

## Article

# Game-Based Learning and Assessment for History Education

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**Abstract:** Regardless of country and age, the importance of history education is a topic of perennial interest. Although the importance of history education is being emphasized in Korea, there are many difficulties in getting students to understand history properly through school classes alone, and it is also difficult to encourage students to participate in classes. The effectiveness of education using games was proven 20 years ago, and the demand for game-based education is gradually increasing in the current education sector, which is becoming increasingly open. In this article, based on the effects proved through research on existing game-based education, the improvement of historical thinking ability, experiential history learning, and the problems of game-based education introduced in a 2009 European Schoolnet (EUN) report and the discomfort of teachers who participated in this kind of education were improved. A plan was suggested to select and use games suitable for basic education. In this study, we selected a history game with a clear historical and period context and without distortion of history, and experimented with teaching using games that focus on historical thinking and learning about empirical history. Textbook-based education was used for comparative purposes.

**Keywords:** re-enaction history learning; game-based learning; historical thinking skills; historical game; historical education

## 1. Introduction

The importance of history education is emphasized in every country and culture. Rather, the more advanced a country is, the more important its history becomes, and support for history education is provided. Korea, which is the only divided country and constantly controversial in terms of historical issues with neighboring countries, needs a lot of investment and nurturing of interest in history education.

Efforts to use games for education have steadily continued for over a decade. Professor Jong Hyun Wi of Chung-Ang University introduced the concept of game-based learning (GBL), which introduced games into education [1], and proved its effectiveness through various educational experiments such as mathematics [2], English [3], politics [4], and economics [5]. He applied an MMORPG (Massively Multiplayer Online Role-Playing Game) called *Sky Island Online* to mathematics education, and obtained positive results in terms of confidence and attitude toward mathematics [2]. In a previous study of GBL, it has been pointed out that the games used for education are simple flash games or games that are played alone without being connected to a network, and the results obtained are also simple. English classes were divided into 50 min of game-using classes using an MMORPG and 50 min of in-depth classes to evaluate the contents of the study. In order to use the game while teaching English reading and communication, and to derive the result, the English test at the end of the experiment showed a significant difference in score [3]. In politics and economics students, after taking game-based classes, we investigated understanding and interest through questionnaire and obtained the results as expected [4,5]. As such, studies on the use of games that have been effective in various subject areas,

theories that combine them, and examples of actual class application have been conducted, while studies on the use of games in history subjects are insufficient.

Educators who observed the disadvantages of instillation-type education in the past produced various types of content such as movies and cartoons to understand history through storytelling and used them in education. Games also consider storytelling the most important factor in determining immersion; thus, history education, where storytelling is important [6], will be one of the subjects that will show the greatest advantage when used as a game.

In this article, using highly accessible commercial games for elementary school students history education is the subject of the experiment, using advantages such as storytelling and experiential learning of games based on history. The advantages of history games come from those that have a positive effect on increasing immersion in the story, so they are tested based on the hypothesis that they will work in favor of teachers who teach, and then we conducted a survey on teachers who participated in the experiment.

## 2. Use of Games in the Educational Field

Since educators communicate knowledge through interactions with students the means to inspire these students' concentration has become a subject of research regardless of the specific period. As one of these means, the concept of gamification or GBL in today's classes is being developed in various directions because it was able to be effective by adding fun elements of a game. 'Gamification' is the concept of adding play elements to fields other than games, and is commonly used to give small-scale goals and rewards. For example, giving a quiz without scoring the results of study as a test is the most common gamification, and a serious game that develops the content itself into a complete game also falls within the gamification category. Furthermore, GBL is a concept that utilizes educational elements in a game, and is a way for learners to learn something while playing the game.

Recently, gamification has been considered a promising future educational approach, making it one of the most favored areas in academic research and development [7]. GBL is a concept that utilizes the educational elements in a game, with the learner reaching the learning goal using a computer game that combines educational content and games without the direct involvement of the teacher [8]. In addition, game-based learning acts as a tool for learners to learn something from interactive learning through audio-visual capabilities, animations, videos, and games [9]. Taevs et al. suggested that semantic representations of auditory or visual stimuli and expressions in different modalities facilitate the formation of cognitive maps [10], and Lammert-Siepmann et al. showed that the memory performance of object identity is improved when visual communication and auditory communication occur simultaneously [11].

Serious games are games that aim to not only employ entertainment elements but also solve real-world problems [12]. However, serious games are currently being developed that focus only on educational efficacy [13–15], and most learning content is designed to study the achievement effects of learning or training using research data on the achievements of serious games or reports from public institutions in games, and takes the form of verifying the impact and performance of serious games [16–18]. However, when planning to educate using actual games, it is necessary to discuss 'how many classes to teach', starting with the teacher installing the games selected to be used; thus, even if the efficacy of serious games is academically proven, it is difficult use them in actual education if accessibility is reduced [19]. Developing a game requires a lot of resources, from graphics to sound, and a lot of advanced personnel capable of designing or coding, depending on the size of the game. There is a limit to covering these costs without investment. However, investments are made mainly in areas of high profitability, and it is difficult to expect high profits from serious games aimed at education.

Jeong and Lee have stated that serious games have an intentional purpose and should be purpose-oriented from the planning stage [20]. Serious games created for education already have excellent functions as educational materials to suit the purpose of development. The problem is that the effort to develop this great educational material requires more effort and resources than writing a single book. Compared to traditional education, serious games can inspire concentration through the advantage of fun, but the marketability is inferior as the genre is not popular. Products with poor marketability do not make smooth investments, leading to a decline in game quality and productivity. Serious games with low productivity have a narrow range of choices, and because they are mainly used for academic purposes, they are not easily shared, so accessibility is also low.

In Europe, research has been conducted for a long time in which advanced technologies or creative concepts are applied to education. European Schoolnet (EUN) is a network that researches and shares these teaching methods, and each Ministry of Education from 34 countries participates. The problems arising from the use of games for educational purposes, as indicated in a report released by EUN in 2009, are shown in Table 1 [21]. The problems introduced in the report are all directly or indirectly related to the selection of games suitable for education. This shortcoming is revealed in the plan to use commercial games, instead of serious games developed for education.

Table 1. Problems of using games in education.

Rank	Reason
1	Cost and licensing
2	Timetable of the school
3	Finding suitable games
4	Attitudes of other teachers
5	Training and support
6	Inappropriate content
7	Worries about negative aspects
8	Insufficient evidence of value
9	Examinations

3. Prior Research

In 2005, as shown in Figure 1, Professor Akira Baba of Tokyo University began researching with Koei and conducted an experiment in which the online games *Uncharted Waters* and *The Ambition of Nobunaga* were adopted as historical textbooks for the first and second graders. It was reported that it had a positive effect on improving learning motivation, increasing physical knowledge, raising awareness of the historical era, and improving cooperation/communication ability [22].



Figure 1. (a) Class with game-based learning; (b) a scene from the game *Uncharted Waters*.

At the 2008 'Korea–Japan Joint International Symposium on the Utilization of Online Game Education', Professor Akira Baba of Japan demonstrated the effectiveness of indirect history experiences in games, and Professor Jong Hyun Wi of Chung-Ang University defined online games as G-Learning, using *MapleStory* and *Online* [23].

Kim and Kim proved that games contributes to the development of historical thinking skills by applying the simulation game *Civilization V* to middle-school classes, which provides opportunities to experience historical events and characters. Although this experiment had side effects that could lead to distortion of students' perception of history, it drew attention by removing anxiety and raising questions about inaccurate reenactments through textbook-linked learning. However, they concluded that since there are practical restrictions for all students to practice in school sites with limited class hours, it is appropriate for exploratory learning activities but requires a lot of time to achieve results in on-campus classes [24]. Hong and Jin developed a serious game for elementary history learning and conducted a study to survey students' satisfaction [25], while Lee and Kim discussed the process of developing a serious game for history education and a method was proposed for inducing participation by providing a task involving content related to historical events [26]. In Europe, research on game-based education is active and investment is well coordinated. In Scotland, more than 500 teachers participated in the game education project, the Consolarium. In Denmark, the trade simulation game *Partition 3* was used for history education, and feedback was provided to parents on learning outcomes. *Partition 3* is a game in which players take on the role of traders and experience the history of Denmark in the Middle Ages [27].

Game-based education appeals more strongly to male students than to female students. A survey conducted by market research firm The NPD Group, Inc. found that male students had a higher level of knowledge of computers and games, but since 2013, female students' interests have been increasing linearly [28], and in simulation-based education, female students show more interest [29]. A study found that 6- to 12-year-olds welcomed games for learning about difficult topics, providing an interesting perspective on problem solving, promoting learning, and increasing interest in topics [30–33]. Microsoft conducts an educator training program called Microsoft Innovative Education Experience (MIEE). Microsoft also offers guidelines on creative education, including game-based education [34].

## 4. Research

### 4.1. Conditions for Selecting Games to Be Studied

The conditions of the game selected as the research topic in this study are as follows.

(1) The historical context must be clear. Historical elements to be taught through games include characters, culture, and technology. Games with an ambiguous context in the age of the game are unsuitable for history education if historical characters did not actually live in the same period or the historical context does not match.

(2) There should be no problems with historical evidence. In most FPS(First-Person Shooting) genre games, there is a problem related to firearms, and this part can be skipped personally as the difficulty of the test is high, but it is necessary to be careful because it can instill inaccurate knowledge in students. The historical evidence referred to several Internet communities. This is not an official indicator. However, as many netizens participate and discuss, any game with problems must be pointed out, so it is possible to get help in selecting the game to use for the experiment.

(3) There should be no distortion of history. Errors occurring in (1) and (2) above can be corrected by educators in the curriculum, but distortion of history refers to problems that will not end in private affairs. For example, among the games set in the Second World War, there was a game with errors (*WW2: Shattered Europe*), in which Finland fought with the Allies and Sweden and Spain participated in the Axis. Games that are expected to have such inaccuracies were excluded from the study.

#### 4.2. Feasibility Study for Analysis Criteria

Historical thinking and re-enactment have been mentioned as a result of a number of historical game-based education studies that have been discussed so far. The Ministry of Education aims to “educate the next generation of historical facts and the historical values inherent in them”, so that students can comprehensively grasp the activities of Korea’s people and understand today’s Korean phenomenon from a historical perspective. To this end, it should aim to foster ‘historical thinking’ [35].

Historical thinking skills vary according to the opinions of historical educators, and attention should be paid to aspects of ‘logical thinking’ and ways to develop ‘historical imagination’. The term ‘re-enactment’ is a phenomenological term that means you feel someone else’s experience as if you were experiencing it again. R. G. Collingwood, a British philosopher and historian, had an approach to history in which the historian attempts to conceptualize the past through evidence [36]. However, most evidence is not sufficient or decisive enough to confirm the process of a historical actor’s thinking, and humans can behave differently under the same circumstances, so reconstructing the behavior of a historical actor is the application of one’s thinking from the perspective of the actor, based on the assumption that “in these circumstances, that person would have done this” [37]. In fact, dramatization learning, role play, history writing, model making, history trial, history diary, and history drawing can be considered as approaches to learning re-enactment history [38]. In other references, there were cases where historical newspapers were published. Lee defined three educational effects learned through experiential historical learning as follows[39].

First, through critical and reflective thinking, the historical behavior that is the subject of learning is not accepted as fixed, but can always be selected and developed under one’s own control.

Second, by re-enactment of historical behavior, the historical behavior becomes the learner’s own behavior, that is, the new historical behavior becomes their own behavior, which means that the learner changes into a new self. Therefore, learners themselves can constantly change according to changes in the historical world.

Third, learning by imaginatively participating in historical behavior enables interaction between historical behavior and learners. Learning and behavior are not separated from knowledge, attitudes, and values, but are integrated into one by an activity called imaginary participation, which means that learning becomes an active process. Furthermore, the learning subject can induce motivation for learning by becoming the subject of close exchange with the learning subject.

As above, through re-enactment history education, students experience more than historical evidence as a subject of learning and ‘understand’ the history at the period being considered. Therefore, re-enactment history classes are appropriate for ‘historical thinking ability’, the goal of history education. It can be called a teaching method [40].

Among the problems of EUN’s report, as detailed in Table 1, only items 2 and 6 can be objectified and resolved. Item 1 is an objective figure, but it is subjective whether it is possible to burden the price. Items 4, 5, and 7 depend on the surrounding environment and the teacher’s own competence. Insufficient evidence for item 8 is resolved after a long study, but it is not an immediate problem. Item 9 is also the teacher’s responsibility. Therefore, we investigated whether item 2 could be divided into concentration sections based on the 40 min of elementary school with the shortest curriculum time, and whether item 6 contained elements that were unreported or inappropriate to teach in addition to the classes classified by the Game Rating and Administration Committee. The setting of a history game is the past, but it is different from the genre. Games in each historical background are classified into genres. Jang and Lee have argued that the relationship between the genre of the game and the field of learning is organized as shown in Table 2 [41].

**Table 2.** Expected learning effects for various genres of game.

Genre	Expected Learning Effect
Role-playing	Ethics and history learning
Simulation	Almost any forms of learning
Adventure	Finding suitable games
Arcade/Action	Attitudes of other teachers
Puzzle	Training and support

In this article, we considered the benefits of the genre and found and selected games that correspond to the three principles described earlier: historical thinking, experiential history learning, and time-sharing elements. As described in Section 4.1, we designed experiments to address the inconvenience introduced by the EUN report.

4.3. Selected Game Analysis

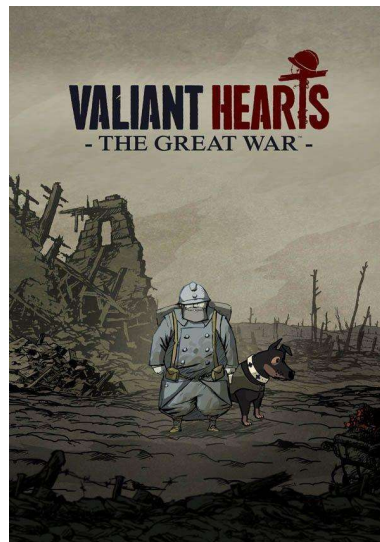
In the EUN report, the difficulty of game-based education was first selected as cost and license. Thus, a game was selected for this study by considering price accessibility.

1. *The Wednesday*(Figure 2)



**Figure 2.** Game *The Wednesday*.

- Price accessibility: about \$14.
  - Historical context: Japanese occupation period in 1945.
  - Description: A grandmother, who was protesting in front of the Japanese Embassy in 1992, suddenly returns to the day before her friends disappeared in 1945. At that time, Grandma was a comfort woman in the Japanese military; it is a puzzle adventure game in which friends find clues about disappearances and attempt to discover the truth.
  - Historical thinking skills: Since it introduces the daily experience of the victims as comfort women and the past activities of Japanese imperialism, such as the Japanese Army Unit 731, Maruta, and Unit 1644, it allows us to think about aspects of the war not covered in the existing history textbooks.
  - Re-enaction history learning: It makes you feel like you are experiencing your own story, not someone else's, because you feel that you created the story by direct manipulation. In this immersive situation, the player expects to experience empathy and loss.
  - Time division: The total play time is 3 to 5 h, but since it comprises several chapters, one chapter was taught per class.
2. *Valiant Hearts: The Great War*(Figure 3)



**Figure 3.** Game *Valiant Hearts: The Great War*.

- Price accessibility: about \$15.
- Historical context: First World War.
- Description: This game was created as a scenario based on an anecdote that would have occurred between 1914 and 1918, when the First World War took place. The main character of this game is not a war hero. It concerns the forced recruitment of soldiers during the war, fighting or fleeing, and surviving, using the surrounding terrain. In the process, all of the hero's companions are killed by guns or shells, showing the tragedy of war.
- Historical thinking skills: The game begins with the assassination of Franz Ferdinand, just as in real history. With the historical declaration of war by Germany on Russia, the protagonist, an ordinary farmer in France, is drafted into the army and the game begins. Based on the historical facts that emerge in this process, it is possible to generate interest in the First World War, and to induce the conscripted protagonist to empathize with the pain of war through victims he encounters while surviving the war.
- Re-enaction history learning: Since the protagonist is an ordinary citizen, it is expected that students' empathy can be elicited, and through this, an experiential history learning will be established.
- Time division: The flow of the game starts with a story and cycles through puzzle-action-story. Using this detail, a rotation of one cycle was used as one lesson.

## 5. Results and Discussion

In this article, an experiment was conducted on 32 6th graders at elementary school who had never learned history. The students were divided into 8 groups to form 2 game education groups and 2 textbook education groups, and lessons were conducted for 1 h and 30 min each for a total of 6 h. The teachers who taught the classes differed in their teaching careers, so teachers with 2, 3, 5, and 10 years' experience conducted the class. There were 4 teachers who participated in the classes, and they did not teach only one group, but instead taught in a different group every week to experience both teaching methods.

In the game education group, only teacher played the game for 2 weeks. When explaining the background, it was important for the students to look at the same screen and focus on it, so they did not used the way each student play the game. After that, for the remaining 2 weeks, they were allowed to study using only middle-school history textbooks. The training conducted in each state is shown in Table 3. The rest of the group

studied the same range from the first week using textbooks. Among middle-school history textbooks, the scope of study, as highlighted in Table 4, was educated by selecting ‘World War and Social Change’ in world history and ‘Joseon Society’s Change’ in Korean history, which are related to the game’s historical context.

Table 3. Class method for each week.

Time	Game-Based Education	Expected Learning Effect
1	Used Game <i>The Wednesday</i>	Used Korean history textbook
2	Used Korean history textbook	
3	Used Game <i>Valiant Hearts</i>	Used world history textbook
4	Used world history textbook	

Each textbook consists of six sections, and it is ideal to spend 4 weeks per unit considering the vacation and exam period of students; thus, the experiment period was selected as 4 weeks.

Table 4. Contents of each textbook.

World History	Korean History
The emergence of civilization and the formation of the ancient world	Prehistoric culture and the formation of ancient countries
The spread of world religions and the formation of local cultures	The development of the era of the north and south countries
Exchange and change in the local world	Establishment and transition of Goryeo
Imperial invasion and movement to build a nation state	Establishment and development of Joseon
<u>World war and social change</u>	<u>Changes in Joseon society</u>
Development and challenges in the modern world	The development of modern society

How each group studied was kept secret from the other groups, and teachers were instructed to have at least 5 min of question-and-answer time, up to 30 min, and to record questions related to the class. As a result, the group with game-based training retained a high level of question and discussion time, while the group trained with textbooks from the beginning gradually decreased in number and time.

Table 5. Number of questions and discussion time for each group.

Game-Based Education			Only Textbook Education	
Time	Question Count	Discussion Time	Question Count	Discussion Time
1	11	18	9	15
2	13	21	6	10
3	11	16	4	6
4	14	22	4	8

As shown in Table 5, groups with game-based education maintained a high level of question count and discussion time, while groups with textbooks from the beginning gradually declined in number and time. Game-based learning groups show higher participation in the second and fourth weeks of teaching with textbooks than in the first and third weeks of teaching with games. Students remained focused for a long time and showed interest with various questions because they played the games with interest. Students who study only using textbooks during the first week of game-based learning and the second week of textbook learning had no difficulty understanding the class, but the active participation time in the class was less than the game-based learning group.

After the fourth week of the experiment, four teachers were given a subjective questionnaire asking for keywords about inconveniences in game-based classes, and about the adoption of game-based education in education after the experiment. As for the inconvenience, there were the same contents as Table 6.

Table 6. Inconvenience survey.

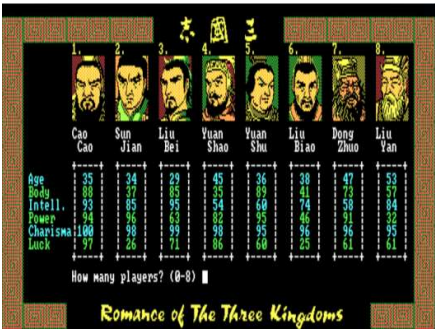
Inconvenience Survey
Limitation of the range of history that can be explained through game stories
The ratio of time required for education in the game and time required for non-essential aspects
Progress deviation from game experience
Long play time compared to short class time

Game-based classes were conducted by a teacher playing games and giving a speech. The reasons for this experiment were designed in consideration of the universal class environment. In general, classes held at schools involve one teacher dealing with multiple students. When many students play games, the speed of progress varies, which forces the teacher to explain things several times.

In addition, there are many cases where there are no facilities to allow several students to play games in the first place. Therefore, the speed of the class depends on the speed of the teacher’s game, which is not a problem of game-based learning because it depends on the teacher’s ability not only in game-based classes but also in textbook-oriented classes. The problem that the range of history that can be explained is limited because the game story is limited is also a limitation of all content used in the game, but content delivered through screen media such as movies and drama can be selected relatively variously. This is because the game industry has a shorter development period than other forms and it is difficult to produce based on true stories, so the number of suitable games is small.



(a)

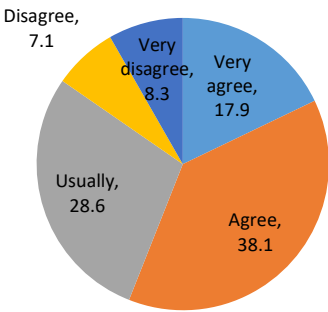


(b)

Figure 4. (a) Prince of Persia (1990); (b) Romance of the Three Kingdoms (1985).

There are also many historical games developed in the 20th century, but it was not easy to use them for other purposes than gaming. For example, Figure 4a’s Prince of Persia is based on the culture of Middle Eastern countries but lacks storytelling, and Figure 4b’s Romance of the Three Kingdoms is a famous historical material called IP (Intellectual Property), but it is not historically accurate. Moon and Kim surveyed gaming consumers in their teens to 30s for a total of 68 games, of which 44 games were developed based on real history and background, accounting for about 65%. In particular, 92% of games developed in the United States and 100% of games developed in Germany were based on real history [42]. Korean history games were characterized by multi-play and expressing the economic situation of the era as well as combat in the game [43]. In history education, students can improve their understanding and memory by experiencing economic and political context through simulations based on the trading system or laws of the period.

Lee and Kim surveyed 83 elementary school teachers about their intention to use game-based learning classes. Of the teachers surveyed, 65% said they did not play games, but when asked if they were willing to use game-based learning in their classes, as shown in Figure 5, 56% said they agree and 15.4% said they disagree. Therefore, the demand for game-based learning is more than three times higher than the opposite [44].



**Figure 5.** Willingness to use game-based learning in class. Lee and Kim, “Study on Teacher Awareness and Application Plan for Game-based Learning in Elementary School”, 2016.

Among the teachers sampled in the questionnaire, most did not play games or have access to game-based education, but it has been proven that the demand for game-based learning is high. Lee and Kim pointed out that the reason there are fewer applications in the field of actual education of game-based learning is negative social awareness, and in order to actively introduce game-based learning, the government selected infrastructure for classes (72.9%), teachers’ will (52.9%), various educational content (49.4%), and teacher training (37.6%) (multiple responses).

In this study, when using serious games developed for education in game-based classes, we recognized the limitations of development scale and accessibility of serious games and sought to use commercial games in education as an alternative. According to the results of previous studies discussed in this article, one of the main reasons why game-based education does not apply smoothly to real-world classes was teachers’ perception and willingness to play games. Since serious games are not as bad as people’s negative perception of games, the majority of previous studies in game-based education include serious games. Studies on game-based education using serious games such as Gounaridou et al.’s “Educated Transportation Behavior and Safety Awareness Using Serious Games” [45], Chen et al.’s “Creating Mobile Games to Investigate Learning Interest by Game Type” [46], and Pombo et al.’s “Study on the Educational Value of Augmented Reality Games” [47] are characterized by proving the effectiveness of game-based learning based on hand-made games. Since these proven systems are not shared with teachers and are not accessible after the study, there is no game to use as a classroom material for game-based education by referring to the proven effects of the papers introduced above. Through the effect of game-based learning, we started this study with a sense of the problem that it is meaningless if it is not actually used and only in studies where students’ concentration has improved and scores have increased. Teachers, subjects of the experiment, were asked to prepare themselves for the class, and teachers had to install games themselves or prepare classes without knowing the name of the game. Since the mission given to the player by the commercial game is different from the desired study goal of the teacher, the teachers who participated in the experiment had difficulty in preparing for the class. However, because communication between teachers was not controlled during the four-week experiment, teachers shared a method to overcome discomfort, and as time passed, preparation for class became smoother, which was the same as the intended result of the experiment.

## 6. Conclusions

The importance of history education is always being emphasized, and the effectiveness of game-based education is continuously verified through other studies. In the case of the United States, Japan, and advanced countries in Europe, various attempts have been made to use game-based education in regular classes over the last decade, while education using games in Korea is in a state of inadequate development.

This study, which began with the aim of solving the inconvenience of teachers who used games as educational materials, focused on solving the problem based on what was reported in the EUN report. One of the most appropriate subjects when using games as education is history, so historical game selection criteria and evaluation indicators were set for the experiment, and experiments were conducted on elementary school students. Different games have different elements that can be used in education. As one of the ways to solve the 'teacher's hard work' mentioned in the inconvenience of educators, we presented examples of using various games in this paper by combining games with various elements.

Just as students who watched historical dramas or movies that show the context of the period exhibited more interest when learning of such periods in history books, more history games are being developed and researched that can produce the same effect. However, if this can be used for education, it is expected that, ultimately, the general perception of games will move in a more positive direction than before.

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