understand what game mechanisms are available in educational games; second, to find a way to help designers choose the appropriate game mechanism for educational game design.

### I. Game mechanisms in educational game

For the first goal, the research hopes to find out what underlying game mechanisms educational games have. Although educational games have become an innovative method in the field of learning, the design of educational games is still a young research topic. Many scholars have expressed their views on the potential energy of games in education. However, there are still a few studies on game mechanisms (Amr, 2012). The game mechanism is the core component of the whole game, which is diversified and complex (Adams & Dormans, 2012). In other words, different game mechanisms play a role in various games. Therefore, the research wants to know what game mechanisms are playing what role in educational games.

### II. Find a way, to help the design of educational games choose appropriate game mechanisms

For the second goal, the research hopes to find a way to help designers choose more suitable game mechanisms for their educational games. This study hopes that the approach can facilitate designers to make design decisions. For example, which game mechanism is suitable for the design of educational games? Which game mechanisms are not suitable and should be abandoned? At the end of this study, it hopes to provide ideas and suggestions for other designers when designing educational games.

### 1.3 Research Question

For the research purpose of the above, the following research questions are proposed:

- I. Game mechanisms in educational games: i) what are the underlying game mechanisms in educational games? ii) what role do these game mechanisms play in educational games?

For this research question, the research hopes to understand the game components and the complex game mechanism system as the starting point. According to previous scholars' studies, those show how complex game mechanisms can stimulate users' interest and influence users' learning. Studies of previous scholars' also show the most relevant game mechanism for learning and how game mechanisms exist in educational games.

This research creates an educational game through prototype development. With the help of existing research, some typical game mechanisms are integrated into the prototype game. Then the research invited players to test the prototype. The research hopes can determine the role of these game mechanisms on the motivation and learning of players in the prototype by testing and analysis.

- II. Find a way to help the design of educational games choose appropriate game mechanisms: how to summarize these game mechanisms to help the educational games design?

Therefore, for this research question, this study aims to find a way to summarize of selecting game mechanisms for the design of educational games. The study hopes to find a way to do more than provide an answer to other game designers about what mechanics to choose in educational games. On the contrary, the summarize method that this study hopes to find can

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provide designers with an opportunity to think about themselves and choose the game mechanism suitable for them to design educational games.

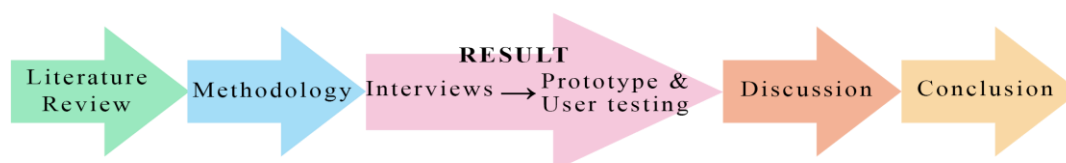
## 1.4 Overview of the Thesis

After this chapter, the paper begins with a literature review and aims to lay the relevant theoretical foundation for this research. This paper mainly uses the following keywords to search for scientific articles: game design, game features, games in learning, evaluation. Then, to cover the comprehensive terminology in the field, the search keywords are added: learning behaviour, game function, design model, and the influence of games on the player or/and learner. According to the above establishes the theoretical framework of this paper.

After the theoretical framework, this paper explains the research methods and research strategies adopted by the Institute as the third chapter – Methodology. The methodology chapter also includes participant sampling, data collection, and analysis methods.

Then is the fourth chapter, called the result. The survey results are divided into three parts: interviews, prototypes, and assessments. The findings of the first part and the findings of the literature review provide design requirements for prototyping. The results of the second part of the research are based on the prototype development process and are further discussed. Prototype testing and evaluation are presented in the results of the third part of the study.

After the results chapter is the fifth chapter discussion. The researcher reflects on the research results and compares the results of this study with previous studies. Comparing provides some insights into relevant game designs based on the results. The reason for this is to add new materials and suggestions to the related game design. The fifth chapter also discusses the limitations of this study and leaves recommendations for future work. At the end of the paper is a summary as the end of the thesis.



*Figure 1. Overview of the thesis*

## 2 The Theoretical Framework

This chapter starts with an understanding of the definition of the game. It aims to make clear of the basic structure of the game (Chapter 2.1) and the necessary information of the educational game (Chapter 2.1.1). In the next 2.2 chapter, the research learns more about the components of games, including the core MDA framework of game design and more detailed game mechanism. The two sections contribute to the prototype game design. They provide knowledge of game design and help broaden the thinking of prototype design. The design knowledge is including the systematic construction of the game itself and the detailed game mechanism, features that may be included in the prototype game. The following chapter (2.3) explores the impact of the game on players, especially the positive aspects. The previous researcher links game with interdisciplinary theories. The research explores the effects of games on players, including psychology, nerves, behaviour aspects based on the previous researcher.

In the last chapter of the literature review, the existing guidelines, models, and frameworks of educational games design are presented. They provide the design method and process of educational games. The critical point is that these design methods provide a set of fundamental design standards for this study, which help to measure the effectiveness of prototype design to a certain extent.

### 2.1 What is a Game

In the past few decades, games have become a complement to reality, creating challenging obstacles and exciting adventures for players. Digital games have become a popular way of entertainment. Today, the variety and complexity of game types are deeply rooted in the hearts of players. Players are free to divide games into different categories in the way they want. For example, games can list single, multiplayer, and massively multiplayer games. Depending on the media platform, games can be, for example, PC games, home video game consoles, mobile device games, handheld devices, VR system games. The above differences are just a part of how players classify different types of games. With so many choices and multiple changes, no matter how players choose to decide the game, the only thing that remains unchanged is that players know very well that this is a game.

The word "Game" is a relatively broad term; it is difficult to use a single definition to summarize all the characteristics of the word "game." Amr (2012) pointed out that many non-English scholars use the words "game" and "play" alternately in their research. It is because the definition of the game has been written in many different languages. After being translated into English, vocabulary has some slip between "play" and "game" (Amr, 2012). McGonigal (2011) explained the connection between "play" and "game" in another way. When people say the word "play," they often have a happy mood, while the psychological state brought by the game to the players is always happy, tense, and exciting.

In this context, scholars believe that games have something unique in nature and draw conclusions after throwing away type differences and sophisticated techniques. Each game has its own closed formal system. Games are considered a rule-based system with variable and quantifiable results (Adams & Dormans, 2012). The same author further emphasizes that rules define the game, and rules determine what the player can do and how the game reacts. McGonigal (2011) claims that all games have four defining traits of games, which are the goal, rules, the feedback system, and voluntary participation. Kim et al. (2018) also generalize the game into four primary characteristics: they must achieve goals, constraints and conditions, incentives and competition, and specific target backgrounds. McGonigal (2011) claims that the most useful and persuasive definition of the game comes from the late great philosopher, Bernard suits. "Playing a game is the voluntary attempt to overcome unnecessary obstacles (McGonigal, 2011, P.22)." It can be seen that scholars' explanations and definitions of games are often overlapping rather than mutually exclusive.

Game is a kind of rule-based activity that people take part voluntarily. This activity is often accompanied by a pleasant, intense, or immersive emotional experience. This study borrows the four defining traits of McGonigal (2011) to analyze the famous game Tetris to understand these definitions of the game in specific cases further. In Tetris, the goal of the game is to increase the level of obstacles and gain more points or other forms of reward. The rule is that the player must move left and right to eliminate spaces. The feedback system is adding space, clearing upgrade levels, and increasing the difficulty of each new level. Voluntary participation is designed to make it easy for players to join and apply their skills to achieve their goals. The achievements and level of the player's achievements in the game increase their chances of success in challenging the obstacles.

### 2.1.1 What is an Educational Game?

Literally, educational games are a combination of education and games. Song and Zhang (2008) believed that games and learning are inseparable in nature. Since kindergarten, teachers have encouraged children to play with building blocks and let them shape different shapes. When children go to primary school, they play hide and seek in PE class. Song and Zhang (2008) claimed that play games are an activity that can best reflect children's learning spirit. When children start to observe, imitate the actions of adults, and play role-playing games, it means they begin to learn. Children will train and develop their creativity and intelligence, positive attitude, cooperation spirit, exploration awareness, and imagination in the game (Song & Zhang, 2008).

With the change in society and the progress of technology, educational games are specially designed games. In recent years, the number and complexity of educational games have been increasing (Marchiori, 2012). The emergence of these educational games brings innovative learning forms and new educational materials for the field of education. The educational game has become the supplement of traditional teaching mode and is playing the potential power and advantage of games. The research shows that educational game provides an active learning environment for learners (Song & Zhang, 2008), which attracts learners to acquire knowledge through intrinsic motivation (Marchiori, 2012).

In a narrow sense, educational games will make players naturally produce learning effects in the process of playing games. The educational game is called a kind of digital game that produces educational effects through interest (Song & Zhang, 2008). The same author further explains that educational games are learning environments, which follow the game mechanisms. Educational games stimulate users' interest and expectation of final victory by creating situations and internal rules. At the same time, the content of the educational game contains rich knowledge and educational effect. In the virtual environment of educational games, users need to learn and use various skills and knowledge to complete the presupposed challenge tasks, and to obtain knowledge and skills (Song & Zhang, 2008; Coller & Scott, 2009).

Considering the design of game mechanisms, and create situations and internal rules is the core of the game design. Therefore, to study the design of educational games, it is necessary further to understand the game framework and detailed game mechanisms.

## 2.2 MDA Framework

From the definition of the game, there are several keywords: 1) closed formal system, 2) rules-based, 3) goals, 4) feedback system, 5) voluntary participation, 6) emotional experience, 7) variable, and quantifiable results. These keywords are inseparable from the core components of the game, namely the MDA framework. Kim et al. (2018) referred to the MDA framework as a theoretical game framework, which is composed of mechanics, dynamics, and aesthetics. Each part of the MDA framework is closely related to the keywords defined in the game.

### 2.2.1 Aesthetics - Voluntary Participation & Emotional Experience & Feedback System

Aesthetics (A) is considered to be an important bridge between games and players' emotions. According to the definition of the game, the keywords "emotional experience" and "voluntary participation" are closely related to the aesthetics in the MDA. Games can convey emotional responses to players through aesthetics such as feelings, fantasies, narratives, challenges, follow-ups, discoveries, expressions, and obedience (Kim et al., 2018; Malone & Lepper, 1987; Wilson et al., 2009; Bedwell et al., 2012; Carenys, Moya & Perramon, 2017). Alevén et al. (2010) have almost the same point of view and claim that aesthetics captures the subjective experience of the player; it evokes the emotional response or pleasure of the player. A multimedia presentation is an output form for aesthetics; it is related to how players master game control. Doney (2019) associates game features related to multimedia presentation with graphics, narrative, storytelling, fantasy, and reality. The MDA framework provides a list of eight aesthetic elements commonly found in games that include feelings, fantasies, narratives, challenges, friendships, discoveries, expressions, and submissions (Adams & Dormans, 2012). It can be seen that scholars' descriptions of the emotional experience provided by aesthetics to players are overlapping.

Game environment, sound effect, visual aesthetics are all related to immersion and player participation (Adams & Dormans, 2012). Designers should consider how to let players have an immersive experience through interactive components such as prompt sound, graphics in line with the game background. It may be an effective way to let players have emotional sustenance and enhance the sense of participation in the game.

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### 2.2.2 Dynamic – Goals & Feedback System & Variable and Quantifiable Results

Dynamic (D) represents the most abstract concept in a game or the entire game system. Kim et al. (2018) defined game dynamics as game goals. Alevan et al. (2010) further explain the game dynamics as the behaviour that players generate when they enter a game when the player applies the game mechanics. The dynamics match the goals in the game definition. Every action of players in the game is to achieve a specific goal of the game.

Werbach and Hunter (2012) claims that the most important game dynamics in the game are control, emotion, narrative, progress, and relationships. Among them, control usually refers to the ability of the player to manipulate or to influence and control the machine in a game, aesthetics (Doney, 2019). Players can influence the dynamic results of the game by controlling the components or make different choices inside the game. It can be said that game dynamics is an act in the game world, and what is generated by the behaviour recognized by the game mechanics.

According to the research, whether a game is interesting or not, it depends not on the interest of the players, but on the components of the game (Kim et al., 2018). Finally, the playability of the game is determined by the flow of tangible resources, intangible resources, and abstract resources in the game system (Adams & Dormans, 2012). The tangible resource refers to something with physical properties in the game. They exist in a particular place and can generally be moved to other sites. The intangible resource has no physical characteristics and does not occupy space in the game world. They also don't exist with a specific location. Adams and Dormans (2012) uses the game "war3" as an example to elaborate; for example, trees are tangible resources - wood is intangible resources. In the game, players take action mechanisms such as logging to transform tangible resources into intangible resources, which is the process of dynamic generation of formal games. So, what is the game mechanisms?

### 2.2.3 Mechanics – Rule-based System & Variable and Quantifiable Results

The game mechanism is the purest part after game stripping aesthetics, technology, and story setting, and also the real core of the game. The game mechanism is the rule, process, and data of the core part of the game (Adams & Dormans, 2012). Game mechanism (M) is

considered to determine the behavior of players in the game, such as the game requires players to cooperate with other players to complete tasks. In other words, game mechanisms define how games go on, when and what happens, and the conditions for winning and losing. Therefore, it is necessary to find a way to summarize and classify complex game mechanisms.

Adams and Dormans (2012) classified game mechanisms into five categories: Physics, economy, progression, tactical manoeuvring, and social interaction (Figure.2). Among them, the physical mechanism usually represents the physical control of movement control, shooting, jumping, and other actions, as well as specific simulation actions. The economy mechanism is closely related to some key resources, such as power-ups, collectables, points, life value, unit building, resource harvesting, unit upgrading, team management. Game economy controls whether the game can provide players with interesting choices. At the same time, whether players can fully meet the consequences of different choices in the game is also related to the game economy (Adams & Dormans, 2012). The progression mechanisms include the preset design of increasing difficulty tasks, which provides players with a series of new challenges and goals. Progression mechanisms also including seasons, competitions, race, story plot to promote the development of the game, lock-key mechanism to control the progress of players. Tactical manoeuvring includes team tactics, resource management, economic building, and unit position mobilization to gain advantages. Social interaction mechanisms include coordinated actions, alliance and competition between players, coordinated actions.

	Physics	Economy	Progression	Tactical Maneuvering	Social Interaction
Action	Detailed physics for movement, shooting, jumping, etc.	Power-ups, collectables, points and lives	Predesigned levels with increasingly difficult tasks, storyline to set player goals		
Strategy	Simple physics for movement and fighting	Unit building, resource harvesting, unit upgrading, risking units in combat	Scenarios to provide new sets of challenges	Positioning of units to gain offensive or defensive advantages	Coordinated actions, alliances and competition between players
Role-Playing	Relatively simple physics to resolve movement and conflict, often turn-based	Equipment and experience to customize a character or party	Story line and quests to give player a purpose and goal	Party tactics	Play-acting
Sports	Detailed simulation	Team management	Seasons, competitions, tournaments	Team tactics	
Vehicle Simulation	Detailed simulation	Vehicle tuning between missions	Missions, races, challenges, competitions, tournaments		
Management Simulation		Managing of resources, economy building	Scenarios to provide new sets of challenges	Managing of resources, economy building	Coordinated actions, alliances and competition between players
Adventure		Managing a player's inventory	Story to drive game, locks and key to control player progress		
Puzzle	Simple, often non-realistic and discrete, physics generate challenges		Short levels providing increasingly more difficult challenges		
Social Games		Resource harvesting and unit building, resources spend on personalized content	Quests and challenges to give player a purpose and a goal		Players exchange in-game resources, mechanics encourage player cooperation or conflict

Figure 2. Five categories of game mechanisms (Adams & Dormans, 2012)

In the game, the structure of the internal economy plays an important role in the dynamic characteristics and playability of the game. Therefore, the common idea of game design is to make the game produce some dynamic systems. In these mechanisms and dynamic systems, players' skills and strategies are more important than luck (Adams & Dormans, 2012). The game mechanism covers all elements affecting the operation of the game. How to design the mechanism in the game directly controls how the players play the game. The game mechanism

also directly affects the players' experience of the whole game. The combination of different game mechanisms increases the variable and quantifiable results, which makes the game unpredictable and interesting.

## 2.3 Game Mechanisms for Learner Experience

According to the definition of educational games by scholars, it provides an active learning environment for learners (Song & Zhang, 2008), which attracts learners to acquire knowledge through intrinsic motivation (Marchiori, 2012). In other words, the experience that educational games bring to learners mainly lies in motivation and voluntary participation. The commonality of great games is that they have convincing goals, exciting obstacles, and well-designed feedback systems (McGonigal, 2011). These three points also apply to educational games. When good game design and educational content are combined, the player's experience of the game also applies to learn (Awad, Alzibali & Alkhrboush, 2018). Games with these three points give learners the desire to conquer challenges, exert more creativity, advance the limits of individual abilities, and encourage learners to participate fully. As emphasized in the definition of games, games have variable and quantifiable results, one of the characteristics of a good game is that it is undefined for the player (Gold 2016; Anderson & Barnett 2011; Boeker et al. 2013; McGonigal, 2011; Domínguez et al., 2013). Players can't guarantee 100% victory when playing games, but they are always working hard to do better.

Whether players are active in learning, what they like to learn, and how they learn all have a direct relationship with learning motivation. Song and Zhang (2008) believed that motivation could not only lead to learning activities but also improve learning efficiency and learning outcomes.

Mcgonigal (2011) and Kiili (2007) pointed out that players are free to choose their favourite, interested, and self-skilled jobs in the game. Similarly, in educational games, players are free to choose how they want to challenge or complete their learning tasks. Song and Zhang (2008) believed that when the game objectives meet the players' interests, the players will be more motivated to learn.

Driven by the game mechanism, players always keep positive and optimistic mood to try to do something they think they are good at and enjoy it (McGonigal, 2011). Let players have confidence in learning and think that they can overcome the preset learning tasks in the

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educational game. It is a kind of self-confidence strategy that enables players to keep an active desire for learning results at all times in the game (Song & Zhang, 2008; Huang 2011). In the game design, players are always arranged to start game tasks, mechanics, challenges, competition, goals, etc. from the simplest to the more complex and challenging sequence (Kim et al., 2018; Garris, Ahlers & Driskell, 2002). With every simple game task, the goal is always to make the player think that it is possible to overcome it. Also, by completing the obstacles in the game one by one, this gives the player strong confidence. Players will find that more challenging tasks and future challenges may be encountered, and they are capable of accomplishing. In the game, players continuously get measurement and feedback through game mechanisms such as the PBL triad (points, badges and leaderboard), progress bar, level, achievement. Players can easily see when they have made progress (such as progress, regression). Instant and positive feedback allows players to work harder and motivate them to complete more difficult challenges. When the challenges in the game are balanced, the playing state of players is like feeling happy in the hard work. Similarly, when the learning tasks and the game tasks are balanced in educational games, the learning process will not be too easy for players to get bored. In the meantime, players will not feel the game challenge looks impossible because the learning tasks in the game are too difficult.

To some extent, the external and internal rewards in the game provide the players with more abundant psychological needs, such as pride, a strong sense of responsibility, identity. According to Dicheva, Dichev, Agre, and Angelova (2015), the white paper of game elements released by Bunchball is divided into game mechanics (game features and functions) and game dynamics (players' needs). McGonigal (2011) and Dicheva et al., (2015) have different classifications, but in essence, they are consistent. External rewards focus on things like money, material, status, or praise. Specific game mechanics include points, upgrades, challenges, virtual goods, leaderboards, gifts, and charity. Intrinsic rewards represent the player's focus on creating value, such as positive emotions, personal strengths, and social connections that result from active involvement in the surrounding environment. According to the game power (the player's needs), they can be expressed in the game as a reward, status, sense of accomplishment, self-expression, competition, and altruism. Song and Zhang (2008) believed that when players get rewards for correctly performing behaviours in the game, they will be more motivated to learn because of a stronger sense of satisfaction.

When more abundant game mechanisms are integrated into the design of educational games, the key is to integrate the design of learning content into the game at the same time.

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Song and Zhang (2008) referred to this approach as an attention strategy to arouse and maintain players' curiosity and interest in learning. When the players are curious and interested in the learning content and learning environment in the game, the players will be more motivated to learn. McGonigal (2011) thinks that the game's excellent mission design always allows the player to find something that suits him. Players can always find a variety of ways to make their incarnation in the game better and more powerful. The game can meet the different needs of most learners, depending on the game's various designs of game mechanics, dynamics, and aesthetics. Besides, there are relevance strategies, confidence strategies, and satisfaction strategies. These strategies respectively correspond to three aspects of educational games to help players increase learning motivation. They are explicit goals of games and learning, balanced game challenges and learning tasks, and get rewards when the behaviours are performed correctly. The results show that these strategies can help educational games improve players learning motivation (Song & Zhang, 2008).

In this context, some scholars have quantified the game mechanisms selected in the educational game and found the most common game mechanics are badges, leaderboards, and experience values. Followed is the rise in rank; the less used are virtual items and avatars (Dicheva et al., 2015). It can be seen that the game designer has a clear preference for the selection of game mechanisms in the design of the educational game. However, studies have shown that some external rewards in the game may have a detrimental effect on the learner (Doney, 2019). Therefore, the design of educational games is not just to bring every component from exciting games. The design framework used in game design and the selection of all elements in the game requires new thinking.

## 2.4 Design Guidelines for Educational Games

Previous scholars put forward the design guidelines, framework, and model for the design of educational games; their common point is to summarize a set of processes for the design. In the design framework proposed by Alevén et al., (2010), it includes three components: learning objectives, MDA, and instructional principles. In the learning objectives part, it emphasizes that designers need to have clear learning objectives. The clear learning objectives help designers ensure that the games created meet a coherent set of learning objectives. Alevén et al. (2010) used three questions to guide designers to make design decisions:

1. What knowledge or skills do players need to have before starting the game?

2. What knowledge or skills can players reasonably be expected to learn from the game?

3. What knowledge and skills might they learn that go beyond what they actually encountered in the game?

Similarly, in the EFM model proposed by Song and Zhang (2008), it is emphasized that the design needs to set educational game goals according to 3D objects. Educational games have learning objectives, and they may be separated or integrated with the original objectives of the game. 3D objects emphasize the combination of knowledge and skills, processes, and methods to develop educational game objectives. Song and Zhang (2008) emphasized that the goal of educational games should be established under the principle of promoting learners' learning. Game goals and learning goals are independent, but they are also inseparable. On the premise of determining the learning objectives of the players, designing the game objectives, and integrating them with the learning objectives may be a good start for designing the educational games.

The second part of the design framework proposed by Alevén et al. (2010) is MDA. The MDA part is to help designers think about games from three interdependent levels. From the perspective of game structure, game mechanism produces its dynamics, which makes players associate with some aesthetics. However, the relationship between the three levels of MDA should not be considered only in the above order in the design process. The MDA part of the design framework advocates the designer to express the aesthetic goal clearly, and make a reasonable choice to the game mechanism to support the aesthetic results. Dynamic is the bridge between mechanism and aesthetics. The designer's choice of mechanism should conform to the input of players (Alevén et al., 2010).

In the EFM model, the idea of game mechanism design is more detailed, which becomes the supplement of the MDA part of the design framework. EFM model points out that appropriate support should be provided in educational games to help learners complete tasks (Song & Zhang, 2008). When players encounter difficulties, props mechanism is an important incentive factor in the game. When the task is equipped with props, the player's attention will also shift from the learning goal to the game, so that the player can reach the state of flow experience (Song & Zhang, 2008).

At the same time, the EFM model advocates transparent game control to avoid learners' distraction. As mentioned in the behavioural economics theory, human cognition and information processing are limited (Bleichrodt, Schmidt & Zank, 2009). EFM model points out

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that the available resources in educational games should be used to process the relevant information of the main tasks, rather than for game control. Doney (2019) proposed the same design guidelines, emphasizing that the setting of game rules cannot make learners bear the unnecessary burden of information. Therefore, the rules of the game should be clear and easy to follow. If the operation of the game is too complicated, the player will put too much energy into learning how to play the game. It will destroy the interest of receiving the game for the first time. The game mechanism to avoid players' distraction also has more aspects, such as the introduction interface, the common UI design of similar games (Song & Zhang, 2008). Doney (2019) confirmed the seven-game mechanisms, which are the most relevant to learning. They are a challenge, competition, feedback, interaction, representation, rules and/or goals, and reflection. Many of them overlap with the game mechanism mentioned in the EFM model.

The EFM model suggests that the game should allow players to act according to their own free will and enhance their direct sense of participation (Song & Zhang, 2008). Creating game situations for educational games is like creating learning environments for learners. Educational games should not limit learners' ability to construct their own knowledge structure and cognitive process. Doney (2019) believes that educational games should provide learners with the opportunity to reflect on their own learning and live new knowledge, rather than just respond to the situation in the game. Feedback and reflection are two closely related mechanisms in educational games. The feedback mechanism should provide learners with the way to think and the reasons to explain the problems, rather than just emphasizing that the answers are right or wrong (Doney, 2019). The design guidelines also suggest that educational games should provide various forms of feedback, such as real-time, prompt, through the interaction of the game environment to transmit feedback.

Learners can discuss and share learning through interaction with other players. Doney (2019) recognized the potential of teamwork and group competition to enhance motivation and collaboration. They provide an environment for learners to discuss and exchange learning with each other. The above suggestions of design guidelines by Doney (2019) coincide with the design idea of the EFM model. The EFM model was proposed by Song and Zhang (2008). EFM is the abbreviation of an effective learning environment, flow experience, and motivation. Song and Zhang (2008) claimed that a good educational game is an effective learning environment in itself. At the same time, the EFM model suggests that the number of interactive feedbacks should also be considered when designing educational games (Song & Zhang, 2008). Players can communicate with the game environment to know if their actions are positive. Educational

games designed on the basis of three elements (EFM) can encourage learners to learn deeply and in the long term. Game design can require learners to provide learning-related information during game interaction, which can achieve a long-term and in-depth learning environment (Doney, 2019).

As one of the feedback mechanisms, competition is regarded by Doney (2019) as a mechanism that can recognize learners' personal achievements. Correspondingly, it is an option to encourage learners to redo their activities and improve their previous achievements by ranking their achievements. A leaderboard is a good choice to meet the competition needs in the game. Doney (2019) proposes to provide a more flexible and flexible way to meet the individual needs of learners when using a leaderboard.

Challenge is the core mechanism of the game. The educational games should have a sense of constant challenge and control the challenge of learning task balance by adjusting game intensity (Song & Zhang, 2008). The design guidelines emphasize providing players with the game content at the right level of challenge (Doney, 2019). The game design can change the level of players and tasks to achieve different challenges. Learners can choose the challenging activities which are suitable for their knowledge level on the basis of existing knowledge. Doney (2019) thinks that the challenge in the game should be able to attract players and make them feel interesting. The challenging task in the game should stretch the learning level of learners, but let learners feel that the challenge can be achieved after efforts. In this process, game mechanisms like levels and experience points generate incentives. Song and Zhang (2008) believed that different levels and experience points have different powers, which can force learners to continue playing for a higher power.

It can be seen that the design guidelines, framework, and models of educational games proposed by previous scholars are overlapped rather than mutually exclusive. In general, these design ideas are to emphasize the clear game objectives and learning objectives and balance game challenges and learning tasks. At the same time, these design ideas suggest that through the careful design of the game mechanism to enhance learners' sense of participation, motivation, and avoid distraction.

### 3 Methodology

This study finds the answer by designing and developing a prototype of an educational game and then inviting players to test it. Due to its explorative nature, this study adopts the inductive approach. The study takes an interpretative position on the research of game cognition, design practice, and process. The inductive approach allows researchers to analyze, summarize, and generalize individual cases in practice (Saunders, Lewis, Thornhill, 2016).

Researchers should pay attention to the choice of research methods because the choice of methods would affect the reliability, effectiveness and academic value of research (Alshenqeeti, 2014). At present, the most commonly used research methods include observation, interview and questionnaire, especially in the process of qualitative research (Dörnyei, 2007). Among the three above methods, Kvale (1996) pointed out that the data collected through interviews is more useful than the questionnaire survey. Researchers can explore and analyse the answers provided by participants in more depth (Kvale, 1996). During the interview, the researcher of this study has the opportunity to describe the specific case in detail, which enables the researcher to get more abundant data from the participants and more suitable for the project theme.

The participants of this study were interviewed several times in different phases of this study. Interviews allow the researcher of this study to analyse, summarise and generalise individual cases in practice. The inductive research can conclude the general conclusion and acquire knowledge by looking for the standard features and the relationship between features. The researcher of this study used the thematic analysis approach to analyse interviews data. The researcher of this study believes that the thematic analysis approach is in line with the inductive research approach. A more detailed explanation of the use of interview methods and thematic analysis approach would be provided in later sections (3.1.2 and 3.1.3, as well as in sections 3.3.1 and 3.3.3). Therefore, the qualitative research approach was considered appropriate.

The research has obtained three aspects of knowledge from literature support. First, referring to the design guidelines and models of educational games proposed by previous scholars, a suitable prototype design process is established. It also provides a certain level of quality standard for the prototype. Second, understand the basic composition and structure of the game to prepare for the prototype design. Thirdly, referring to the previous scholars'

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research, help the researcher to choose the underlying game mechanisms for the prototype. Therefore, in addition to the literature review, the research process can be divided into three phases. In this paper, the three phases are called Phase\_1: Preparation for Prototyping; Phase\_2: Prototype Development; Phase\_3: Testing. Such a research plan comes from a design strategy called the double diamond model. It is a structured design method, which describes divergent thinking and convergent thinking. The dual diamond model has four stages: discovery and definition constitute the first diamond; development and delivery constitute the second diamond. The dual diamond model allows the entire study to be placed in two diamonds.

In the first diamond, the first stage is discovery. According to the Design Council (2015), the “discover” phase usually represents the original idea or inspiration; it means the diverging thinking period of exploration and research. This stage helps the designer determine the needs of the user. The first stage is the insight into the problem. In the first diamond, the second stage is the definition. It is a convergence phase for analyzing and evaluating the data collected in the first stage. The first diamond corresponds to the phase1 of this study: Preparation for Prototyping. It is a process of discovering the challenges faced by samplings in learning history. It is also a process of setting learning goals for the game after discovering problems. In this phase, semi-structured interviews are used to collect data. At the same time, combined with the literature review, the first phase of research provides design requirements for prototype development.

The purpose of the first diamond is to design the right thing, and the second diamond is to make the design right. In the second diamond, the first stage is development. This stage is the divergent thinking process of starting the real design concept, which also represents the prototype development phase of this study. This stage allows the designer to weed out bad ideas in the process through build, test, and iterate. The essential design is finally retained. In the second diamond, the last stage is delivery, which is a convergence process. It corresponds to the third phase of this study, testing. The prototype is developed as an educational game, and knowledge is acquired in the process of development and testing. In this process, samplings need to take historical before and after the prototype test and record the scores. In this study, pre-test and post-test are used to measure the learning outcomes of samplings. The measurement method is the gain score, that is, the difference between the scores of pre-test and post-test. At the same time, this study also continues to use interviews to explore the game mechanisms that influence the players' gain score and learning motivation.

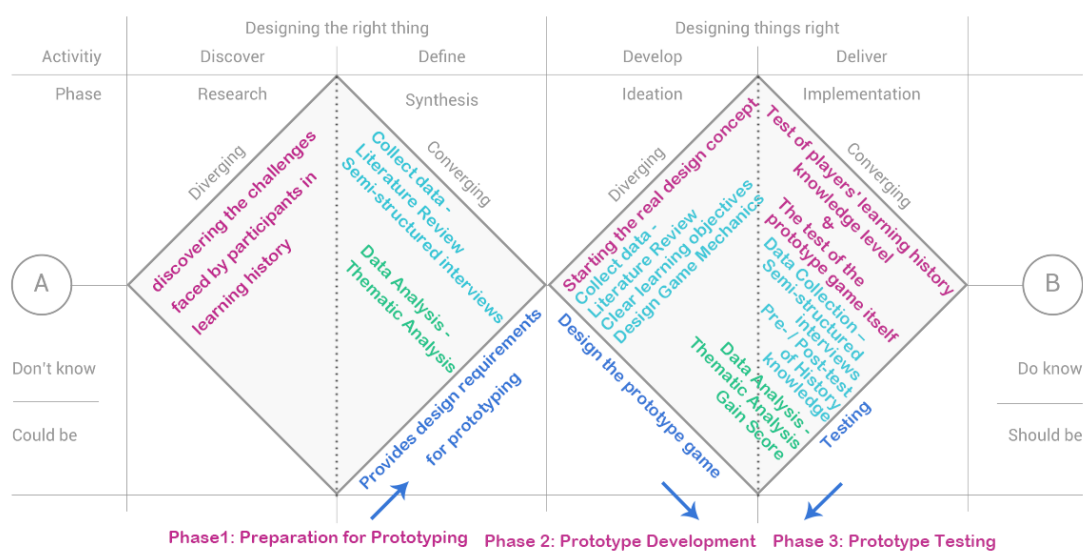


Figure 3. Showing the overall of using the double diamond and methods, as well as the phases distribution of this study.

### 3.1 Phase 1: Preparation for Prototyping

In essence, educational games are a combination of education and games. Previous research has provided the building blocks for educational game design. Alevan et al. (2010) emphasized that special attention should be paid to the definition of learning objectives in the design. Game objectives should be established in the principle of promoting learning (Song & Zhang, 2008). Therefore, in the first phase, this study is divided into two parts, corresponding to the learning and the game, respectively. In the learning section, it includes exploring the challenges faced by samplings in learning, so as to discover the needs for using educational games. It is in preparation for the design of explicit learning objectives in the prototype game. The learning section of this research phase uses interviews to collect data. This is the first time of using interview methods during this study, which supports the later design of the prototype game for the education-related part. The game section is carried out with the support of literature, which refers to the game definition and framework. It provides the basis for prototype design by understanding the basic components of the game.

Learning objectives, game design, and user group choice are inseparable. Therefore, it is necessary to confirm the selection of samples before conducting formal interviews and prototyping.

### 3.1.1 Sampling

Since the subject of this study is related to the design of educational games, the preliminary idea is to select a specific subject as the background content of games. In this study, the prototype game would take Chinese history as the background theme as an example. King, Horrocks and Brooks (2019) advocates that participants in various positions related to the research topic should be recruited, because different participants may reveal meaningful differences in experience. Such as gender and class also help to discover how different social groups experience similar domain changes.

Studies have shown that there are certain risks associated with educational games research in the classroom. Learners may not have the right to choose the game they like, because of the irreversible external interventions such as the classroom environment or teachers. Chen et al. (2017) believe that most of the games in the classroom environment are dull and unattractive. If educational games are not interesting enough, the learners will not choose and be interested in games without external pressure. Therefore, the interview participants selected in this study would focus on adults. Compared with junior and high school students, the participants in this study are those who have more authority to choose the games they like. Combining the above points with the example of using Chinese history as game content, the sampling objectives of this study also meet the following points:

1. The target group has received part or all of the nine-year compulsory education and/or high school study in China.

China's nine-year compulsory education and high school learning represent that during this period, history subject has always existed as a required course at school. This means that all participants who meet the first condition have accepted a unified history foundation course. Regardless of participants' current level of historical knowledge, they all have a certain degree of a basic conception of Chinese history.

2. Participants are reading or have a bachelor's degree or above. Furthermore, the major is not related to history.

After high school, college students may have the opportunity to study history in depth according to the requirements of their major. This research is aimed at adults who have not received a more professional and in-depth history lesson than basic history courses. Therefore, people who have been professional students of history are excluded from the target group. Also, at least the undergraduate adult ensures that the target group has a certain degree of learning ability to a certain extent.

3. If the sampled participants have graduated, they will need to meet the conditions for working in a non-educated institution.

This part of the sampling participants does not have schools, teachers, and other external factors that contribute to a mandatory learning environment. In other words, this part of the sampling participants is gradually beginning to stay away from learning and a positive learning atmosphere.

Seven users participated in the study. They were recruited through email, social networking events. Before the interviews, participants signed a written consent to authorize the use of personal information for the study. Authorizations include allowing the study to record and analyze the participants' statements, using anonymous nicknames to represent their names, and publishing their personal information. Table 1 shows seven participants who meet the above sampling criteria and their basic profiles. It includes their nicknames or aliases, ages, majors, and current jobs state.

<b>Table 1 – Participants of Interview 1</b>				
	<b>Participants</b>	<b>Age</b>	<b>Academic Background</b>	<b>The Current Work</b>
1	Cheng	27	Finance & Business Major	Employed
2	Dazui	35	Dance Major	Employed
3	Keke	38	Accounting Major	Employed
4	Li	30	Hotel Management	Waiting
5	Mona	26	Business Major	Employed
6	Qian	28	Business Major	Studying
7	Qiang	36	Digital animation Major	Self-employed

*Table 1 – Participants of Interview*

### 3.1.2 Data Collection – Interview

Compared with quantitative research, qualitative research emphasizes meaning, experience, and description; it usually adopts an oral description (Dörnyei, 2007). Qualitative research does not require statistical significance but requires researchers to have insight into the behaviour and motivation of research objects, as well as their possible impact (Saunders et al., 2016).

All participants were interviewed in the form of semi-structured interviews. Compared with the structured interview, the semi-structured interview is non-standard, and there is no fixed list of questions in advance. Researchers usually have a rough list of topics or some key questions to cover. The semi-structured interview allows researchers to omit questions, to add some questions, or to change the order of questions according to the actual interview situation. The advantage of this is that the interviewees are allowed to speak freely during the interview. If the research needs to understand the reasons for participants' decisions or the reasons for their attitudes and opinions, a semi-structured interview is a good choice (Saunders et al., 2016). Semi-structured interviews would provide researchers with an opportunity to probe answers and collect rich and detailed data sets. According to Adams (2010), the game design method is a player-centred, which focuses on player characters and player experience. Only after understanding the user's learning needs, can the research put forward the design requirements for the learning objectives in the prototype. At the same time, the prototype of educational games would be more targeted for sampling users. Therefore, the semi-structured interview is appropriate in this study. It can help this study to capture the behaviour and psychology of players quickly and accurately.

The interview at this phase is to prepare for prototype development, with three main aspects. Aspect1 is to understand the academic background and learning experience of the sample. It allows researchers to quickly familiarize themselves with the interviewees and conduct more in-depth interviews as a starting point. Aspect2 is to explore the attitudes and views of the interviewee about learning history. Aspect3 is to explore the challenges faced by the interviewee in learning history and the factors that may cause such challenges. Therefore, before the interview, the researchers set the basic topic and outline.

1. understand the experience of learning history of participants
2. understand the time, place, or form that participants can use to play games

3. explore areas where participants find it difficult to learn the history
4. explore the attitudes and views of participants on learning history
5. factors that may lead participants to their opinions
6. explore what participants think is interesting during learning history

Semi-structured interviews are conducted in a one-to-one format. The interviewees are provided with drinks, comfortable seats to create a more relaxed, private, and quiet environment. Before the interview began, the interviewer was allowed to record in the form of an audio recording. Also, recordings were deleted later according to the will of respondents. Each interview took about 45 minutes to 60 minutes. The outline of the interview was first briefly to introduce the research topics to the participants. The respondent then introduced their name, age, academic background, and learning experience. Their introduction is an effective way to collect the dynamic background of the participants and help the subsequent conversation go smoothly.

Participants have studied and/or have graduated in different universities, such as comprehensive universities, key universities, or even in different countries. Therefore, participants were asked to introduce briefly their own learning journey. It might create a completely different learning environment for participants. The introduction is an effective way not only to get to know the interviewees quickly but also to collect their learning experiences.

In addition to simple self-introduction and academic background introduction, other ways of asking interview questions are also neutral. According to Saunder et al. (2016), different types of questions should be appropriately used in semi-structured interviews. During an interview, the research includes open questions, probing questions, and specific and closed questions. According to the above interview outline, relevant questions are integrated into three kinds of questions. The order of the questions and the questions asked vary according to the actual answers of each interviewee. However, generally speaking, the theme of the main questions for this research was presented in the following ways.

Open questions include the following contents. "What is your experience of learning history?", "What kind of experience do you think learning history brings to you?", "What do you think are the characteristics of learning history?", "How do you study history?", and "How do you remember history?" Similar questions are mostly "what," "why," and "how," which allow respondents to describe a situation or event. According to Saunder et al. (2016), open

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questions can encourage respondents to provide developmental answers and also enable researchers to obtain facts and reveal attitudes.

Probing questions are used to explore respondents' responses further. The wording is similar to open questions, but with specific focus and direction (Saunderet al., 2016). For example, in this research, when participants talked about their experience of learning history, the researcher continued to ask some probing questions. Respondents were asked to answer, for example, "Why do you think so?". When interviewees talked about their work, the researcher continued to ask tentatively, "Do you play games in your leisure time?" and "How much time do you usually spend playing games?". In the interview, respondents were also asked to answer questions such as the following: "What is the reason for your attitude towards learning history?", "What causes you what you called 'stress'?", "Why?", "What prevents/enhances your interest in learning history?", "Do you think your learning method helps you learn history?", "Why do you study history in this way?", and "Why is it fun/boring?". Probing questions are also used to find explanations that are not understood or what the interviewee means. The questions include, for example, "what is the national unified examination for admissions to general universities and colleges?" and "What do you mean by 'boring'?".

Specific and closed questions can be used as introductory questions to interview topics, as well as to obtain specific information or confirm facts or opinions (Saunderet al., 2016). Respondents were asked to answer questions such as: "Can you talk about your current work situation?", "How much time do you think you can play games?", "Do you like learning history?", "Is it a common phenomenon?", "Do you remember what you learned about history?", "Are there any parts of history that interest you during learning?", and "What do you think is the most difficult part of learning history?".

### 3.1.3 Data Analysis: Challenges in Learning

The research adopts the thematic analysis method to analyze the data collected in this phase. It is a basic method of qualitative analysis, which provides a systematic and flexible analysis method for qualitative analysis. The thematic analysis method is to search for topics or patterns that occur in a dataset to get detailed descriptions and explanations (Saunder et al., 2016). The data collected were transcribed manually by the researcher. Although it is laborious to copy data items manually, the researcher can quickly get familiar with the data (Saunder et al., 2016). In the process, the researcher uses different colours and coding to classify data with similar

meanings. Saunder et al. (2016) pointed out that coding is an important means to manage data so that data can be rearranged and retrieved according to relevant codes. A coded extract of data is referred to as a unit of data. In order to unify the coding in the whole process, a diagram is established to classify different topics by marking the same colour and coding. Then insert specific data into these topics to provide an overview and facilitate the analysis of the interview. At this phase, the researcher builds data using the following colours, codes, and theme Tags:

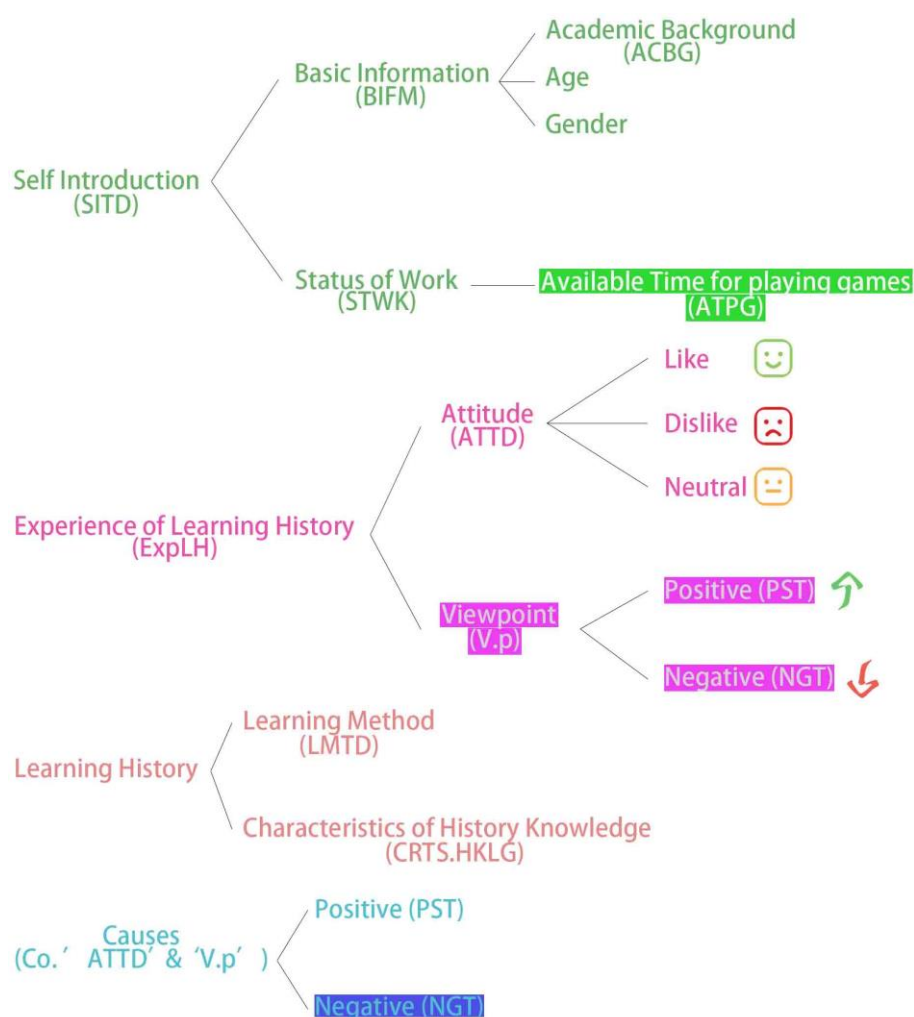


Figure 4. Data Management for the first interview

Using this method for data management after the interview is transcribed, the researcher is more likely to analyze the data. The process of coding and searching theme gives the researcher a clear overview of all participants' answers. Similar or contradictory answers are easier to identify.

## 3.2 Phase 2: Prototype Development

In this stage, the researcher of this study started the design by brainstorming and sketching, as well as used Adobe Photoshop, Adobe Illustrator, printing and tailoring to improve and make the prototype. Among the above methods, brainstorming is a way to stimulate innovative thinking. Wilson (2013) points out that the brainstorming process allows for any ideas to emerge, even if the ideals may be crazy and absurd. The more important role of brainstorming is to enable designers to evaluate and screen ideas and find the most appropriate and valuable ideas among many ideas (Wilson, 2013). Part of the design inspirations came from the previous scholars' evaluation and summary of various game mechanics. There was also a part of the design inspirations came from the findings after the interview in the first phase, which is about the challenges faced by the participants in learning history.

The initial idea is to use mobile phones as the operating medium. However, due to the limitation of technology and time, the prototype is finally presented without coding. The prototype was presented to the participants in the way of a combination of physical prototypes and paper prototypes for testing. Adams and Dormans (2012) pointed out that if the game does not rely on precise timing, physical or other computing-intensive mechanisms, a physical prototype, and paper prototype are an excellent choice. In this study, the prototype technology of creating a low-fidelity prototype horizontal slice is used to realise the test of the game concept and design ideas. According to Adams and Dormans (2012), the horizontal slice is a prototype, which contains all parts of some aspects of the game, but not others. The researcher of this study thinks that it is suitable to create a horizontal slice for this study - because horizontal slices allow the researcher in this study to focus more on the game mechanics design.

On this basis, the design of the prototype follows the four defining traits construction framework. At the same time, the researcher integrates each component into the four defining traits. In the prototype, goals represent the combination of design guidelines (Aleven et al., 2010) and 3D goal design (Song & Zhang, 2008). The prototype goals are divided into learning goals and game goals. The inspiration for game rules comes from five categories of mechanisms. The design of feedback takes into account the role of use mechanism in learning objectives — the part of using prototypes to help players learn, which is related to dynamics. Voluntary participation is related to emotional experience, that is, aesthetic design.

### 3.3 Phase 3: Prototype Testing

The prototype test in this phase is divided into two parts which are the test of players' learning history knowledge level and the test of the prototype game itself. Therefore, this thesis divides the collected data and data analysis into the following sub-sections for an explanation.

#### 3.3.1 Description of How to Use the Prototype

The prototype is a design based on the concept of a mobile application. However, the prototype is presented to participants in the form of physical and paper for testing. As a result, some mechanics in the prototype have to transform the digital form into other ways for the participants to use them.

Before the participants started the game, the researcher introduced the rules of the game and the circulation of the internal economic mechanism to the participants orally. For example, how to determine the order of players, the starting and ending conditions of card games and specific card rules. The introduction also includes the rewards for different positions after the end of the game, the rights and rewards that players have in the game, and the ways to get rewards (please refer to Chapter 5).

All players take a nickname for themselves before they start the game and record it on paper. Throughout the game, all players call each other by nicknames. At the end of each game, players would get the corresponding points and experience value of the game ranking. All players have a piece of personal paper in the process of playing the game, which is used to record the change of points, display personal information and avatar. Players are free to choose what collections, rewards, and personal data to display on their own paper. It is done to allow participants to experience the personalisation setting in the prototype.

The researcher prepared some 1SEK coins for participants to use as a virtual currency. Participants can choose to exchange points for coins. Players with more experience can unlock more convertible items. The researcher also prepared small cards to serve as virtual items in the game. These little cards include those with the right to change their names, double points cards, card sets with different achievements, card sets with different borders, and expression card sets. The researcher also prepared pieces of paper with different avatars and pictures of cultural relics to provide participants with experience of the collection mechanism in the game. In the process of speaking, players can choose to show emoticon cards at any time to replace the expression

function in the real scene. During the game, the player puts the personal paper and rewards and items on the table to make sure that everyone can see them. Also, all players have a common paper on the desktop to record leaderboard information.

### 3.3.2 Data Collection – Interview

The interview in this stage is similar to that in the first phase, and the research still adopts the semi-structured interview. The interview in this phase is mainly from two aspects to understand the participants' subjective views on the game mechanism in the prototype. The first aspect is to explore the mechanism to improve participants' motivation. The second aspect is to explore the game mechanism in the prototype that helps participants learn history. In addition, there are nineteen game mechanisms in the prototype, including rules, nicknames, points, leaderboards, badges, level-up (experience value), virtual items, virtual currency, profile photo, try many times, competition, collection, personalized setting, unlocking, achievement, expression, first-person narration, and avatar. Based on the above interview objectives and game mechanism contained in the prototype, the researcher has set up the basic interview question theme and the questions purpose outline.

1. understand the motivation of players of playing and learning.
2. which mechanisms in the prototype motivate participants to play the game?
3. how these 19 mechanisms keep participants motivations?
4. which mechanisms in the prototype motivate participants to learn the history?
5. what makes participants feel less challenging to learn history?
6. know whether the participants enjoy the fun of the game in the learning process. (and vice versa)
7. why the game mechanism promotes/reduces participants' motivation?
8. how does the prototype help participants think and answer questions in the post-test?

Similar to the interview in the first phase, the researcher's questioning style is neutral. Based on the above interview topics and outlines, the order and manner of questions in the interview would be changed according to the actual situation. The interview also includes open questions, probing questions, and specific and closed questions.

The beginning of the interview is to understand the participants' motivation and purpose of playing the game. Participants were required to answer questions such as: "What game mechanism do you want to continue playing?", "What game mechanism makes you interested in playing games?", "Why do you want to keep playing?", and "What is the game mechanism that leads you to give up the idea of continuing the game? Why?". In this process, the researcher asked further probing questions based on the feedback given by the participants. For example, "What game mechanism brings what you called 'more powerful'?", "What do you mean by 'desire for knowledge'? What and Why?", and "What game mechanism has changed your learning thinking?".

According to the participants' different feedback, the interviewer discusses the impact of the prototype on the participants' learning with interviewees. Participants were required to answer questions, for example, "What and how game mechanism helps you reduce the difficulty of memory?", "What makes you less motivated to learn history?", "What kind of experience do these mechanisms bring to your learning?", "Do you also enjoy the fun of the game while you are learning?", and "What game mechanism do you think helped you most to improve your learning?".

The interview also discusses whether the prototype can help reduce or solve the initial learning difficulties of participants. Interview questions include, "Do you think the process of learning history has changed?", "Did you learn anything about history you did not know before after playing the prototype?", "What game mechanism helps you learn history?", "How does the game mechanism help you learn history? Can you give me an example?", "Do you feel that your score in the post-test is higher than that in the pre-test?", "How do you think about the answer to pre- and post-tests?", and "How does the prototype help you answer the test questions?". At the end of the interview, participants were required to discuss their feelings about the overall game experience and suggestions for the prototype.

### 3.3.3 Data Collection - Pre- and Post-test of History Knowledge

The research process of this study is experimental, because to some extent, whether the prototype can improve the historical knowledge level of participants is unknown. The process of the experiment consists of three steps. Step\_1 is the test before play the prototype; step\_2 is to play the prototype game; step\_3 is the test after play the prototype. In other words, participants were invited to take a test of their knowledge of history before and after playing

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the prototype game. A pre-test is to assess participants' prior knowledge before prototype intervention in this research. In this phase, the researcher compared the scores of the two historical tests of the participants. The comparing is for testing whether the prototype improved the participants' level of historical knowledge. Therefore, improvement in learning was measured in this study using the gain score. The method of the gain score is one of the methods proposed by scholars to estimate the treatment effect in a pre-test and post-test experiment (AMR, 2012). Gain score refers to the difference between post-test and pre-test scores, that is,  $\text{post-test score} - \text{pre-test score} = \text{gain score}$ . In an experimental research process, the reliability of gain scores was considered high recognised by Dimitrov and Rumrill (2003). Pre- and post-test scores are obtained through three-module, which correspond to the prototype learning contents.

Shadish, Cook and Campbell (2002) confirmed the reliability of gain score to research but pointed out that researchers need to consider the validity check. When the questions of pre-test and post-test are the same, it may produce a testing threat and affect the internal effectiveness of the research. Amr (2012) pointed out that the same pre-test may guide the subjects to conduct the post-test, leading to better post-test scores. Such a score increase may not be the result of an intervention. Therefore, in this research, in order to avoid pre-test sensitization, the researcher has made similar and equivalent substitutions for pre-test and post-test questions. There are 40 questions in each of the two tests, 60% of which are identical, and the remaining 40% is different. Another consideration is that the time difference between the pre-test and the post-test is very close, and the subjects may become sensitive due to the pre-test. Therefore, the time interval between the pre-test and the post-test is 2 hours. During this time, the participants of this research played games.

The test content is customized according to the learning objectives and the corresponding game mechanism in the prototype. The pre-test and post-test respectively have three modules, the dynasty development test, the emperor's information test and the historical event test. The test of the dynasty module corresponds to the integration of learning content into the rules of the game, as well as the game mechanism called try many times. The test of the emperor module corresponds to the design that the learning content is displayed on the card in the form of text in the prototype. The test of the historical event module uses first-person narration, the communication platform, and competitive game mechanism. All participants had 30 minutes to finish one test.

In the dynasty development test, the test questions are related to the development order of the Dynasty. The test questions are in the form of single choice questions, multiple-choice questions, blank filling questions, and sorting questions. The following is an example of some test questions (Figure 5). For the complete pre-test and post-test questions, please see the appendix.

1. Fill in the name of the dynasty or the corresponding year:  
" \_\_\_\_\_ : 221 BC - 207 BC " or " the Southern Song Dynasty: \_\_\_\_\_."
2. What is the correct sequence of ancient Chinese dynasties? ( )
  - A. Shang, Jin, Song, Ming, Qing
  - B. Sui, Three Kingdoms, Yuan, Ming, Qing
  - C. Shang, Qin, Sui, Tang, Ming
  - D. Shang, Zhou, Qin, Yuan, Song
3. What dynasties did the Southern Dynasty go through? ( )
  - A. Northern Wei
  - B. Song (Liu Song)
  - C. Qi
  - D. Liang
  - E. Chen

*Figure 5. The Example of Test Questions for Dynasty Module*

In the module of the emperor information test, the test questions are related to memorizing the emperor's information, including the year and the dynasty. The knowledge points of this part are related to the historical figures that have the most direct connections with each dynasty. The following is some example of test questions (Figure 6). For the complete pre-test and post-test questions, see the appendix.

1. What was the dynasty established by Wang Mang?
2. What is the longest-reigning emperor in Chinese history? Which dynasty he belongs to?
3. The title of "emperor" began in the \_\_\_\_\_ Dynasty and was \_\_\_\_\_ (name of the emperor).
4. The emperor who overthrew the Yuan Dynasty was \_\_\_\_\_ (name of the emperor).

*Figure 6. The Example of Test Questions for Emperor Module*

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In the test module of historical events, the test questions are related to historical events, historical figures and culture evolved from historical allusions. The questions of this module are to test the understanding of the connection between historical events and historical figures. It also tests the subjects' understanding of the causes, processes, and results of historical events. The questions also about the connection between historical events and modern life. The following is some example of some test questions (Figure 7). For the complete pre-test and post-test questions, see the appendix.

1. What Dynasty has the Xi'an circumvallation been built-in?
2. What was the dynasty that set up the "Taiyi bureau"? ( )
  - A. Han Dynasty
  - B. Sui, Tang, and Five Dynasties
  - C. Song Dynasty
  - D. Qin and Han Dynasties
  - E. Ming and Qing Dynasties
3. Tian'anmen rostrum was designed in the \_\_\_\_\_ dynasty.
4. The unified characters of Qin Shihuang are \_\_\_\_\_ fonts.
5. The idiom "fù jīng qǐng zuì" refers to which historical event, and is related to whom?

*Figure 7. The Example of Test Questions for historical Events Module*

### 3.3.4 Data Analysis – Gain Score and Interview

Participants in this phase of the test were the same seven participants as in the first phase. All seven participants completed all the data collection steps. Step\_1 is to take the pre-test of historical knowledge. Step\_2 is playing the prototype game. In step\_2, because the prototype is limited by technology and time, the researcher used a combination of physical prototype and paper prototype to let participants test. All seven participants played at least four games each. Each game consists of different players. After the researcher introduced the specific rules of the game, participants immediately began to contact the prototype. The card game in the prototype is a physical form. Players have real cards to play. Each player would have their paper page to record their items. For example, at the end of each game, the researcher recorded the corresponding points, virtual items they got, badges, achievements, borders, rewards, and other items received by each player on paper. Besides, all players have a common paper page, which

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is used as a record of the leaderboard. Step\_3 of data collection completed by participants is taking the post-test and the interview.

As mentioned above, the pre-test and post-test have three modules, namely, the dynasty development, Emperor information, and historical event module. First, the researcher reviewed all participants' pre-test and post-test tests. In order to compare the differences between the pre-test and the post-test, the researcher recorded the scores representing the knowledge level of the participants had integral.

There are 14 questions in the dynasty module of the test, 28 points in total. Among them, each question has 1 point of the first 13 questions, a total of 13 points. In the last question, each dynasty that answers correctly is recorded as 1 point, a total of 15 points.

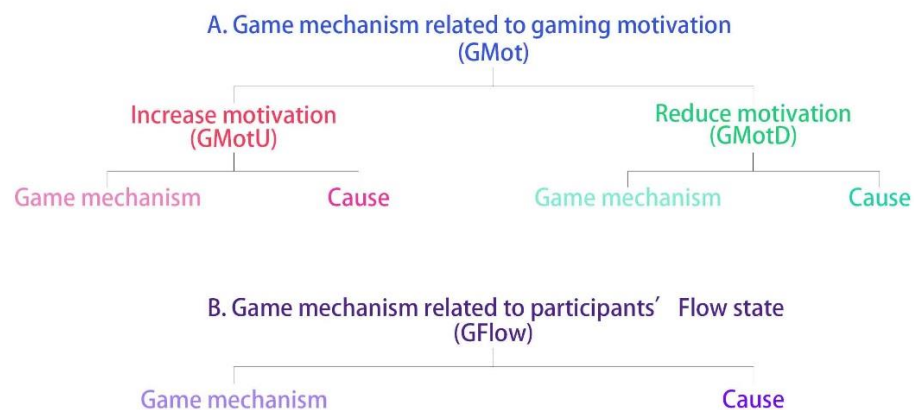
The emperor information module has ten questions, 33 points in total. Among them, 1 point for each of the first nine questions, a total of 9 points. In the last question, one score for each correct answer to the emperor's year number or name, as well as the correct order, totaling 24 points.

There are 16 questions in the historical event module, 39 points in total. Among them, each question got 1 point of the first ten questions, a total of 10 points. Each space in question 9 is 1 point, 4 points in total. Questions 12 to 16 have 5 points each, including five elements: time information, historical figure information, cause, process, and result of historical events. Each correct answer to an element is scored 1 point, a total of 25 points. Therefore, the scores of the pre-test and the post-test are calculated by the sum of the scores of the three modules, totaling 100 points respectively. Then, the researcher drew a table and filled in the scores of pre-test and post-test and the total scores of each participant under different test modules.

The researcher still uses the theoretical analysis approach to analyze the data collected at this phase. The researcher artificial transcribed the data. Then, the researcher searched for themes that occurred in the dataset and encoded data with similar meanings. In this phase, the data is not only generated by interviews but also the gain scores generated by pre-test and post-test. The researcher explored the subjective views of the participants from the interview data. In order to avoid too subjective data, gain scores are used as the supplement of interview data. Based on the data of tests, the gain score objectively shows whether the participants' mastery level of historical knowledge is improved due to the intervention (playing prototype games). At this phase, the researcher uses the following colours, codes, and subject tags to build the

interview data (Figure 8). Later, the researcher inserted specific data into these themes to provide an overview and facilitate data analysis.

From the perspective of participants, aiming at the game aspect



From the perspective of learning, aiming at the learning outcomes aspect

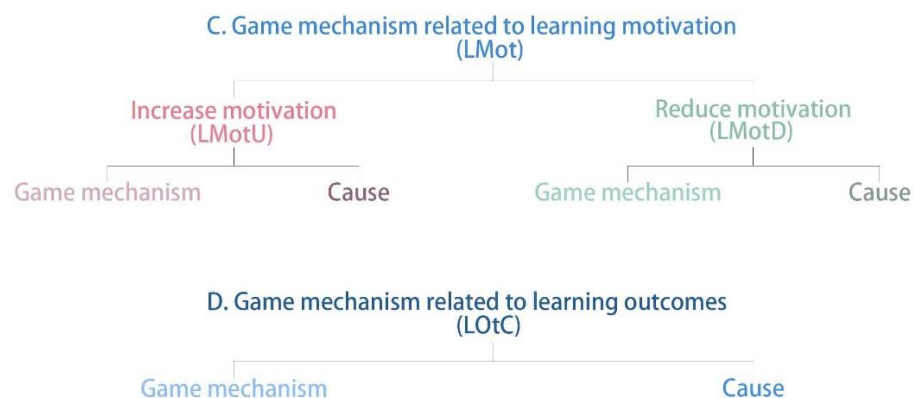


Figure 8. Data Management for the interview in the testing phase

### 3.4 Limitations

Because history is a broad meaning word, its exact definition is divided. As Nash (2016) said in his book, history has different meanings for different people. At a macro level, history can be used to explain the changes that have taken place throughout the empire for thousands

of years. On a microscopic scale, history may only involve individual stories for only a few days or hours. Therefore, this study tends to explain the definition of history from a macro perspective. Because history is a very complex and comprehensive subject, this means that this study cannot summarize the history of the world. Therefore, in order to focus more on the design of the game, this study limited the historical content of the game to some of China's history. This is also the reason why the countries concerned are entirely confined to China. The above sample groups have a background related to China.

The prototype concept of this study is a game system. Due to objective reasons such as time constraints and programming capabilities, prototypes are not made with real code. The construction of the entire game program is essential, but more important is the design process of the game system itself. Therefore, instead of writing the code, the concept of the entire prototype game system is mainly provided to the players participating in the test in physical form.

### 3.5 Ethical Considerations

The interviews involved each respondent's dynamic background, including their past personal experiences. To a certain extent, this may lead to the disclosure of private information of some participants. The researcher must protect the data of the participants as much as possible. According to the General Data Protection Regulations (GDPR) (2017), the study received written consent from the participants before all interviews. During the interviews, the recording was started with the consent of the respondents. According to the will of the respondents, after the transcription of the interview content, the recorded data is deleted. More importantly, all participants were told how their data would be used during and after the study. The researcher must also consider what information participants need and to collect the personal information the study needs. To better hide the true identity of the interviewees, the names of interviewees were anonymized in the process of editing this thesis.

## 4 Results

This chapter introduces the research results, which are divided into two parts corresponding to the three-phase of the research. The first part introduces the results of the first interview before prototyping. The second part introduces the test results after the prototype test.

### 4.1 The Interview – Challenges in Learning History

The interview provides an opportunity for the researcher to have a deep understanding of the players, to understand the factors that may cause the players to feel difficult in learning. At the beginning of the interview, participants were asked to make a brief self-introduction, including their previous study experience and work status. Most of the participants have a similar study experience because they have lived in the same social education system. When the participants were asked to describe their learning history, they all recall their junior or senior high school years. For the participants, history is always one of the compulsory courses stipulated by the school in most of their student years. However, in all the required courses, participants think that history is not important. There are two main reasons for participants to think that history is an unimportant required course. One of the factors is the arrangement of class hours and the distribution of examination frequency. Participants need to learn many different subjects at the same time in their student period. It makes it difficult for participants to study multiple subjects at the same time. In the description of participants, a common phenomenon is that the time of history course is often occupied by the teachers of other major compulsory courses.

Another factor that led participants to think that history is an unimportant required course is the educational system planning from society. Under the influence of the arrangement of the school and social education system, participants feel the primary and secondary division of all required courses. It leads participants to think that learning history is an unimportant subject in the subjective consciousness of participants. After knowing the academic background of all seven participants, the researcher of this study found that two of them are art students, four are science students, and one is liberal arts students. For Cheng, Keke, Mona, and Qian of science students, as well as Qiang and Dazui of art students, after the second year of high school, the history course is not even a required course. According to the participants' introduction, all high

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school students would choose the subjects of liberal arts or science departments or become an art student. At the same time, the choice of subjects would affect the types of subjects that participants need to take in the unified national examination for admissions to general universities and colleges. According to the participants' introduction, English, Mathematics and Chinese are tested with a full score of 150 points for each subject of the unified national examination. Besides, it is also divided into comprehensive examination for liberal arts or science comprehensive examination, which is a total score of 300 points for the three designated subjects. The unified national examination for admissions to general universities and colleges is a significant experience for the participants. According to the participants, the unified national examination determines whether they can enter their ideal high school and university. For Qian, reminiscing the unified national examination means studying day and night, and the countdown 100 days to the unified national examination. For Cheng, the unified national examination also means that he needs to rank scores with more than 9.4 million high school students to compete for admission to the ideal university. In this context, for Qian, Cheng, Mona and Keke, as science students, they put most of the time in learning science subjects during their student life. In the same way, Qiang and Dazui put the most attention on their professional art courses.

The above point seems to have penetrated the ideas of the participants. According to their explanation, it is a widespread phenomenon. In general, the participants' attitude towards learning history is one of the factors that affect their learning history. Except that history is regarded as an unimportant required course, participants' attitudes towards learning history can be divided into three types: like, dislike, and neutral.

## NEUTRAL

Among all the seven participants, three represented by Li, Cheng and Qian expressed their neutral attitude towards learning history. There are two main reasons for the three participants' neutral attitude towards learning history. One reason is that learning history is something that has nothing to do with the participants. After the loss of forced learning factors from schools and teachers, some participants no longer have any interest in learning history. Learning history is regarded as a process that must be experienced as a student, and it is boring and make people sleepily. Li reminisced about her history teacher and used "an emotionless storytelling machine" to describe the state of the teacher's class. At the same time, Li describes the experience as

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"forced learning" and points out that the historical stories have nothing to do with her. "Like" or "dislike" are not enough to describe Li's attitude towards learning history.

Another reason is that participants' attitudes are always wavering between likes and dislikes, such as Cheng and Qian. In other words, except to Li's stated neutrality, there are both parts of learning history that participants like and dislike. Therefore, the following two sub-paragraphs separately describe the results of participants' attitudes towards learning history.

## LIKE

In the eyes of participants who like to learn history, history is full of stories, mysteries and unknowns. In the process of interview, ancient history, the war of the history, the rise and fall of the country and the dynasty are all the parts that participants mentioned most interested. For Cheng, such the above history makes him feel the significance of recording history and learning history. Historical knowledge records the development and change of human society. Another reason for Cheng's interest is that the history of war is full of stories, and there is continuity between them. During the interview, Cheng was very excited when he illustrates specific historical story and great wars, such as the event of "borrowing arrows with thatched boats" in the war of Chibi in the late Eastern Han Dynasty. Cheng described the cause, process, and result of the war. For Cheng, it would be an interesting process to learn history after deeply understanding a certain historical event. Qian also expressed his like for learning history. Qian likes the ancient parts of history, such as ancient Egyptian civilization, Greece, and even the origin of history, the mythical age. Qian describes these histories with the unknown and mystery, which makes Qian full of curiosity.

On the other hand, participants' attitude towards learning history also depends on their learning needs. Among all seven participants, Dazui and Qiang linked the learning needs to their own work. Dazui studies Chinese classical dance and often meets elements related to Chinese history in her daily work. Therefore, Dazui has great opportunities and needs to contact and understand Chinese history, whether influenced by cultural background or work needs.

For Qiang, years of freelancing have made him meet more people from different levels of society. During the interview, Qiang put forward a new concept about the need for learning historical knowledge. In Qian's view, talking about historical knowledge with others is a means of social communication in his career. Qian believes that the reason for the above phenomenon

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is the growth of age and the accompanying thirst for knowledge. In this context, Qiang is required to have more knowledge reserve in the working environment.

## DISLIKE

External factors and the characteristics of historical knowledge are the main factors that make participants dislike learning history. First, the external factors come from the test pressure of the student time, the teaching methods of the teachers, and the learning methods which is forced to form. During the student period, participants could not allocate more time and energy to study history because of the teaching arrangements. However, participants were forced to bear the pressure from examinations. According to the feedback from the participants in this research, a common phenomenon of history teachers' teaching style in the past is the way of reading textbooks and highlights exam key points. The heavy schoolwork and examination pressure make the participants used to cope with the examination and learn history by rote. At first, Cheng used "to cope with an exam" to express his dissatisfaction with learning history. For Cheng, the coping test is to look at the contents of the history textbook, review the key points of the test marked by the teacher. After that, Cheng memorizes the time, place, and historical figures of the historical events by rote. This way of learning history appears in the descriptions of all seven participants. According to other participants, learning history is about memorizing huge amounts of data in order to pass the exam. In the tone of the other six participants except for Dazui, the word "coping with examinations" sounds helpless and forced. Among them, Keke, Mona, and Qiang all express their dislike of learning history. Keke and Mona think the process of learning history is boring and hard to remember. The process of learning history makes them feel bored, and that knowledge has nothing to do with their life. Qiang even uses "torment" to describe the process of learning the history knowledge. Rote learning is one of the root factors that lead the participants of this research think that the process of learning history is boring and forced to cope with the examination. However, rote learning is the most commonly used way of learning history by participants of this research.

Secondly, the characteristics of historical knowledge itself are one of the factors that make the participants dislike learning history. The seven participants agreed that "time, historical events, places, historical figures, causes, processes, and results" are the contents that must be remembered in the process of learning history. All of the seven participants felt the challenge of memory. Complex and extensive data make the memory of participants comfortable to be confused and difficult. Therefore, the challenge of memory is the most challenging and obstacle

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to overcome in the process of learning history for participants. Cheng's explanation of the way of learning to cope with the exam is the most repeated learning experience and process for all participants. Participants tacitly used the same words to describe the process of memorizing historical knowledge, "rote learning." Historical knowledge contains huge data, which makes it difficult for participants to remember. From the feedback of the participants in this research, the researcher summed up the characteristics of historical knowledge that made the participants feel learning difficulties. In the process of learning historical knowledge, historical knowledge can be divided into three fixed problems, corresponding to "when", "where", and "who". According to participants' descriptions, the most common questions in the history test is: "when did the historical event happen?", "Where is the historical event?", "Who are the people involved in historical events?". When participants focused on memorizing these questions, historical events became irrelevant to them. For the participants in this research, an irrelevant historical event cannot be interpreted and understood correctly. The vast historical knowledge data makes the memory process of participants very difficult and confusing. Using inappropriate learning methods, such as "coping with exams" and "rote learning," also makes participants feel bored with the learning process. On the contrary, review the most interesting characteristics of historical knowledge for participants are its story, unknown and mysterious. When learning history knowledge is decomposed into the above three questions, the most interesting part of history knowledge disappears.

In the interview, the researcher also knows the working status of the participants. All seven participants had to work overtime more or less during their work. Participants generally said that the time they could use to play the game was not stable because of work. Cheng, Qian, Mona, Li and Qiang have a common that they are all senior gamers. All of these five participants said that the time they can use to play the game depends on the workload and overtime. For Qian, Cheng, Mona, even if they are busy at work, they will squeeze out at least 1-2 hours to play large computer games every day. Mona said that playing games have become a habit in her life. On weekends, Mona may spend more than 10 hours a day playing games. Li's situation is similar to Mona's. Li is currently unemployed. According to Li, she now has at least half a day to play games. Qian, who is now studying for his second master's degree, said it is easier to control the time by himself. As a result, more time can be allocated to playing games than during work in the company.

Instead, all seven players will use their fragmented time to play mobile games. According to Qiang, because of work, unstable playing time and equipment requirements even forced him

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to change his favourite game types. Mobile games such as the "Honor of Kings", "Player Unknown's Battlegrounds (PUBG)", and computer games such as the "League of heroes" and "dota2" are the most popular games among participants. These games have several common features which lead participants of this study like. First of all, compared with MMORPG, these games do not require players to have a very fixed time to complete tasks. Secondly, these mobile games let players choose to play or not to play at any time and place. For the participants, the requirements of hardware devices for running the games are not high.

According to the interview, the researcher summarized the feedback from the participants as follows. The difficulty of learning is memory. The characteristics of the historical knowledge that causes learning difficulties are huge data. The factors that lead to the negative emotions of participants come from their own interests and external pressure. The factors that induce the participants' positive emotions come from historical characteristics, such as storytelling, relevance, mystery, and unknown. The learning methods related to the participants' negative emotions are coping with examinations and rote learning. Considering that work has become the instability of the participants' playing time, the researcher thinks that the running type of the prototype game should also be considered in the design. Therefore, the interview in this phase puts forward the design requirements for the prototype educational game of the game content and game types.

## 4.2 The Interview After Playing the Prototype

Seven participants completed all the tests, including the first step of taking the pre-test of the historical knowledge, the second step of playing the prototype game, and the third step of taking the post-test and the interview. The researcher collected and analyzed participants' feedback on the prototype and compared participants' levels of historical knowledge before and after the intervention.

At the beginning of the interview, the researcher and interviewees discussed motivation related issues. In the narrative of the interviewees, five participants believed that the game mechanism stimulated their learning motivation. Although the views are the same, the game mechanics and reasons that motivate the participants are different. On the one hand, the reasons for stimulating participants' motivation for learning history and playing game are consistent and overlapping. The participants represented by Cheng, Qian and Keke claimed that there are three

main reasons to motivate them to play games and learn. These three reasons include the desire to win the game; the desire to gain more power or reward; and the desire to show off to others and gain a sense of identity.

Cheng and Qian point out that points, rankings and promotions have made them more competitive. Cheng pointed out in the interview that the rules of the game give Cheng more desire to win the game. Because the rules allow players compared with other players during the whole playing time. The reason for being competitive is not only to win each game but also to get a higher rank in the open leaderboard.

Qian and Keke said that they are motivated because they want more power and rewards in the game. In the prototype, players can use points to exchange virtual currency, more gorgeous badges, profile-photo frames, and more advanced virtual items through the game victory. Players also need to accumulate their own experience value to meet the promotion conditions and then unlock more game playing methods and modules. Qian and Keke are both curious and looking forward to the unlocked new game modules and playing methods. Keke said that the earlier he can unlock new props and advanced game modules, the more opportunities he has to lead other players in-game progress. Participants are motivated by external and internal rewards. Both Keke and Qian are motivated to play games because of the collection system. As Qian said in the interview, when he collects a full range of game items, he will feel special satisfaction and pride. At the same time, Qian likes to show off his collected virtual items and his own image of game characters to friends in order to seek a sense of identity. Participants' desire for more internal rewards is aroused by external rewards, and vice versa. The game mechanism inspired the game motivation of Qian, Cheng and Keke. Competition, points, leaderboard and level-up satisfy Qian, Cheng and Keke's desire to win, pride, satisfaction, and show off, as well as the desire to gain a sense of identity from others.

In the interview, participants were required to answer the game mechanism related to promoting their learning motivation, and why and how to promote learning motivation. The game mechanism and reasons for stimulating Cheng, Qian and Keke's learning motivation are consistent and overlapped with the above motivation of playing the game. Because of the rules and mechanisms set in the prototype, players with more historical knowledge will have more chances to win the game. Cheng, Qian and Keke said that the motivation of their learning is to win the game. The three participants hope to gain more chances to win the game by mastering

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more historical knowledge, so as to accumulate more points in exchange for rewards and ranking leading positions.

On the other hand, some participants think that part of the game mechanism in the prototype helps them to learn. The game mechanism most mentioned by participants is first-person narration, a communication platform, game rules, and level-up. Five of the seven participants mentioned the level-up mechanism. Participants emphasized the importance of level-up and unlocking in the game. Mona, Dazui and Qian believed that it would be easier for them to enter the game through level restriction and then gradually unlock the more difficult challenges. In this process, level-up and unlocking will play a role in guiding players. Qian and Li pointed out that level-up breaks down learning objectives into small stages step by step, which is more in line with their original historical knowledge level.

*"I think it is a good starting point for the order of the development of the dynasty. When I level-up, I can go to the more challenging game room and learn the harder stuff."/.../"Breaking down learning objectives into small steps is in line with my current learning progress. The learning task will not be too difficult for me to complete." – Qiang*

The mechanism combination in the prototype chance card pool requires players to tell the five elements related to historical events, time, historical-figures, causes, processes and results. Li and Mona mentioned in their first interview that listening to stories of historical events is irrelevant and boring. The game mechanism of the prototype changed Li and Mona's idea of listening to historical stories. The game mechanisms in the chance card pool helped Li, Mona and Dazui find a connection between themselves and listening to historical stories. The explanations of the three participants are the same. The combination of game rules, first-person narration, and communication platform makes them participate in the game all the time. Because the game mechanism requires the player to vote for the correctness of the historical story described by other players.

*"Whether it's as a narrator or a listener," /.../ "I need to listen carefully to other players' narratives and then make my own judgment." - Li*

Similar to Li, Mona and Dazui's ideas, Keke and Qian also believe that first-person narration increases their sense of direct participation in the game. Keke and Qian's direct sense of participation comes from the learning environment created for them by the first-person narrative and communication platform. Keke describes the learning environment as "like a student learning group".

*"Learning groups allow players to help and share knowledge with each other," - Keke*

Among all the seven participants, Keke, Mona, Qian and Li all claimed that the learning environment of learning together with other learners and helping each other increased their learning motivation.

Another part related to a good learning environment is created by game aesthetic design. Liang and Dazui propose an aesthetic design to provide them with associative memory methods and a sense of substitution related to learning content. All the aesthetic designs in the prototype are integrated into the art design that can represent ancient China. In Qian and Dazui's submission, the art design that matches the learning content creates a learning atmosphere with a sense of substitution and a unified style for the whole game process. The art design of the prototype has increased the association between the learning activities, the learning content and playing.

Qian also mentioned the mechanism in the prototype to collect costumes of various dynasties and match costumes for their game characters. The game mechanism mentioned by Qian is what motivates him. As mentioned above, the collection mechanism satisfies Qian's psychology of sharing, showing off and wanting to gain a sense of identity. Qian used "my children" to describe the virtual items he collects in the game. Aesthetic design, such as the appearance of items, the game artistic style captures the emotional response of the players, making the game and learning content closer to the players.

Dazui and Qian believe that prototype games provide a learning environment of free choice. Different game mechanisms and different learning contents are combined together so that learners can freely choose the learning part and the game part they are interested in. For Qian and Cheng, a single game rule that compares the strength of cards is not attractive enough. In contrast, the mechanism of the randomness, free speech and the need to exaggerate to gain the

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trust of other players are more playable. For Qian and Keke, the collection system, using points and virtual currency to exchange external rewards, allows them to find something more suitable for playing.

In the interview, in addition to the five participants' recognition of the learning motivation inspired by game mechanics, there were also participants' objections. Participants in this research, such as Li, Qiang, Cheng, Mona, Keke and Qian, believe that virtual items and virtual currency make the game richer and more playable. However, Dazui and Qiang think that too many virtual items and convertible virtual currencies distract them. "There are too many transactions way between currencies and items, it makes Qiang and Dazui is confused.

*"Although the content that can be played in the game has become richer, but I feel that my attention has been distracted. I don't know how I should choose, should I focus on learning history or running games. " - Dazui*

Qiang and Mona point out that PBL triad and competition with players reduce their learning motivation. Qiang took part in four-game prototype tests, but all four games ended in failure. As a result, there is a big gap between Qiang's final game score and other players (see the attachment). PBL triad and competition mechanism not only motivate Cheng, Qian and Keke but also make Qiang and Mona lose confidence and motivation in themselves. Mona's ranking in the game is not good, and she feels sad and not confident.

*"because all players know that the points in the prototype represent the level of historical knowledge to a certain extent. I am ashamed of my low ranking and points on the leaderboard. " - Mona*

The researcher believes that PBL triad can motivate and promote the learning motivation of players who are in a leading position in the pursuit of competition, such as Cheng, Qian and Keke. For the relatively backward players, the competition will bring a strong sense of oppression and shame experience, which will make them lose self-confidence and learning motivation, such as the experience feedback of Qiang and Mona.

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Finally, the interview discussed the overall game with the participants of this research. The personalized setting, nicknames, avatars, emoticons, virtual items and virtual currency are all game mechanisms mentioned by participants. Cheng, Li, Mona, Qian and Qiang recognize the freedom of the game, it focuses on personalized settings, nicknames, avatars and emoticons. Mona, Qian, Li, Cheng and Qiang think that a lot of commercial games are now equipped with personalized settings as standard. Players are free to change their UI, avatar and nickname. Mona describes similar game designs as "not amazing" and "universal.". The other four participants shared similar views and said they were used to including similar designs in the game. Participants are used to changing their avatars, nicknames and UI designs in the game.

*"I like this design very much. I often change my nickname or avatar according to my mood in other games". - Cheng*

*"Personalized settings allow me to arrange comfortable game interfaces according to my own habits. I often change my nicknames and avatars because I'm tired of watching them, even if it costs money to change them in 'final fantasy XIV'. " - Qian*

#### 4.2.1 Gain Score

In addition to promoting and reducing participants' motivation, game mechanisms and rules are also related to learning outcomes. Song and Zhang (2008) believed that motivation could not only lead to learning activities but also improve learning efficiency and learning outcomes. Qian and Cheng are motivated by PBL triad components to win games. The researcher looked at the two participants' pre-test and post-test, as well as their gain score rankings (see the attachment for rankings). Qian ranked second and first in pre-test and post-test respectively. Even though Qian's original historical knowledge score is higher than that of other players, Qian's gain score still increased significantly after prototype intervention. In the interview, Qian was not attracted by the game mechanism corresponding to the dynasty module. However, the gain score of Qian in the dynasty module is improved. The researcher thinks that Qian's desire to win games has turned uninterested game mechanisms into motivation. Cheng remains in the top three in the pre-test and post-test rankings and ranks first on the game leaderboard. According to Cheng's feedback, Cheng always maintains his ability and relies on his level of historical knowledge to win. It is reasonable to believe that learning motivation and

activities induced by PBL triad and competition promote Cheng to achieve more learning outcomes.

Participants	TEST	Dynasty	Gain Score	Emperor	Gain Score	Events	Gain Score	Total Score	Gain Score
Cheng	Pre-test	13 / 28	+9	6 / 33	+3	22 / 39	+3	41/100	+15
	Post-test	22 / 28		9 / 33		25 / 39		56/100	
Dazui	Pre-test	10 / 28	+8	10 / 33	+1	24 / 39	+1	44/100	+10
	Post-test	18 / 28		11 / 33		25 / 39		54/100	
Keke	Pre-test	9 / 28	+12	11 / 33	+4	13 / 39	+5	33/100	+21
	Post-test	21 / 28		15 / 33		18 / 39		54/100	
Li	Pre-test	10 / 28	+12	5 / 33	+6	14 / 39	+3	29/100	+21
	Post-test	22 / 28		11 / 33		17 / 39		50/100	
Mona	Pre-test	12 / 28	+9	3 / 33	+7	13 / 39	+6	28/100	+22
	Post-test	21 / 28		10 / 33		19 / 39		50/100	
Qian	Pre-test	12 / 28	+11	9 / 33	+3	21 / 39	+10	42/100	+24
	Post-test	23 / 28		12 / 33		31 / 39		66/100	
Qiang	Pre-test	8 / 28	+12	6 / 33	+2	14 / 39	+5	28/100	+19
	Post-test	20 / 28		8 / 33		19 / 39		47/100	

*Table 2. Pre-test and post-test scores of participants, and their gain scores*

In terms of each test module and the total score (Table 2), all seven participants had gain scores in the three modules. The researcher compared participants' gain scores in the dynastic module, the emperor module, and the historical event module. The gain score of participants in the dynasty module is generally higher than that of the emperor information module and a historical event module. The researcher found that participants received significantly different gain scores in the historical event module. The highest gain score is Qian, who got 10 points. The other participants' gain score in the historical event module is no more than 5 points, and even the lowest gain score is only 1 point. A similar situation also appears in the emperor information module, but the situation is not extreme in the historical event module. In the test of dynasty module, the participants' answers have a common feature. All participants were asked to fill in the name of the corresponding Dynasty. The testing of dynasty modules requires a clear understanding of the historical development sequence. Choice questions may be answered correctly by participants' luck. Therefore, the researcher changed the choice of multiple-choice questions and mixed single-choice and multiple-choice. Therefore, the test requires the players to consider and choose carefully. The test also includes open questions as a supplement to choice questions. Such a test design reduces the risk of guessing the right

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answer because of luck. Besides, some of the pre-test and post-test contents are not included in the learning purpose and content of the prototype. Part of the pre-test and post-test content only appears in the form of text in the game, but not in the game mechanism and actual play methods. The researcher distinguished these questions when collecting gain scores. The purpose of such action is to reduce the gain score obtained, not because of the risk of intervention (playing games); it makes the gain score data reliable. Then, the researcher discussed with participants about the problems found in the tests, as well as the experience of playing prototype.

When the interview discussed what mechanism is to help improve learning outcomes, the game mechanism that participants mentioned most are the try many times and game rules. Almost all participants mentioned that the mechanism of judging the strength of corresponding cards by dynasty order helped them remember the dynasty development history. Participants pointed out that the game mechanism that they tried many times provided them with learning opportunities for repeated practice. All seven participants appreciated the design of the text prompt provided on the back of the dynasty card, which showed the timeline of the development of the Chinese dynasty. Participants mentioned the same details of the prototype game. When participants were unable to determine the order of the dynasties themselves, they were helped each time with text messages from the cards. Keke pointed out that repeatedly checking the text messages on the cards and playing them in the right order made him deepen the right Dynasty development order. Keke uses "muscle memory" as a metaphor for the way of remembering through repeated attempts and practices. Qian and Li use "imperceptibly" to look like the process of memorizing historical knowledge after many attempts and practices. Appropriate help can also balance learning tasks and game challenges.

Keke, Cheng, Li and Qiang all have similar views. They believe that the prototype provides a kind of thinking logic for them to answer questions related to the order of dynasties. Keke and Cheng both said that the game rule to determine the energy strength of the corresponding cards was based on the order of the Dynasty's development. It helped Cheng to deduce the position of the dynasty in China's 5000 years development history. The game rule also provides participants with a way to associate and help them remember the order of dynasty development. Li and Qiang said that they use the order of dynasties to judge the strength of the corresponding cards. The game rule helps them associate the relationship between different dynasties. From the perspective of gain scores, all players have improved their level of historical knowledge.

The researcher also discussed with the respondents the phenomenon that the gain score of emperor information module was significantly lower than that of the dynasty module. Li pointed out that although the emperor's information is displayed on the cards in the form of text, in the actual game process, the game mechanism only requires players to know the emperor's name and the corresponding Dynasty. However, many questions in the pre-test and post-test are about the relationship between emperors and their historical events. Keke and Mona recognize similar views. Keke and Mona pointed out that although emperor information was displayed on cards, they did not pay attention to the "useless" text messages during the game. Therefore, the researcher thinks that it is not enough to display and inform the players of the learning content in the form of text. Players' attention is more easily attracted by the actual game operation and rules so that they can more effectively receive the learning content integrated into the game mechanism.

In general, the game mechanism can increase participants' motivation to play games and learn, as well as to obtain learning outcomes. It is worth noting that some game mechanisms also have the risk of reducing participants' learning motivation. Among the interview feedback of the participants in this research, to some extent, verified the validity of educational game design guidelines proposed by previous scholars. Participants' feedback during the test phase also helped the researcher to better identify what needs attention in the design of educational games and make appropriate design decisions.

## 5 The Prototype

There are two versions of the prototype. The first version is the initial prototype version drawn after the first interview. The second version is to optimise and modify the initial prototype version after a quick internal simulation. This version is which one presented to the participants of this study for testing.

### 5.1 Initial Prototype Version

A large amount of data in historical knowledge makes it difficult for the participants in this study to remember in the learning process (see section 4.1). The researcher determining game structure, then to design specific game mechanisms for each part of the prototype. At the same time, the researcher tries to integrate the learning content into the game mechanism. The ultimate goal of the prototype is to reduce the challenges faced by participants in learning history to a certain extent. Prototype game is a system that takes a card game as the core and contains rich game mechanisms.

#### COMPONENTS IN CARD GAMES

The prototype card game has three modules: standard element card pool, chance card pool, and tool cards. Among them, the standard element card pool includes clothing cards, dynasty cards and emperor cards. The tool card is a health card, which represents the initial health of the player before starting the game. There are historical figures cards, idiom cards, cultural relic card, and peach cards in the chance card pool. The peach card represents that it can instantly restore players a drop of blood.

#### RULES

Players need to judge the strength of the cards in the game according to the timeline of the development of the dynasty. The power of cards is determined by the order of dynasties. It means that the earlier the dynasty, the stronger the corresponding card is. The game requires players always to remember the relationship between the dynasties, to promote the progression of the game. The game also requires players to distinguish which dynasty different emperors belong to, to judge what cards can be and cannot be played. Players must always judge the

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development order of each dynasty in the whole game process. It also determines what cards can suppress other players. The game uses the game mechanism “try many times”, and every time the player plays a card, it is a process of remembering historical time.

When the player has no cards to play, the game provides the player with two options: i) directly choose to lose a drop of blood; ii) choose to draw cards from the chance card pool. The chance card pool has an independent game mechanism. When players draw cards from the chance card pool, they may get historical figures cards, idiom cards, and peach cards. If the player draws a cultural relic card, historical figures card, the player needs to describe a historical event related to the historical figures. Similarly, if the player extracts the idiom cards, the player needs to describe the historical information related to the historical event represented by the idiom. Players may also get a peach card in the chance card pool, which means the player can add a drop of blood directly. If the player gains a peach card with full HP, it wastes a chance of a peach card.

It depends on the votes of other players to determine whether the task of chance card pool is successful or not. Players need to gain the trust of other players after telling the historical allusions corresponding to idiom cards or historical figures cards. If the player's story is considered correct by other players, the player will not lose any blood. If other players have any questions about the story the player is telling, the story-teller need to convince other players to trust the historical story is accurate. In the end, it was decided by vote that if most players thought the story was false, the story-teller would lose one drop of blood. Conversely, the story-teller is safe and keeps the health constant. In other words, if the story-teller is not sure of the facts, the player must bluff. In addition, any other players can challenge the story-teller if they think that story-teller is bluffing. It means that the more history players know, the greater their chances of winning the game.

Because players have the right to choose freely, new dynamics may arise. Therefore, players would get different feedback. For example, when the player completes the task in the chance card pool, the existing health can be kept unchanged. If the player's task in the chance card pool fails, the player has to lose a drop of blood.

Card games have independent starting and ending conditions.

Start - the player randomly selects the cards representing the order to determine the rotation of the game. In order to keep a learning atmosphere in the game, players need to compare the power of cards before the game start. The emperor's cards determine the cards representing the

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order. As with dynasty cards, players need to identify which dynasty the emperor belongs to. If the emperor of the same dynasty, players need to identify the order between the emperors. Correspondingly, the older the emperor is, the stronger the card is; and the earlier the players start the game rotation. Besides, all players have the same amount of health and hold cards to start the game.

In the process - each player always has five hand-held cards from the standard element card pool. Each time an existing hand-held card is consumed, the player can randomly obtain a new hand-held card from the card pool. During the whole game, players play according to the above rules. It means that players need to learn the origin, process, and result of historical events. Players also need to learn to identify the development order of dynasties, the dynasty of the emperor, and the events and historical figures which are in the chance card pool.

End - each game ends in one of three ways, victory, draw, or defeat. The first situation is when the player's health is zero, the player defeat and quit the game. The second situation is that when all the cards in the standard element card pool are consumed, but the player's health is not zero, the game ends. In this case, the player with the most HP wins. All players are ranked according to the amount of HP at the end of the game. If all remaining players have the same health, the remaining players are the draw. If some of the remaining players have the same amount of blood, the corresponding players will rank in equates. Other players with less HP will be ranked from the next player in the same row. For example, if two players are equated for the first place, the remaining players will be ranked third.

## FEEDBACK

At the end of each game, players can get corresponding points according to their own ranking. For example, the first place can get 4 points plus; the second place can get 2 points plus; the third place can get 1 point plus; the fourth place can reduce 3 points. Points accumulated by players will be published in the form of leaderboards.

If players win, draw, and loses, they will get the corresponding points. Players have many different ways to unlock different achievements — for example, the achievement of winning three times, five times or eight times in a row. When the player gains victory 5 or 10 times in total can gain achievements. When players rely on the chance card pool to reverse the situation and finally win, they can get achievements. When players have accumulated a certain number of points, they can obtain corresponding achievements.

Besides, there are many return feedbacks in the prototype that are related to external rewards and internal rewards. The preliminary design idea is as follows:

In the prototype, players can use points to exchange for money and use the money to buy virtual goods. The material rewards that players can obtain include the profile frame, badge, collection, and consumable items. Points will also be used to rank players, and will eventually be displayed on the leaderboard. The higher the player's ranking in the game, the more gorgeous the badge. The more points, the higher the ranking is. The settings highlight the player's position in the game. Higher status means that players can gain more power, such as opening game rooms with passwords, and forcing other players to leave their own game rooms. When the player wins, achieves, and special items in each game, the game system will praise them. For example, public congratulations on the player's winning, get new achievements or collections. The prototype also includes an upgrade mechanism. After each game, players can get corresponding experience points according to the result of the game. The higher the level of the player, the higher the level of the room they can join. For example, at the end of each game, the first player can gain 126 experience points in addition to 4 points. The second-place can increase by 2 points and 100 experience points. The third-place can get 1 point and 83 experience points, and the fourth-place can subtract 3 points and increase 62 experience points. The experience value system of the prototype also increases the activity of daily login to obtain experience value bonus. For example, when players log in on the first day of the game, players cannot get an experience bonus. If the player logs in for two days in a row, the player can gain 5% of experience value in a single game. When the player logs in the game for seven days or more, the player can gain 30% of the experience value in a single game. If the player disconnects the number of consecutive login days, the experience bonus will be calculated based on the first day of login and start again.

The challenge mechanism in the prototype is in addition to the core card game; there are also challenges designed to get into more advanced game rooms. For example, the game room is divided into the elementary, intermediate level, advanced, master, and professional levels. For the game mechanism itself, the player level of the elementary room is lower than 30. Players in the intermediate level room are rated above level 30 and below level 60. Besides, players need to pass the preliminary examination, which is related to the preliminary learning goals. In other words, players can only compete with players who have a similar game level and learning level. For the learning part of the prototype, the game content in the elementary room is relatively simple. As an example, the game content in the prototype with the development of

Chinese history as the learning goal. Players must pass a test to identify the corresponding knowledge level of Chinese history development, in order to enter a more advanced game room.

The prototype also contains different virtual items, such as player character image, collection, room password lock, renamed card, gender card, hidden historical winning or losing card and created an alliance card. Leaderboards also rank players according to different perspectives, such as point ranking, victory percentage ranked, charm value ranked, money ranked, and collection ranking. Charm value depends on the clothes the players' characters wear. If players want to get more gorgeous clothes, they need to join in more advanced game rooms and get more points or money. The prototype also includes different social platforms, such as alliance, chat box. The game system also supports players to give virtual goods to each other.

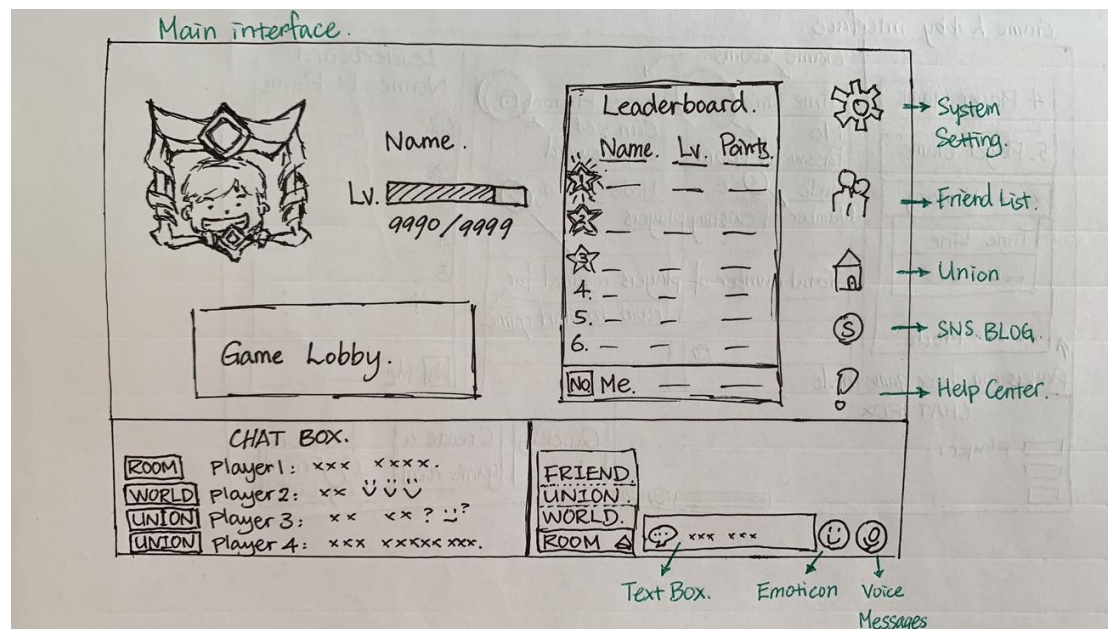


Figure 9. The main interface of the prototype

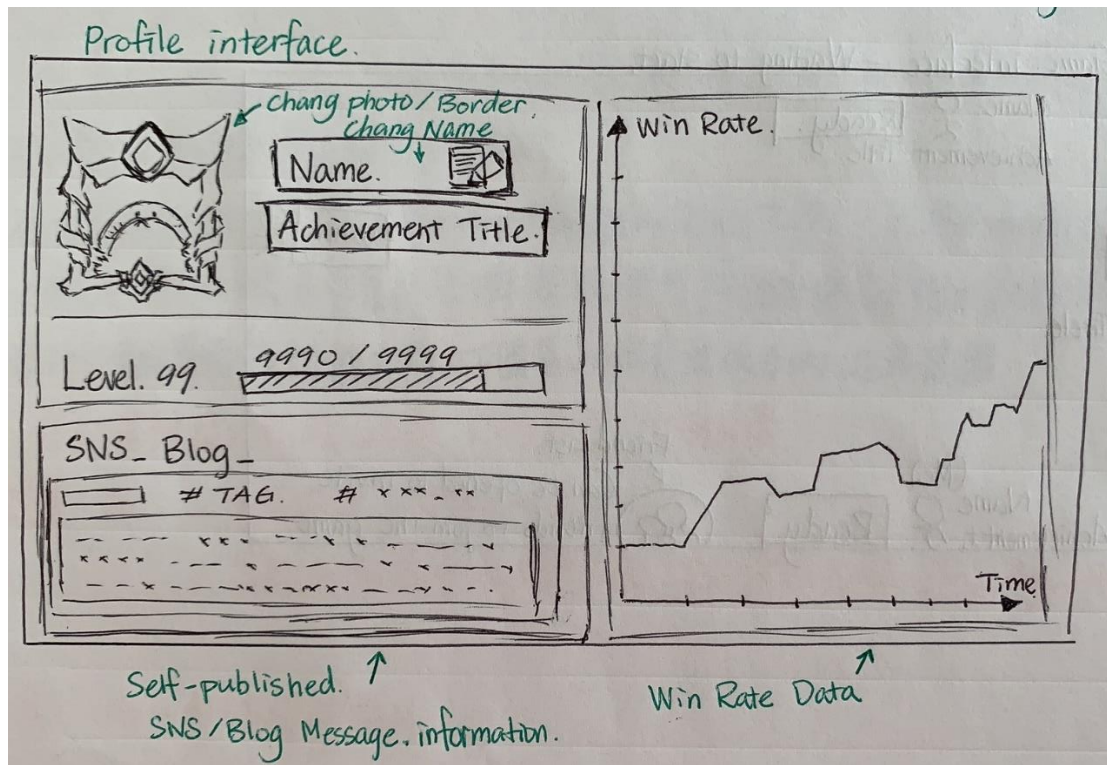


Figure 10. The profile interface of the prototype

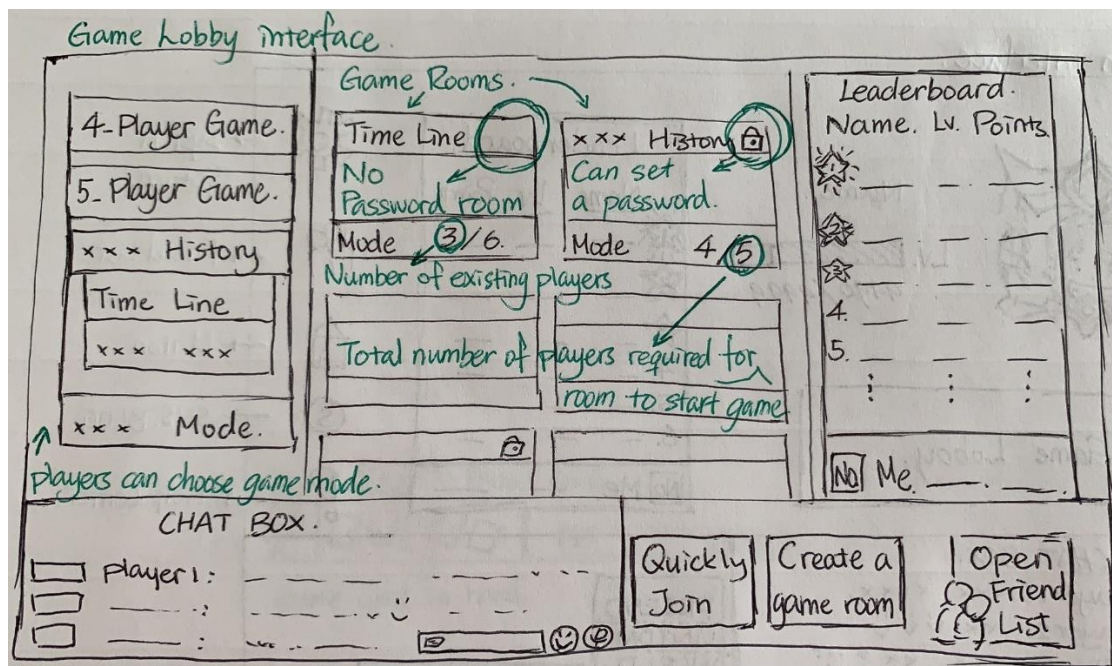


Figure 11. The game lobby interface of the prototype

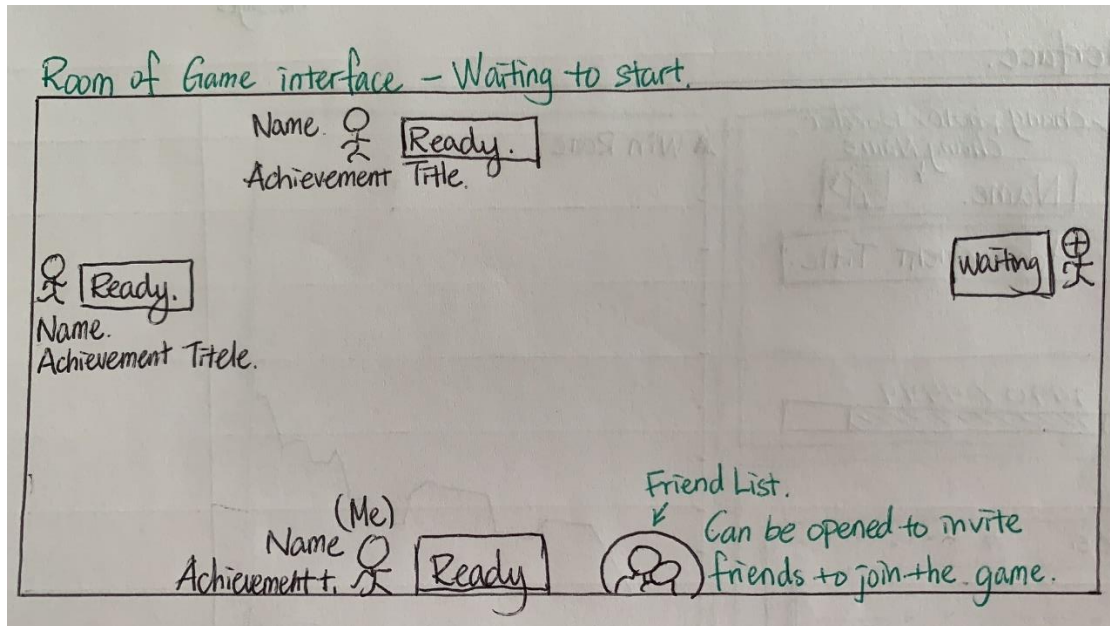


Figure 12. The game waiting-room interface of the prototype

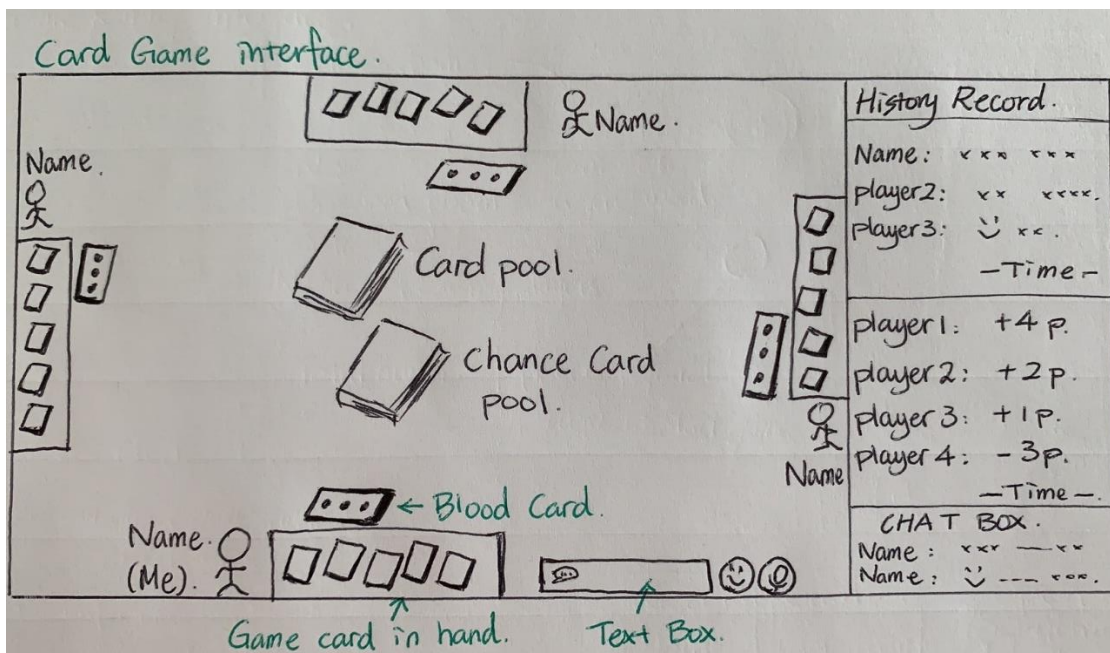


Figure 13. The game screen interface when players playing the card game

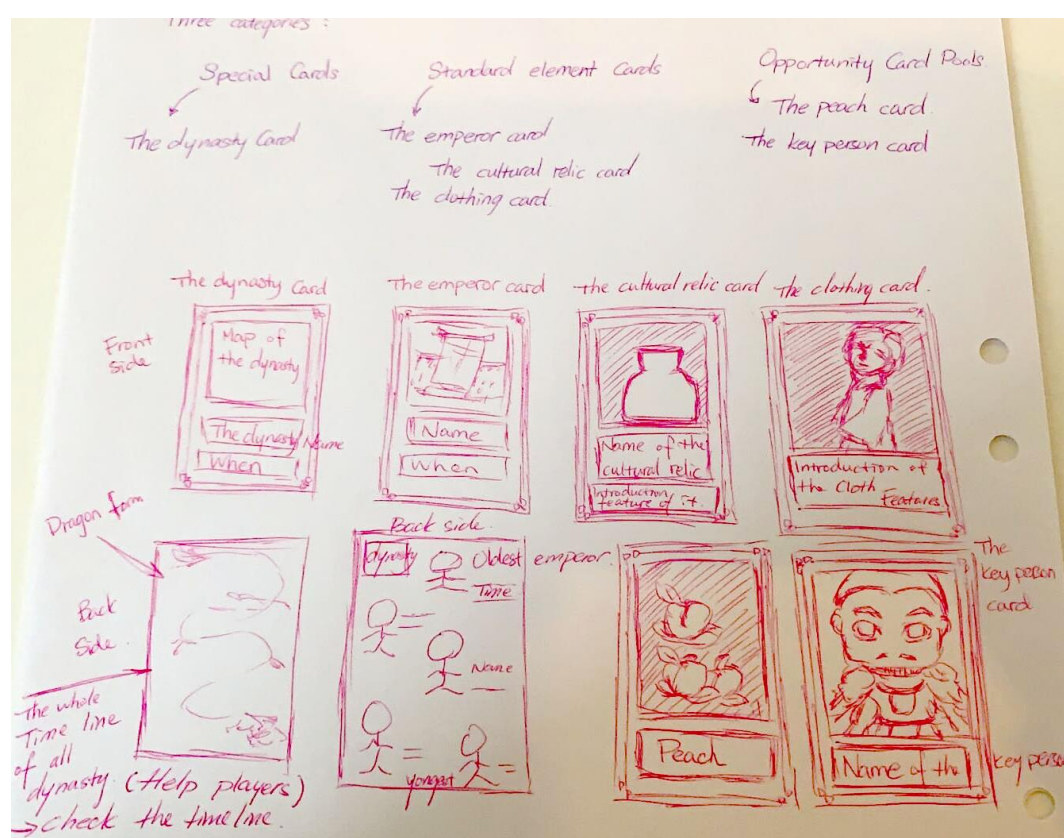


Figure 14 shows the draft of different kinds of cards in the prototype.

## 5.2 The Prototype for the Participants

The design of the initial version stays at the stage of draft and idea bursting. The rules and usage of the game need to be tested to verify whether the game can run smoothly. Therefore, the researcher of this study conducted a quick internal simulation of the initial version. The quick internal simulation was carried out with the help of the researcher of this study and a friend. The quick internal simulation adopts the technology of vertical prototype. This quick internal simulation only tests the rules of the card game to check whether there are bugs in rules. The researcher wrote the names of dynasties and the emperors on paper. According to the real characteristics of the Dynasty costumes and authentic cultural relics, the researcher made sketches on paper. Later, the researcher and another friend simulated several games of four players' card games.

In the process of simulating the game, the researcher found that some rules around the standard element card pool restricted the game promotion process. Later, the researcher made some adjustments to the design of the prototype based on the details found in the quick simulation. The following paragraphs show some comparisons and changes between the initial version and the new version while maintaining the above gameplay (refer to section 5.1).

## INITIAL VERSION

In the simulation process, the researcher found that clothing cards and cultural relic cards hindered the process of the game. Because the pattern of the items in the clothing cards and cultural relic cards is difficult to match with the real ancient costume and cultural relic in the prototype.

In the initial version of the rules, players play a dynasty card such as the Ming Dynasty. The next player can play a dynasty card earlier than the Ming Dynasty, such as the Tang Dynasty. Another choice is to play an emperor card belonging to the Ming Dynasty. The third player can also play a Dynasty card earlier than the Tang Dynasty which played by the second player. If the third player plays the emperor card, the emperor card must also belong to the Ming Dynasty and be older than the emperor card played by the second player.

## NEW VERSION

In the new version, the researcher optimised some rules around Dynasty and Emperor cards. Players play a dynasty card, such as the Ming Dynasty. The next player plays a dynasty card earlier than the Ming Dynasty, such as the Tang Dynasty. In another case, players can play all the emperor cards they have which emperors belong to the Ming Dynasty. At the same time, players need to supplement the number of cards they played out. When players play emperor cards, they no longer need to compare the age between emperors. Instead, players only need to play emperor cards belonging to the same Dynasty.

The original rules of playing cards make it difficult for players to play cards in the initial version. The rules of the initial version lead the game to rely too much on the opportunity card pool. Therefore, the researcher simplifies the rules of playing cards appropriately without changing the core rules.

To solve the problem that clothing card and cultural relic card hinder the process of the initial version, the researcher cancelled these two kinds of cards. However, the researcher believes that the distinctive costumes and cultural relics of each dynasty are still an essential part of historical knowledge. Therefore, the researcher moved the game elements of clothing and cultural relics into the internal economic mechanism of the prototype game. In the initial version, players can earn points, exchange money, and use the money to buy virtual goods. On this basis, the virtual items of the game add the corresponding characteristics of costumes and cultural relics of each dynasty. Clothing and cultural relics can be used as virtual objects for players to collect and display them in the players' game interface.

In the initial version, some ideas about the internal economic mechanism of the game were too digital. There are also some mechanisms about the internal economy of the game that needs to run for a long time. For example, game mechanics such as when players log in to the game continuously, the system will issue bonus of percentage experience value; get higher permission about designing room password lock, forcing other players to leave their own game room, etc. Therefore, the prototype finally confirmed 19 game mechanics for participants to use and abandoned some mechanics that are difficult to implement in a short-term physical prototype.

Rules: as mentioned above, the game rules of the prototype combine learning objectives with learning content. A large part of the game rules service to learn objectives and content. The other part of the rules of the game serves for the card judgment mode and the conditions for ending the card game. In general, the rules of the game determine how players play the card game in the prototype, and how to end the card game.

Points: at the end of each game, players will get corresponding points and experience values according to the ranking obtained at the end of the game. The players with higher ranking can get more points and experience value. The players with the last ranking even need to subtract points and only get a small amount of experience value. Such a mechanism design enlarges the gap between players, is positive feedback what reduces the stability of the game.

Leaderboard: the leaderboard will rank players according to their accumulated points. The leaderboards prove to a certain extent the players' game skill and the mastery of learning knowledge. Leaderboards allow players to immerse themselves in the atmosphere of competing.

Badges, achievements, collections, avatars: these game mechanisms form part of the game economy in the prototype. When players achieve certain goals and conditions of the game, they can get more and more gorgeous badges, advanced achievements, more items and more

beautiful character images. It is also part of the feedback mechanism of constructive returns, the higher the net revenue when players win more games.

Virtual items, virtual currency: these two-game mechanisms build another part of the game economy in the prototype. The more victories the player gets, the higher the ranking at the end of each game; the more points and experience the player can get. Points can be used not only for ranking competition but also for virtual currency exchange. Virtual currency can be used to exchange more advanced and gorgeous virtual goods and props.

Personalized-setting, nicknames, avatars, emoticons: these game mechanisms add a player's freedom in the game. Players can change the design of the game according to their preferences. Personalized-setting includes personal information such as nicknames and avatars that are displayed in the game. Players are also free to choose the Emoji package for a chat.

Level-up and unlocking: when the player finishes a card game, they will get corresponding experience value according to the position at the end of the game. When the experience value is accumulated to a certain value, the player can level-up. Only when players accumulate enough levels can they take part in an assessment of their current level of knowledge. When the player passes the assessment, the game will unlock the more advanced game room and what is more difficult to learn. That is to say, players in the same level of game room encounter players with similar knowledge level.

Try many times, first-person narrative and communication platform: as mentioned above, these game mechanisms are included in card games. Every attempt of players is a process of memorizing historical knowledge. The first-person narrative and communication platform require players to fully participate in the game and learn historical knowledge with a positive attitude. At the same time, the prototype game encourages players to communicate with each other and learn through mutual help.

In addition to optimising the rules of the game, the researcher further designed card and interface based on the draft. The following picture shows the changed game interface design (Figure 15-19) and the art design of different kinds of cards (Figure 20-26). The researcher made real cards for participants to use during prototype testing.

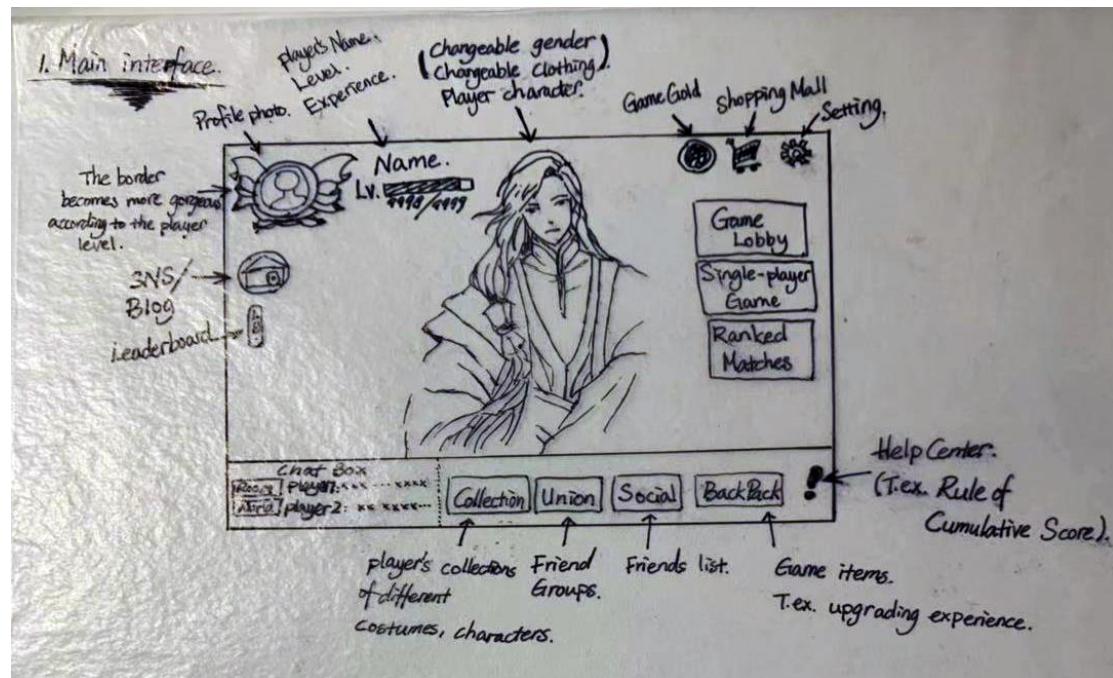


Figure 15. New Main Interface

After the change, the layout of the main interface has been changed, and the display of the player's role image has been added.

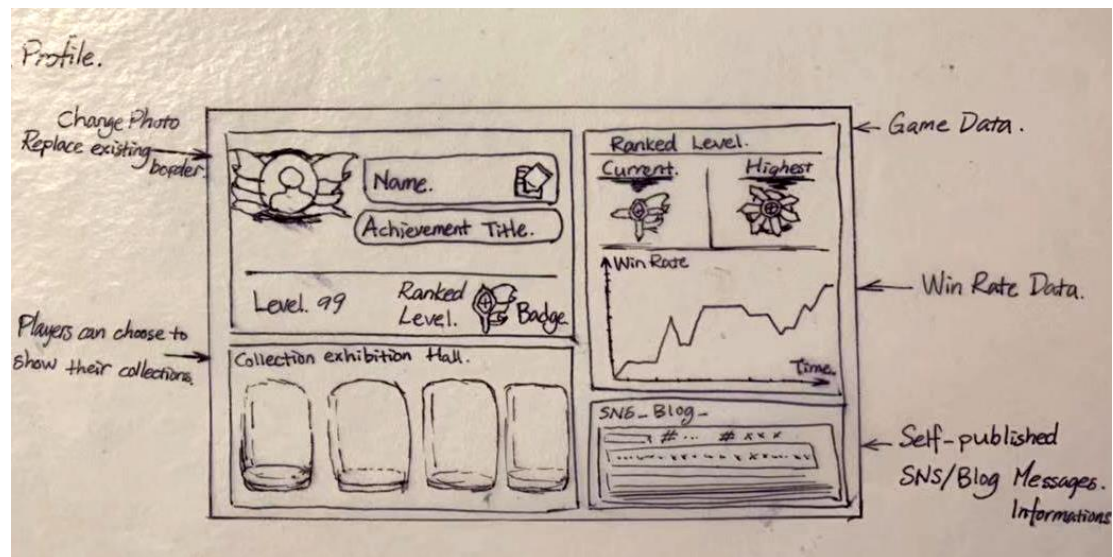


Figure 16. New Profile Interface

The display area of collection mechanism in the new profile interface replaces the original SNS module. The new profile interface also began to show the badge mechanic.



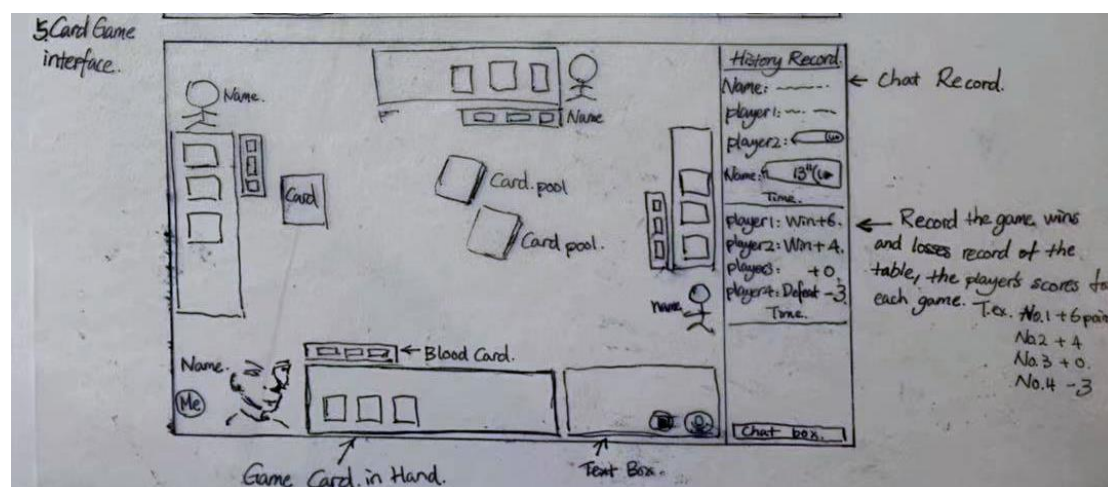


Figure 19. New Gaming Interface

In the same way, the layout of the game waiting interface and the gaming interface has been changed, and personal information such as the player's avatar image and level has been added.



Figure 20. The Front Side of Dynasty Card

The picture shows the front side of one of the dynasty cards. Visually, the colour of the front of the card is suitable for long-term viewing. The main background image of the card is the Chinese dragon pattern. The dragon pattern is one of the decorative designs on Chinese bronzes. In traditional Han culture, dragons are often used to symbolize auspiciousness. In

Chinese history, only the emperor could wear the yellow robe and have the dragon pattern on the clothes. The name of the dynasty was written on the card in Chinese calligraphy. Details of the dynasty are written on the left. When players see traditional Chinese designs such as dragon designs and calligraphic fonts, they can quickly think of history. The same artistic design concept appeared on other cards.



Figure 21. The Front Side of the Emperor Card

Out of the same artistic design concept as the dynasty card, the emperor card shows the ancient Chinese architecture. The Chinese emperor's name in Chinese calligraphy and corresponding year number is written. The name of the important dynasty in which the emperor is located is also written on the card. It is written in a font called ZhuanTi. The font ZhuanTi is one of the writing fonts from ancient China and was used from the Zhou Dynasty.



Figure 22. The Backside of the Dynasty Card and the Emperor Card

The text on the back of the card is still in Chinese calligraphy. The order of the existence of all dynasties is around the card. The central Chinese character represents how the word "dynasty" was written in Chinese.



Figure23-24. The Front Side of the Peach Card & The Back Side of the Chance Card Pool

In the peach card, the peach is drawn by the Chinese ink painting style. The buildings on the cards are illustrated in the style of ancient Chinese architecture.



Figure 25-26. The Front Side of the Idiom Card & The Blood Card

The Chinese characters of the idioms are written in the centre of the card with its pronunciation. There also is an ancient Chinese architectural pattern in the background.

## 6 Discussion and Reflection

The discussion section covers the benefits of discovering history through games during the research. In the discussion section, the researcher reflects on the two issues related to the design decisions proposed in the results section and put forward design suggestions.

### 6.1 Benefits of Learning History Through Playing Game

According to research results, players have seen benefits in learning by playing games. For example, clear game rules and goals allow players always to know what they are doing and learning while playing the game. The game also helps players reduce the difficulty of learning. Through different game mechanisms, they provide multiple ways of learning for players to memorize the knowledge they need to learn. The aesthetic design provides players with associative memory methods and a sense of substitution related to learning content. The game mechanism “try many times” provides players with the opportunity to learn through many practices. “Try many times” also let players become more familiar with the learning content in the process of doing challenges many times. Communication platform provides players with an atmosphere where they can learn with other players. The level-up and unlocking break down the learning difficulty and goals into small goals for players. It provides players with appropriate levels of learning and game challenges. To the player's psychology, PBL Triad has inspired some players. The game also provides players with a pleasant and relaxed learning environment. The game allows players to psychologically reduce the external stress caused by stressful studies and examinations.

The benefits of games discovered in the study are closely related to the findings in the literature. Adams (2010) advocates player-centred game design, and McGonigal (2011) believes that the player can enter a psychological state called "flow" during the game. Player-centric game design advocates focusing on the psychological needs of players. Therefore, understand the difficulties that players face in learning, and then help players solve practical problems in learning through game design. This research takes learning history as an example and finds that learners have difficulty remembering historical figures, time, and historical events. Therefore, the prototype game designed the game mechanism related to historical development and historical figures. The first-person narrative game mechanism allows players to learn from each other's known historical content in an environment of communication with

other players. Participants in this study learned relevant historical knowledge while enjoying playing games. McGonigal (2011) believes that the mental state known as "flow" refers to the player's always on the verge of failure during the game. However, the player is unwilling to give up the challenge and continue to maintain their highest level of performance. The above explanations are in line with players' actions in the game, complete the challenge step by step after trying many times. Players also become more familiar with the learning content in-game. In the game test, some participants are not afraid of failure and hope to get more victories, rewards and status through more games.

McGonigal (2011) believes that games make players psychologically willing to overcome completely unnecessary obstacles contained in games. Those obstacles can make players feel happy. In the prototype, the participants of this research overcome the obstacles of memorizing dynasty order, Emperor information and the five elements of historical events, to complete each card game. As emphasized in Doney (2019)'s educational game design guidelines, the purpose of the game needs to be consistent with the aim of learning. Players can feel that learning difficulty is reduced by playing the game. The reasons are that players overcome challenges when playing the game happily, actually also overcomes the difficulties in learning. Participants in this research got gain scores in post-test and began to overcome the memory barrier of memory Dynasty order. Also, the game mechanism not only inspires the players' motivation to play the game but also inspires learning motivation. When the players obtain learning results through interfere (playing games), they also enjoy the fun in the process of playing games. The education game establishes an inviting, relaxed and pleasant learning environment for the players.

Five of the seven participants were gamer. They were Qian, Cheng, Qiang, Mona and Li. In the research process, gamer participants can easily compare the prototype with similar game types and mechanisms with their past numerous game experiences. Although the prototype is presented in the form of physics and paper, gamers have an infinite close association with the prototype design of the final digital concept. In this regard, the researcher believes that the feedback and opinions given by gamers are beyond the prototype presentation ability and expectation.

A small number of participants were non-gamers. Two of the seven participants, Dazui and Keke, were not used to playing games. Game designer Brie (2017) advocates a team of non-gamer members to design the game. Brie (2017) claims that non-gamer designers can jump

out of the habit of thinking and give more amazing ideas and details. The feedback given by non-gamer participants in prototype testing is quite different from that provided by gamer participants.

#### PARTICIPANTS WHO ARE GAMERS

Participants who are gamers have several things in common. This part of participants can quickly notice the effect and influence that mechanics may bring to their game process. Especially the entertainment experience is more prominent. Therefore, participants who are gamers are more demanding in terms of game fun.

#### PARTICIPANTS WHO ARE NON-GAMERS

The participants in this part pay more attention to the ease of using the rules of the game. When the game mechanism is too rich and complex, non-gamer participants are more easily confused and lose their learning goals. However, the rich mechanism and the competition with other players are the aspects that gamers feel interesting in the game. To some extent, the feedback given by gamer and non-gamer participants in prototype testing is opposite to each other.

The researcher believes that gamers' feedback and suggestions on the prototype are helpful for the entertainment and mechanism design of most games. On the contrary, the feedback from non-gamers is to regulate the design balance of the prototype between entertainment and learning objectives. If the participants are gamers, the design may become more commercial and entertaining games. If the participants are non-gamers, the design of the prototype may not have enough difficulty and attraction for gamer users.

To some extent, the research received feedback from both sides. Of the seven participants, only two were non-gamer. The research chooses to use pre-test and post-test to evaluate the learning outcomes of all users. On the one hand, digital data comparison is reliable and most intuitive compared to asking users if the prototype is effective in improving learning outcomes (Amr, 2012). On the other hand, the test method of the gain score, as a supplement to interview, it balances the difference of game performance between gamer and non-gamer. The researcher envisioned what would happen if the study were tested only in the form of questionnaires and user ratings. Although feedback from gamers and non-gamer participants on the entertainment and learning aspects of the prototype can also be obtained, the researcher cannot rule out the

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risk that the data is too subjective. Gamers may give a low score because the prototype does not achieve the playability of the entertainment game. In the same way, non-gamer may spend most of their energy on understanding game challenges and neglect the actual help of game to learning. Here, there is an extra risk of influencing the results of the study than the current research. The risk is that the research results may be affected by the user's personal preference for game types, personal game experience, game operation and other variables (Hartmann & Klimmt, 2006; Adams & Dormans, 2012). The current research methods narrow the gap between gamer and non-gamer in terms of game understanding and gameplay skills level, which may have an impact on the research results. At the same time, interviews and case descriptions still allow gamer and non-gamer to express their own unique views on the game.

## 6.2 Design Requirements for Educational Games

The educational game design guidelines put forward by previous scholars and participants' learning needs of this research, the design requirements of a prototype are made. The essence of educational games is a combination of education and games. The game is a formal closed system with four defining traits: goal, rule, feedback and voluntary participation (McGonigal, 2011). The game itself is a complex, rich system, and full of variable and quantifiable results. The components that make up the four defining traits of McGonigal (2011) are inseparable from the design of the MDA framework. Aesthetics captures the emotional response and subjective experience of players, including feeling, fantasy, narration, challenge, following, expression, friendship, discovery and obedience (Kim et al., 2018; Alevan et al., 2010; Doney, 2019; Adams & Dormans, 2012). Dynamic is the behaviour generated when the player applies the game mechanism during gaming (Alevan et al., 2010). Werbach and Hunter (2012) claim that the most important game dynamics in the game are control, emotion, narration, progress and relationship. The game mechanism is the purest part after game stripping aesthetics, technology and story setting; it is the real core of the game. Adams and Dormans (2012) classified game mechanisms into five categories: Physics, internal economy, progression, tactical manoeuvring and social interaction.

An educational game is a specially designed game, which provides an effective learning environment for learners (Song & Zhang, 2008). Educational games attract learners to acquire knowledge through intrinsic motivation (Marchiori, 2012). Therefore, designers need to think

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about how to build a design to attract players' attention, improve their interest in learning and increase their motivation for learning. Designers also need to think about how to set learning goals and integrate learning content into the game mechanism.

Aleven et al. (2010) emphasized that the design of educational games needs clear learning objectives. Similarly, Song and Zhang (2008) emphasized in the EFM model that the design of educational games needs to set the goals of educational games according to 3D objects. 3D objects emphasize the combination of knowledge and skills, processes and methods to develop the goals of educational games (Song & Zhang, 2008). In other words, the goal of educational games should be established under the principle of promoting learners' learning, which may be separated or integrated with the original goal of the game. Therefore, because of the challenges faced by the participants in this study, the researcher follows the suggestions of previous scholars to design the goals of educational games and learning goals in games.

According to the interview, participants have a certain understanding of Chinese history, but the memory of detailed data is vague and confusing. Therefore, the learning goal of the prototype is to help participants memorize knowledge and to design according to the characteristics of historical knowledge. The learning goal of the prototype is 1) learning Chinese history, starting from remembering the overall order of dynasty development. 2) Remember which dynasty each emperor belonged to. 3) Learn the cause, process, result, and period of events. The game goal of the prototype is 1) players need to reduce the number of blood loss in each game and keep more blood than other players. 2) Players need to win every game to get more points and rewards.

In the game mechanism, players need to use the combination mechanism of the first-person narration and communication platform to narrate knowledge related to historical events. At the same time, the researcher hopes to increase players' sense of participation through relevant mechanisms. The researcher also hopes, to some extent, change the concept that learning history has nothing to do with them. In this process, the game requires players to participate in the storytelling process as narrators or listeners. Also, the researcher designed mechanisms to prevent listeners from feeling that other people's stories have nothing to do with themselves. Several listeners judged the correctness of the story by voting. In other words, the listener needs to listen to the narrator's words carefully so that they have the right to decide whether the narrator can challenge the success of the task.

Prototype design combines learning content, game mechanism, and game rules. The researcher hopes to use prototype design to help participants reduce or solve the difficulties in learning history by addressing the learning needs of participants in this study.

In general, the design of learning objectives and rules in the prototype is more inclined to the history subject. The learning objectives and rules in the prototype are based on the difficulties and challenges faced by interviewees in learning history. "Rote learning" is a learning method that is disgusted by participants. The opposite of rote learning is a way called experiential learning. In experiential learning theory, learning is regarded as a process (Kolb & Kolb, 2005). Kolb and Kolb (2005) pointed out that learning should involve learners in a process that can maximize their learning ability, which includes feedback on the effectiveness of their learning efforts. The researcher of this study believes that the process of learning history by playing games is to transform "rote learning" into "experiential learning".

The previous scholars' design guidelines are helpful to the researcher in this study. Based on the design guidelines of Song and Zhang (2008) and Adam and Dormans (2012), the researcher of this study summarised two steps of designing game rules and objectives. These two steps are not only for the design of educational games based on history, but they are also suggestions for general educational games.

Steps\_ 1: To explore the difficulties users face in learning and the needs of the game. The researcher of this study thinks that the design of educational games can be more targeted to solve the problem after understanding the user's learning difficulties and game needs.

Steps\_ 2: Try to integrate the design of learning objectives and some game challenges. In such a design, users have a higher chance to play games while not forgetting the purpose of learning. These two steps may be a good start for designing a general educational game.

### 6.2.1 Suggestions for Choosing Game Mechanics

Returning to the purpose of this research, the researcher hopes to explore the underlying game mechanism in educational games and find a way to help the design choose appropriate game mechanisms. The researcher raised the following research questions: i) what are the underlying game mechanisms in educational games? ii) what role do these game mechanisms play in educational games? iii) how to summarize these game mechanisms to help the educational games design?

In the chapter of literature review, many previous researchers introduced the influence of various game mechanisms on the interest of games. Kim et al. (2018) believe that whether a game is attractive does not depend on the player's interests, but on the components of the game. Therefore, more and more diversified and complex game mechanisms are incorporated into interesting games. Based on the educational game design guidelines proposed by Song and Zhang (2008), Doney (2019), Alevan et al. (2019) and the previous researchers' research on the interesting game mechanisms, 19 different game mechanisms are selected for the prototype. After testing, the researcher made suggestions for the design of educational games based on 19 game mechanisms included in the prototype.

Based on the results of prototype user tests, the researcher of this study divided the 19-game mechanics contained in the prototype into three categories. The first category is the core mechanism related to both playability and learning. The second category is game mechanics, that require careful consideration by designers. The third category is the non-core game mechanism that can add brilliance to educational game present splendour.

In the first category, these game mechanisms include rules and goals, level-up and unlocking, first-person narratives, communication platforms, try many times, and aesthetic design. The game mechanisms mentioned above provided clear help for players to obtain learning outcomes and learning progress in the prototype test. Therefore, the researcher suggests that designers can choose these game mechanisms as the core game mechanism in educational game design. Both the design of commercial games and educational games focus on the player-centred design (Adams, 2010). Player-centred game design, which focuses on the characters of players and the gameplay that players will experience (Adams, 2010). In educational games, the game experience of players should include both entertainment and learning. Song and Zhang (2008) believed that when the game objectives meet the players' interests, the players will be more motivated to learn. Alevan et al. (2010) used three questions to guide designers to make design decisions:

1. What knowledge or skills do players need to have before starting the game?
2. What knowledge or skills can players reasonably be expected to learn from the game?
3. What knowledge and skills might they learn that go beyond what they actually encountered in the game?

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The goal design of educational games should consider the combination of knowledge and skills, processes, and methods (Song & Zhang, 2008). The same authors emphasized that the goal of educational games should be established under the principle of promoting learners' learning. In educational games, game goals, and learning goals are independent, but they are also inseparable (Song & Zhang, 2008). In the process of research, the researcher of this study followed the design suggestions put forward by Alevan et al. (2010), and Song and Zhang (2008), using game rules to promote players to achieve game objectives and integrating and separating game rules and learning objectives. The prototype decomposes learning objectives into small steps by steps of level-up and unlocking. At the same time, the prototype uses level-up and unlocking to build an environment for participants to learn and play together with other players who have similar strength. Participants benefited from game rules in the prototype. The prototype went on smoothly and won the favour of some players. At the same time, the prototype improves the participants' historical knowledge level to a certain extent. Therefore, the researcher suggests that designers can choose the first category game mechanisms as the core game mechanism in educational game design.

The second category includes competitions, leaderboards, points, and badges (the PBL triad). It was found in research that these game mechanisms are usually directly related to the desire to win and the idea of defeating other players. According to the study by Dicheva et al. (2015), PBL triad is a typical external reward mechanism. Werbach and Hunter (2012), and McGonigal (2011) regard the PBL triad as a core mechanisms system among many different game mechanisms. PBL triad provides players with a direct feedback system, and it gives players with incentives and progress. However, Doney (2019) believes that external rewards may harm players' learning. The prototype test confirmed the harm for the participants' study. For players pursuing a sense of competition, as well as who has the top position in external rewards, the PBL triad has promoted their learning motivation. For players whose learning outcomes are relatively backward, the competition will bring a strong sense of oppression, just like the pressure brought by the exams during the student period. PBL triad may also bring shame experiences to this type of player, which will cause them to lose self-confidence and motivation. Competition and PBL triads can have a positive or negative impact on players in different situations. Therefore, the researcher of this study suggests that designers need to consider carefully when use competition and PBL triads in educational game design.

The third category of non-core game mechanics includes virtual items, profile photo, collections, expressions, avatars, personalized settings, nicknames, and virtual currency. The

above game mechanisms performed well in prototype tests; they bring entertainment to the game and have the potential to improve motivation. In terms of learning outcomes, the above game mechanisms have no key role in learning. Otherwise, there is a distracting risk from learning if there are too many above game mechanisms in the educational game. The researcher of this study believes that appropriate selection of such a game mechanism can help to add fun to the game and attract learners. If the game design uses too much of this kind of game mechanism, the game design may confuse the learning purpose and motivation because players pay too much attention to the fun of games.

## 7 Conclusion

The game design itself is a complex and worthwhile process. How to balance the fun and learning outcomes of the game is a challenge in educational game design. Therefore, how to choose game mechanisms becomes crucial. After clarifying the learning needs faced by learners, it is essential to develop game mechanisms that are consistent with learning goals.

In this aspect, the game mechanism in the prototype mainly focuses on the first-person narrative and communication platform. These two game mechanisms increase the sense of participation and promote the learning environment in which players help each other. Level-up and unlocking allow the game to disassemble learning tasks and goals into small goals so that players are more confident to complete more difficult learning tasks. Also, by comparing the gain scores of participants after pre-test and post-test, the researcher believes that the prototype education game helps participants learn history knowledge. After intervention (playing games), the participants' level of historical knowledge has improved to a certain extent. In this process, the core factors that help participants to remember the huge historical data are the integration of learning content into the setting of game rules, as well as use a game mechanism “try many times”.

The internal economy built in the prototype makes the players feel that the game becomes interesting and rich. The specific game mechanics are embodied in the prototype as virtual items and virtual currency. Besides, personalized settings, nicknames, avatars and expressions make the players feel freer in the game.

However, some game mechanisms also have negative effects when they have a positive impact on the prototype. During the test, the researcher found that points, competition and leaderboards could reduce the risk of learning motivation. For participants who like to compete and take the leading position of PBL triad, the game mechanisms points, leaderboards and competition motivate them. On the contrary, participants who are lagging are likely to feel discouraged, ashamed and want to give up because of competition, points and leaderboard. Most participants appreciated game mechanisms such as virtual items, virtual currency, personalized settings, nicknames, avatars and expressions. However, when there are too many similar mechanisms in one educational game at the same time, it may cause the risk of distracting participants' attention and learning motivation. Therefore, the researcher believes that in the process of designing educational games, there are two issues worthy of careful

consideration and decision-making. The two questions are how to design learning goals and game goals; how to choose a game mechanism?

An active educational game can not only attract learners but also solve some of the difficulties faced by learners. Even an active educational game may output substantial learning knowledge for players. In general, learning by playing games is a creative way of learning. How to choose the right game mechanisms in design will influence the effect of the game on learning.

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## Appendix

### Glossary

EFM = EFM is the acronym of effective learning environment, flow experience and motivation.

MDA = MDA is the acronym of mechanics, dynamics and aesthetics.

PBL triad = PBL is the acronym of points, badges and leaderboard.

### Sampling

	<b>Participants</b>	<b>Age</b>	<b>Academic Background</b>	<b>The Current Work</b>
1	Cheng	27	Finance & Business Major	Employed
2	Dazui	35	Dance Major	Employed
3	Keke	38	Accounting Major	Employed
4	Li	30	Hotel Management	Waiting
5	Mona	26	Business Major	Employed
6	Qian	28	Business Major	Studying
7	Qiang	36	Digital animation Major	Self-employed

Pseudonym Cheng is participant 1. He received a complete nine-year compulsory education in China. Then Cheng took the academic test for junior high school students and successfully entered high school. Then he took the national unified examination for admissions to general universities and colleges and entered his dream key university. During the university, Cheng studied finance service and then went to the UK to study international finance. Finally, he graduated from management and international business MA. Now he has returned to China and worked in a fortune global 500, his first year in the company.

Pseudonym Dazui is participant 2. Dazui received a complete nine-year compulsory education in China. Then Dazui took an art test and entered a professional college and graduated from dance major. Dazui is still engaged in dance-related work and has worked for 13 years.

Pseudonym Keke is participant 3. Keke received a complete nine-year compulsory education in China. Then Keke took the academic test for junior high school students to enter high school. Then Keke took the national unified examination for admissions to general universities and colleges and entered the university. Keke majored in accounting during his

college life, and successfully entered the enterprise work after graduation. So far, Keke has been engaged in accounting for 15 years.

Pseudonym Li is participant 4. Li had nine-year compulsory education in China until the second year of junior high school. Later Li went to Sweden to study in junior high school and high school. Then Li went to study in Switzerland and graduated from hotel management. Li has returned to China, and once had worked in China for two years related to hotel speciality. Li is now waiting for employment.

Alias Mona is participant 5. Mona had a nine-year compulsory education in China until she graduated from junior high school. Mona took the academic test for the junior high school students and the national unified examination for admissions to general universities and colleges. Then Mona went to the UK to study for a bachelor's degree and master's degree, graduated from marketing. After graduation, Mona returned to China and has been working in enterprises for two years.

Pseudonym Qian is participant 6. Qian received a complete nine-year compulsory education in China. Then Qian took the academic test for the junior high school students and the national unified examination for admissions to general universities and colleges. Qian entered key universities in China, majoring in Global trade business. Later Qian went to the UK to study for a master's degree and graduated from brand management. After his master's degree, Qian returned to China and worked in a fortune global 500 for one year. Now, once again, Qian went to the UK for his second master's degree, majoring in politics media East Asia.

Alias Qiang is participant 7. Qiang received a complete nine-year compulsory education in China. Then Qiang took the national unified examination for admissions to general universities and colleges and graduated from digital animation major. Qiang has been a freelance work since graduation. According to Qiang, he has held many different types of jobs. The initial work is mainly related to painting, illustrator, and graphic design. Now Qiang's work is more related to video shooting, post-production, director, and advertisement. Qiang has worked for 12 years since graduation.

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## Pre-test and Post-test Questions

- ◆ The content of the black font is the pre-test questions. The highlight yellow is the post-test questions. The blue font is the correct answers.

### The sequence of dynasties Test Module

- 1 Qin Dynasty: 221 BC - 207 BC
  - 1.1 The Northern Song or Earlier Song Dynasty: 960 – 1127
- 2 Han Dynasty: 202 BC - 220
  - 2.1 Qing Dynasty: 1644 – 1911
- 3 Three kingdoms, and Jin, and The Northern and Southern Dynasties: 220 – 581
  - 3.1 Tang Dynasty: 618 – 907
- 4 The Southern Song Dynasty: 1127-1279
- 5 Sui Dynasty: 581 – 618
  - 5.1 The Wei state of the Three-Kingdoms Period: 220 - 265
- 6 Ming Dynasty: 1368 – 1644
- 7 Choose the correct order of Chinese dynasties from the following options. The correct answer is? ( C )
  - A. Shang – Jin(金) – Song – Ming – Qing
  - B. Sui – The Three Kingdoms – Yuan – Ming – Qing
  - C. Shang – Qin – Sui – Tang – Ming
  - D. Shang – Zhou – Qin – Yuan – Song
  - 7.1 Choose the correct order of Chinese dynasties from the following options. The correct answer is? ( A B )
  - A. Tang – Song – Yuan – Ming – Qing
  - B. Xia – Shang – Zhou - Warring State Period

C. The Three Kingdoms - Warring State Period - The Northern and Southern Dynasties – Sui

D. Five Dynasties and Ten Kingdoms - the Sixteen States – The Three Kingdoms – Song

8 Choose the correct order of Chinese dynasties from the following options. The correct answer is? ( D )

A. the Later Liang - the Later Jin(晉) – the Later Zhou

B. the Western Zhou - the Eastern Zhou – Qin

C. Tang - the Five Dynasties – Song

D. Xin - the Eastern Han – The Three Kingdoms

E. the Northern Wei - the Western Wei - the Northern Zhou

9 The Sui Dynasty replaced the Northern Dynasty.

10 The dynasty that does not belong to the Southern Dynasty is \_\_\_\_\_ Dynasty? ( A )

A. Yuan

B. Song

C. Chen

10.1 Choose the correct order of Chinese dynasties from the following options. The correct answer is? ( D )

A. the Eastern Han - the Western Han – Wei – Jin(晉)

B. the Northern Song – Jin(金) - the Southern Song – Yuan

C. Tang – the Later Tang - Southern Tang – the Later Liang

D. the Western Zhou - the Eastern Zhou – Qin – Sui

11 The Southern Dynasties experienced \_\_\_\_\_. ( B C D E )

A. the Northern Wei

B. Song (Liu Song)

- 
- C. Qi
  - D. Liang
  - E. Chen

12 The first dynasty in Chinese history is the Xia Dynasty.

12.1 In the history of Chinese dynasty, the five longest dynasties are Zhou Dynasty (about 791), Shang Dynasty (about 500), Xia Dynasty (about 471), Han Dynasty (about 407), Song Dynasty (about 319).

13 The three nearest dynasties are the yuan, Ming and Qing Dynasties.

13.1 Before Tang Dynasty, it was Sui Dynasty.

14 Please rank the following 15 dynasties in the order from ancient times to the present. Yuan, Xin, Xia, Shang, the Three Kingdoms, Jin(晋), Qing, Qin, the Warring States, the Northern and Southern Dynasties, the Five Dynasties and Ten Kingdoms, Song, Tang, Ming, Sui.

Xia – Shang - the Warring States – Qin – Xin - the Three Kingdoms – Jin(晋) - the Northern and Southern Dynasties – Sui – Tang - the Five Dynasties and Ten Kingdoms – Song – Yuan – Ming – Qing

### Emperor information Test Module

15 Which dynasty is also called "Yin Dynasty"? ( A )

- A. Shang
- B. Xia
- C. Jie
- D. None of the above

16 Which dynasty built the Qianling mausoleum? ( A )

- A. Tang
- B. Ming
- C. Song

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#### D. Qing

17 The dynasty Wang Mang established was the Xin dynasty.

18 The first emperor in Chinese history was the first emperor of Qin.

18.1 The title of "emperor" began in the Qin Dynasty and was Ying Zheng (the name of the emperor).

19 The longest reigning emperor in Chinese history is Kangxi. He belonged to the Qing Dynasty.

19.1 The longest reigning emperor in Chinese history is Aisin Juelu Xuanye (the name of the emperor). In office for 61 years. Year Kangxi. It belongs to the Qing Dynasty.

20 The last emperor in Chinese history was Aisin Juelu Puyi.

21 The founding emperor of the Ming Dynasty was Zhu Yuanzhang.

21.1 The last Han Emperor was Chongzhen emperor, Zhu Youjian, who belonged to the Ming Dynasty.

22 There were 16 emperors in the Ming Dynasty. And please name the three of the emperors from Ming.

22.1 The last Emperor of the Han nationality was Chongzhen emperor, Zhu Youjian, who belonged to the Ming Dynasty.

23 Choose the correct order of the emperors from the following options. The correct answer is? ( C D )

A. Li Zhi – Li Yuan – Li ShiMing

B. Tang GaoZu – Tang GaoZong – Tang TaiZong

C. Li Yuan – Li ShiMing – Li Zhi

D. Tang GaoZu – Tang TaiZong – Tang GaoZong

24 Please write the years and names of the 12 emperors of the Qing Dynasty, and rank them in the order of old in age.

- 
1. 爱新觉罗·努尔哈赤 年号 - 天命
  2. 爱新觉罗·皇太极 年号 - 天聪与崇德
  3. 爱新觉罗·福临 年号 - 顺治
  4. 爱新觉罗·玄烨 年号 - 康熙
  5. 爱新觉罗·胤禛 年号 - 雍正
  6. 爱新觉罗·弘历 年号 - 乾隆
  7. 爱新觉罗·颙琰 年号 - 嘉庆
  8. 爱新觉罗·旻宁 年号 - 道光
  9. 爱新觉罗·奕訢 年号 - 咸丰
  10. 爱新觉罗·载淳 年号 - 同治
  11. 爱新觉罗·载湉 年号 - 光绪
  12. 爱新觉罗·溥仪 年号 - 宣统

### Historical Figures and Events Test Module

- 25 What Dynasty has the Xi'an Circumvallation been built-in? [From the Sui and Tang Dynasties to Ming Dynasty.](#)
  - 26 What are the four great inventions of China? [Papermaking, compass, gunpowder and printing](#)
- 26.1 Which of the following dynasties did not build the Great Wall? ( D )
- A. Han
  - B. the Northern Zhou
  - C. Ming
  - D. Qing
- 27 It was the [Qin](#) dynasty that dug the LingQu.

- 
- 28 The Forbidden City was built in the [Ming](#) Dynasty.
- 29 The Tian'anmen Rostrum was designed in the [Ming](#) Dynasty.
- 30 Select the correct options which are match correct between the following historical figures and the dynasty. ( [A D](#) )
- A. Li Bai – Tang
  - B. Su Shi – Tang
  - C. Du Fu – Song
  - D. Han Yu – Tang
  - E. Liu ZongYuan – Song
- 31 Which dynasty did the "Comprehensive Mirror for Aid in Government"? ( [A](#) )
- A. the Northern Song
  - B. the Five Dynasties
  - C. the Southern Song
  - D. the Northern and Southern Dynasties
- 32 What Dynasty set up Taiyi bureau? ( [C](#) )
- A. Han
  - B. Sui Tang and the Five Dynasties
  - C. Song
  - D. Qin and Han dynasties era
  - E. Ming and Qing dynasties era
- 33 "Nine sons seizing the legitimate power" took place in the [Qing](#) Dynasty. The winner is [Yin Zhen](#). He is the [fourth](#) (ordinal number) son of Emperor [Kangxi](#), [Aisin Jueluo Xuanye](#).
- 33.1 What are the main parties in the period of "nine sons seizing the legitimate power"? [The first son, The Crown prince, The Third son, The Fourth son, The Eighth son \(The Fourteenth son\)](#)
- 34 "Burning Confucian" took place in the [Qin](#) Dynasty, which was initiated by [the first emperor of the Qin Dynasty \(the historical figure\)](#).

- 35 The first emperor unified the font is [XiaoZhuan](#).
- 36 "San Gu Mao Lu (sān gù máo lú) "refers to what historical events and it is related to whom? \_\_\_\_\_, and it took place in the [Three Kingdoms period](#) (the Dynasty).
- 37 "Wang Mei Zhi Ke (wàng méi zhǐ kě) "refers to what historical events and it is related to whom?
- 38 "Yue Fa San Zhang (yuē fǎ sān zhāng) "refers to what historical events and it is related to whom?
- 39 "Fu Jing Qing Zui (fù jīng qǐng zuì) "refers to what historical events and it is related to whom?
- 39.1 "Zhi Shang Tan Bing (zhǐ shàng tán bīng) "refers to what historical events and it is related to whom?
- 40 "Ru Mu San Fen (rù mù sān fēn) "refers to what historical events and it is related to whom?
- 40.1 "Wan Bi Gui Zhao (wán bì guī zhào) "refers to what historical events and it is related to whom?

## Table of Game ranking

- ◆ *No.1 +4 p, +126 Exp*    *No.2 +2p, +100 Exp*  
*No.3 +1 p, +62 Exp*    *No.4 -3 p, +62 Exp for each card game*

	Round 1			Round 2		
No.1	Cheng	+4 p	+126 Exp	<u>Dazui</u>	+4 p	+126 Exp
No.2	Qian	+2 p	+100 Exp	Cheng	+2 p	+100 Exp
No.3	Mona	+1 p	+83 Exp	<u>Keke</u>	+1 p	+83 Exp
No.4	Li	-3 p	+62 Exp	<u>Qiang</u>	-3 p	+62 Exp
	Round 3			Round 4		
No.1	<u>Dazui</u>	+4 p	+126 Exp	<u>Keke</u>	+4 p	+126 Exp
No.2	<u>Keke</u>	+2 p	+100 Exp	Li	+2 p	+100 Exp
No.3	Qian	+1 p	+83 Exp	<u>Dazui</u>	+1 p	+83 Exp
No.4	Mona	-3 p	+62 Exp	<u>Qiang</u>	-3 p	+62 Exp
	Round 5			Round 6		
No.1	Cheng	+4 p	+126 Exp	Qian	+4 p	+126 Exp
No.2	Mona	+2 p	+100 Exp	<u>Keke</u>	+2 p	+100 Exp
No.3	Li	+1 p	+83 Exp	Li	+1 p	+83 Exp
No.4	<u>Qiang</u>	-3 p	+62 Exp	<u>Qiang</u>	-3 p	+62 Exp
	Round 7					
No.1	Cheng	+4 p	+126 Exp			
No.2	Qian	+2 p	+100 Exp			
No.3	<u>Dazui</u>	+1 p	+83 Exp			
No.4	Mona	-3 p	+62 Exp			
The Leaderboard of Total Score Ranking						
No.1	Cheng	+14 p		+478 Exp		
No.2	<u>Dazui</u>	+10 p		+418 Exp		
No.3	Qian	+9 p		+409 Exp		
No.3	<u>Keke</u>	+9 p		+409 Exp		
No.4	Li	+1 p		+328 Exp		
No.5	Mona	-3 p		+307 Exp		
No.6	<u>Qiang</u>	-12 p		+248 Exp		