

# Narrative Elements Analysis for Educational Mobile Game Development

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**Abstract:** In the traditional learning, students get learning information and materials which the teachers prepared according to the book in advance. Students can not control the way to learn and get motivated in learning. Mobile learning is trying to improve the students' learning motivations and learning performances by allowing students to use mobile devices to observe the real learning objects in the real world. In mobile learning, there are still many unsolved questions existed, for examples, how to make students enjoy the outdoor observation activities and be actively in finding the knowledge which they prefer to learn. In other words, in most of cases, students learn in school just because of they have to. This research wants to analyze narrative elements and use this analysis results to try to design the educational mobile games to make students be more actively in learning. This research is discovering the mobile game narrative elements and also using context-awareness knowledge structure to store the knowledge and characteristics of learning objects to deal with different domain knowledge in real learning environment. The research objective is to know what narrative elements in educational mobile game can make students be actively to play the game.

**Keywords:** Context-awareness, Knowledge Structure, Game, Narrative, Story, Quest, Mobile Game

## Introduction

In traditional learning, students get learning information and materials from reading the book and teachers use the examinations to find out the students' academic achievement. The examinations are pressure to the students and can not make the students learn actively.

Recently, internet makes life be more convenience because of people can get the information they need at anytime and anywhere as long as they have computers and internet connections. With internet, e-learning makes the learning activity happen even the teachers and the students are separated by geographical location and time. Students can do more with the mobile devices, for example, when students in the museum, they can use their mobile devices to search the information they want with internet connections.

There are still many unsolved issues in mobile learning research domain, for example, how to increase the students' learning motivations. The learning motivation issue could be well solved by game-based learning. Students can learn with less pressure while they are playing the game and they won't feel they are learning, because of students are attracted by the game. This research's goal is to discover how to increase the students' learning motivations by combining the benefits which brought by mobile learning and game-based learning. The benefit that mobile learning has is students can learn anytime and anywhere with their mobile devices and the benefit that game-based learning has is the narrative can attract the students.

In order to develop such mobile education game, this research has to analyze the necessary narrative elements which can make educational game mobilize. Section 2 discusses the related researches about game-based learning, educational mobile games, and narrative. Section 3 finds four necessary narrative elements for developing a educational mobile game. Section 4 shows an example of narrative elements for Teng Fang Li's House which is an educational historical spot in Taiwan, and Section 5 describes a scenario of the possible educational mobile game with the narrative elements designed in Section 4 for Teng Fang Li's House. At the end of this paper, Section 6 makes the conclusions and talks about possible future works.

## Educational Game and Narrative

### Ubiquitous Learning and Game-based Learning

In recent year, computer technologies and internet are widely used to assist teachers' teaching and students' learning, which is called e-learning (Brodersen, Christensen, Dindler, Grønbaek & Sundararajah, 2005). As mobile technology is getting mature, mobile devices become a good facility for learning. The way which uses mobile phones, PDAs, smartphones, and any devices with mobility to learn can be seen as mobile learning and can provide at least three benefits: (1) learning in real environment, (2) get rid of the wire connection by using wireless connection and (3) learning activities are no longer limited by the place and can happen in the real world (Chen, Kao, Yu & Sheu, 2004). Ubiquitous learning thinks education is happening all around students and they may not even notice they are learning. Ubiquitous learning can deal with the weakness of mobile learning such like mobile learning only provides specific domain knowledge in the specific learning environment and sense the personal contexts such like location (Chen, Hsieh & Kinshuk, 2006; Chang, Wu & Heh, 2008). This research not only wants to use context-awareness knowledge structure to achieve the different domains and provide suitable service in different users and places but also uses game concept to enhance the learner actively learning.

Recently there is a new learning strategy which is called game-based learning. Game-based learning takes the digital games to the front of the students to improve and facilitate the learning process (Pivec, Dziabenko & Scinnerl, 2003). Garris and colleagues (2002) propose the game-based learning model as Figure 1 shows (Garris, Ahlers & Driskell, 2002).

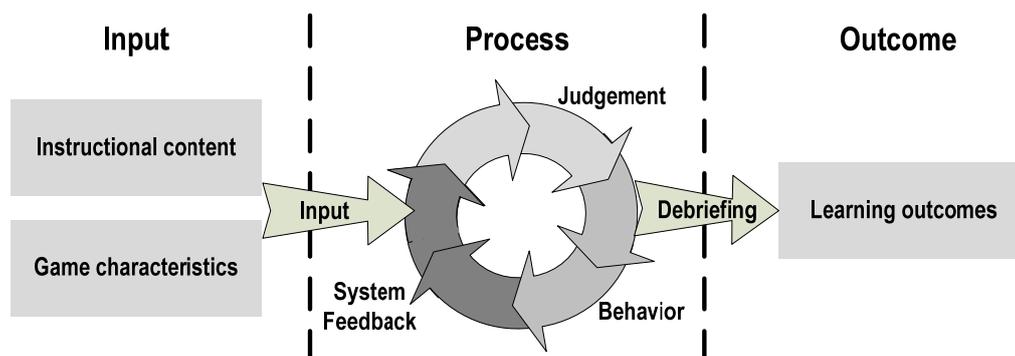


Figure 1. The game cycle.

Learners can learn by repeating the cycle: (1) judgment, (2) behavior, (3) feedback. Through this cycle, learners can improve the confidence, interest, getting better effort, and getting system feedback about the performance. Finally learners finish the game, they will get learning outcomes.

### Educational Mobile Game

With mobile devices, players can play the game in the real world (Schwabe & Göth, 2005). Bell and colleagues (2006) introduce a location-based game for players and analyze the players' daily life patterns, e.g. when and why the players play the game (Bell, Chalmers, Barkhuus, Hall, Sherwood, Tennent, Brown, Rowland & Benford, 2006). Barkhuus and colleagues (2005) propose a mobile game called Treasure (Barkhuus, Chalmers, Tennent, Hall, Bell, Sherwood & Brown, 2005). In Treasure, players can compete with each others by stealing others' coins and collaborate with each other to get double or more coins. This paper uses the idea of Treasure to create the scenario of the educational mobile game in which players need to get the most valuable treasures to win the game.

Some educational mobile games use GPS (Global Positioning System) to locate the students' locations and to give the appropriate tasks, for examples, the game will never ask the students to "find a book" in a zoo and "identify a plant" in a historical museum. Frequency 1550 is a GPS-supported educational mobile game and students can learn Amsterdam's history by playing the game (Admiraal, Raessens & Van Zeijts, 2007).

### Narrative in Games

Berger (1997) takes a narrative as a story and thinks the story telling the things that have happened or happening in the game (Berger, 1997). The story must contain events, and an event contains when, why, and where the event takes place. For more details of narrative elements in game, Bordwell and Thompson (2001)

propose that there are three important elements in the game narrative: (1) causality, (2) time, and (3) place (Bordwell & Thompson, 2004). Furthermore, Mallon and Webb (2005) have analyzed narrative elements in adventure and role-playing games and propose that character interplay contains psychology issues such as trust or suspicion (Mallon & Webb, 2005). Dickey (2006) develops an adventure game and analyzes how narrative supports the problem solving process (Dickey, 2006).

From these researches, there are many different narrative elements could be used in developing games. This paper lists these narrative elements and finds out the necessary narrative elements which should be considered in developing educational mobile games.

## Narrative Element Analysis

There are two tasks in analyzing necessary narrative elements for educational mobile game development. The first job is evaluating the importance of the five narrative elements in games (Mallon & Webb 2005; Dickey, 2006; Berger, 1997; Bordwell & Thompson, 2004) and the relations among these narrative elements as Figure 2 shows:

1. Character: There are two roles in games, players and NPCs (Non-player controlled characters), the roles have characteristic values, e.g. archaeologist and grave robber.
2. Interplay: Interplay is the interaction between a player and an NPC. Non-player controlled characters can give players quests, hints (useful information), and nonsense or even incorrect information to players. Players can collect all information surround them in the game world and ask the NPCs' helps to work out the quest solutions.
3. Story: Story contains goal(s) and events. Players must achieve goal(s) to finish the game. Each event contains one or more quests. In each event, players receive quests from NPCs and make their own decisions for solving quests. The different decisions the players made will lead the players from one event to different events. Figure 3 shows NPC<sub>1</sub> gives players incorrect information about where to find the quest item which NPC<sub>2</sub> asks for and players will make three different decisions with the information and quests they have received from NPCs.
4. Structure: Structure has the event selection and arrangement to control and describe how and why the events happened. In other words, Structure makes the players experience different stories with different sets of sequential events.
5. Setting: Setting contains background story and the information about the game world.

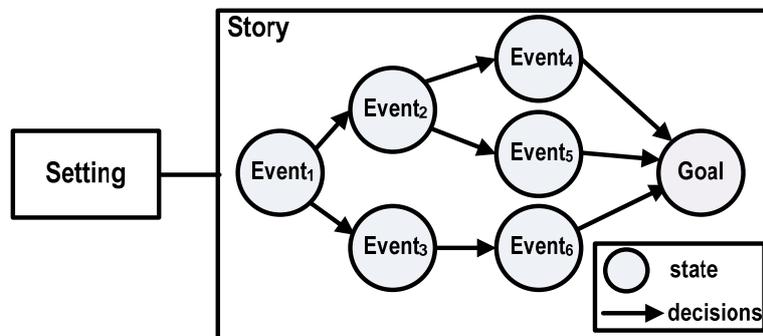


Figure 2. The relations among story, setting and events

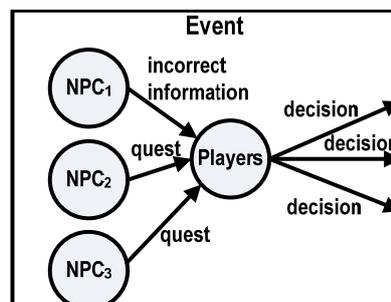


Figure 3. The interplay occurred among characters in a single event

As Figure 2 and Figure 3 show, players can make decisions (or do actions) according to the information and quests they received from NPCs in each event, and the decisions they made will lead them from one event to other events.

After re-organized the five narrative elements and considered the game mobility, we think three narrative elements are important and necessary to be included in the educational mobile game development:

1. Character: There are two roles in educational mobile games, players and NPCs, the roles have characteristic values, e.g. archaeologist or grave robber.
2. Interaction: An interaction which is happened between a player and a NPC leads the player getting information or quests from the NPC. If players' roles (or campaigns) are different from the NPC, the NPC will either give no quests and information to the players or give the quests without the details of where the players can find the quest items, e.g. the quest item is on the desk, the NPC only tells the player that the quest item is not in the kitchen. Unlike Mallon and Webb research (2005) (Mallon & Webb 2005), NPCs in educational games do not provide incorrect information to players in our design in this research, because of the incorrect information may make the players build misconceptions in their mind and it will be a concern of educational purpose.
3. Storyline: Storyline in educational mobile games includes the goal(s) (educational purposes), quests (learning activities), background story, and scenes (learning units with difficulty differences). The quest contains when and why the quest happened and what the players need to do to solve the quest. A scene has one or more quests. In this research, we use the context-awareness knowledge structure to store the learning objects and its characteristics involved in the quests.

Figure 4 shows the relations among these elements. At the very beginning, the game will show the background story to players when they enter to the game world (Scene<sub>1</sub>). In each scene as Figure 5 shows, NPCs will provide the players useful information or quests and allow the players making their own decisions and solving the quests. In the next section, we design an educational mobile game for the educational historical spot in Dashi, Taiwan, with the three necessary narrative elements we have analyzed here.

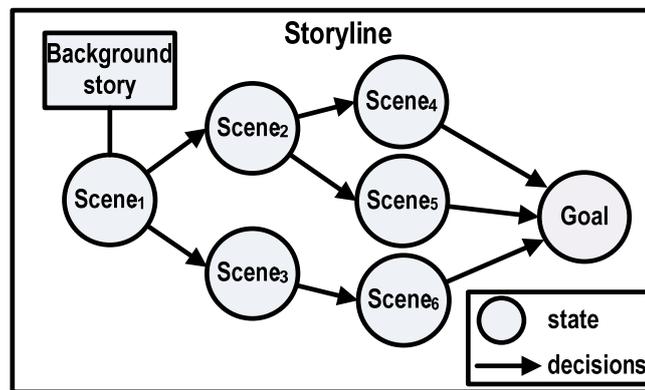


Figure 4. The relations among storyline, scenes and background story

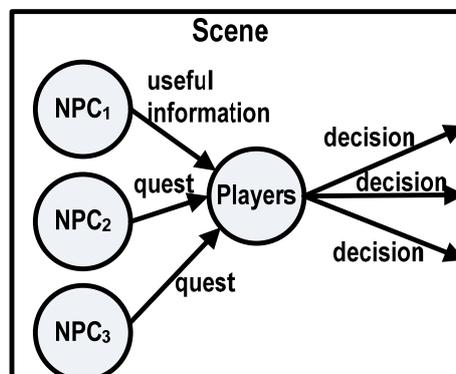


Figure 5. The interaction occurred among characters in a single scene

## Narrative Elements Design for Teng Fang Li's House

Teng Fang Li's House is an educational historical place in Dashi, Taiwan. There are many things such as artifacts or architectural styles having educational meanings and can be taken into educational mobile game to the visitors to learn. In this section, we use the narrative elements analyzed in previous section to design the mobile educational game for Teng-Fang Li's House.

### Character Element

In this educational mobile game, there are two roles, archaeologist and grave robber. Archaeologists want to prevent the treasure in Teng Fang Li's House from grave robbers. If the role the player plays is different from the NPC, the NPC will not tell the player where to find the quest items. Each quest in the game has time limit. If the player can not complete the quest in time, the player will fail to solve the quest and the treasure will be taken by his/her opponent, e.g. the archaeologist (if he/she is grave robber) and grave robber (if he/she is archaeologist).

There are six NPCs in this game, John, Jason, Alice, Jack, Patrick and Nio. Jason, Alice, Nio and Patrick play the quest givers and information consultants for the archaeologist campaign. John and Jack play the quest givers and information consultants for the grave robber campaign. Jason, John, Nio and Patrick give the quests to players, at meanwhile, Alice and Jack offer the information to players.

### Interaction Element

In this educational mobile game, there have six NPCs. Four NPCs give the quests to players and two give related information to players. The interactions happened between players and NPCs will be influenced by the players' roles (or campaigns), e.g. if the player plays the archaeologist and the NPC who belongs to the grave robber campaign will only give the player irrelevant information or the quests without the detailed information.

### Storyline Element

The storyline element covers the goal(s), the quest(s), the background story, and the scenes of Teng-Fang Li's House:

1. Goal: The educational purpose of the game is identifying the invaluable things which have historical meanings in Teng-Fang Li's House. For example, no matter what role the player is playing, the winner is the one who can identify the most invaluable treasures with important historical meanings in 30 minutes.
2. Background story: The background story in the game is "Many grave robbers have heard about there are many treasures hiding inside Teng-Fang Li's House and they have decided to find the treasures out and sell it to make money. Archaeologists have also heard about the treasures hiding inside Teng Fang Li's House and grave robbers want to take the treasures for money. Archaeologists would want to identify the artifacts with historical meanings as many as they can in order to ask the national museum and the government sending hands to protect the site". At the beginning of this game, players will receive the background story and choose which role they want to play.
3. Quest: A quest has two things: (1) why the NPC gives the quest to the player, (2) what object(s) is(are) the quest item. In this game, the player can complete a quest by taking a picture on the quest item(s) and/or writing down related descriptions. When the player turned in the quest item(s), the NPC will check the correctness of the required quest item(s) and give the player complete description about the quest item(s) in order to make him/her know more.

### Scenes, Learning Objects and Knowledge Structure

In order to cope with the different domain knowledge, this research uses context-awareness knowledge structure to store the all information about the Teng-Fang Li's House. The game we designed for Teng-Fang Li's House has four learning objects and two scenes as Figure 6 shows. Figure 6 shows an example of how we use context-awareness knowledge structure to store the information of learning objects and its characteristics involved in quests. Context-awareness knowledge structure has three layers:

1. Domain layer: Domain layer stores topics or subjects the real world covers, e.g. Teng-Fang Li's House in this case.
2. Characteristic layer: Characteristic layer stores the domain's characteristics. There are three characteristics: (1) Attribute indicates the object's attributes; (2) Usage means what the object is used for; and, (3) Meaning represents the implicit meaning of the object. For examples, the Wuliang has Truss attribute and there are 11 trusses surrounding it; the Tashou is used for getting out of the rain like a shelter in the past; the Dongjia implies the social status of the house owner.

- Object layer: Object layer stores the real objects which may be used for learning, e.g. Wuliang is the roof beam, Tashou is the eave, Dongjia is the wooden framework, and Dengliang is a beam for hanging lamps in Teng Fang Li's House.

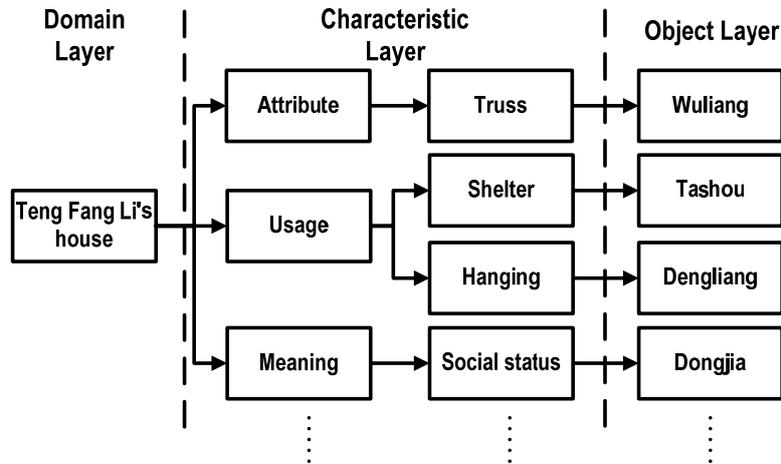


Figure 6. Context-awareness knowledge structure for Teng-Fang Li's House

We can use the context-awareness knowledge structure as foundation to build the scenes and associate with learning objects as Figure 7 shows. There are two scenes, the Hall and the Vestibule. The Hall has two learning objects, the Dongjia implies the social status of the house owner, if the house owner has higher social status, the Dongjia in his/her house is higher; and the Dengliang is used for hanging the Tiangongdeng which is a special lamp usually can be seen in temple. The Vestibule has two learning objects, the Wuliang is a house beam with 11 trusses surrounding it and the Tashou is treated as shelter.

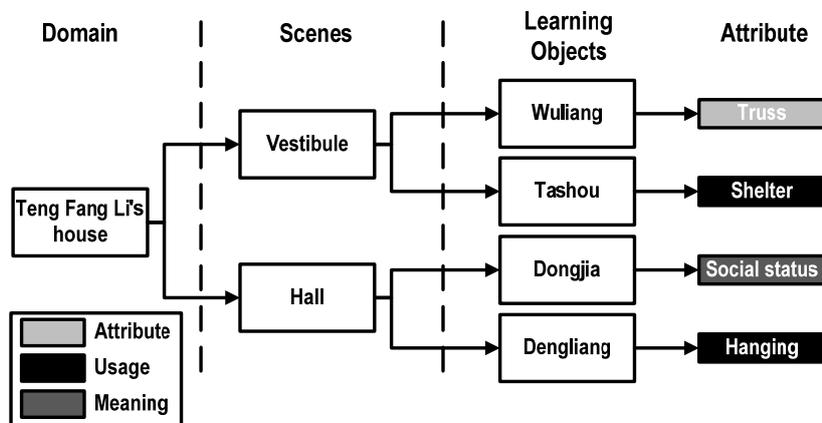


Figure 7. Scenes and learning objects in Teng-Fang Li's House

### Scenario of Educational Mobile Game for Teng-Fang Li's House

In this section, we illustrate a scenario of how the educational mobile game of Teng-Fang Li's House works. Figure 8 shows a linear Storyline which contains two scenes: the Vestibule and the Hall. The game will introduce the background story to players at very beginning when the players entered the Vestibule inside Teng-Fang Li's House. The scene, the Vestibule, shows there are three NPCs and the player, Keith, on the middle of Figure 8. Similar to the Vestibule scene, the Hall scene on the right of Figure 8 shows the relations between another three NPCs and Keith.

As Figure 8 shows, there is a player, Keith, in our scenario. At the beginning, Keith reads the background story and then chooses to play as an archaeologist.

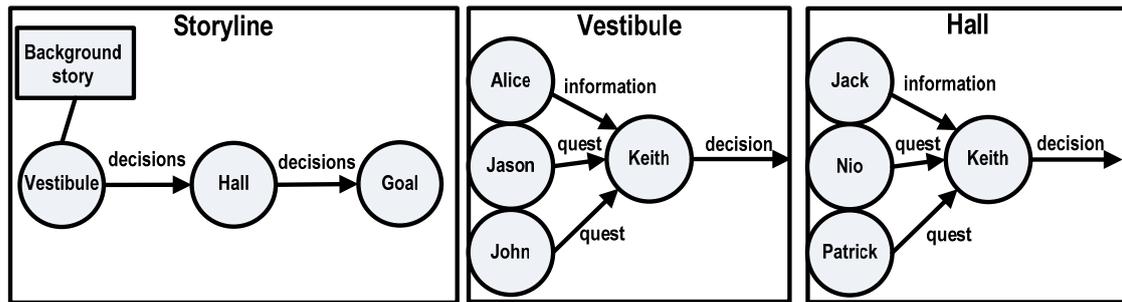


Figure 8. Example in Teng Fang Li's house

1. In the Vestibule scene:

Keith goes to the Vestibule and the game starts. The game shows him the background story and asks him choosing a role to play. Keith wants to protect the artifacts from the grave robbers and chooses to play an archaeologist. When Keith looks the environment surrounds him in the Vestibule, he finds that there are three NPCs. He asks Jason for more information first. Jason says: "Hi, I need some helps. I want to write down the description about Tashou which is always for shelter in the past, but I can't find my pen. Would you please find the Tashou and write what you observed for me?" Keith accepts the quest and has a fundamental idea about what Tashou is. He finds Tashou accordingly and writes down what he observed. After Keith turns in the quest, Jason gives him more information about Tashou.

When Keith finished the first quest, Keith approaches John for more information about the meaningful artifacts. However, John is working for the Grave Robber campaign, so he says: "Hey, archaeologist, I have something for you, however, you have to find the Wuliang and take a picture for me first. What I can only tell you is, the Wuliang is not on the ground." Because Keith does not have sufficient information about the Wuliang from John, he spends a lot of time and finally finds it. Keith takes the Wuliang's picture and turns the quest item in. After he finished the John's quest, Keith asks Alice for more. Alice says "You can go the Hall to seek for more meaningful artifacts." Keith then goes to the Hall for collecting treasures.

2. In the Hall scene:

When Keith gets into the Hall, Keith finds out that there are also three NPCs here. He approaches to Jack first; however, Jack only says "What a wonderful day today is, the weather is very good!" It seems Jack doesn't want to talk to Keith. Why? Keith doesn't have idea. Actually, as we know, Jack is also working for the Grave Robber campaign, so it is impossible to Keith to get any useful information from Jack. It's life.

Keith then turns to Patrick for more information about the meaningful artifacts. Patrick says "Actually, I have something for you, but you have to complete Nio's quest first." According to the information, Keith then approach to Nio for taking the quest. Nio says: "Hey, I need a picture of Dengliang, but I don't have camera. Can you take a picture for me? Hmm, the Dengliang is located behind the Hall. Hope you can find it out! Good luck!" According to the information about the Dengliang, Keith looks for the Dengliang and finally he finds it out and takes a photo with his mobile phone. When Keith turns the photo of the quest item, Nio gives him more information about Dengliang as rewards.

After Keith finished Nio's request, Keith talks to Patrick again to see if he knows other meaningful artifacts. Patrick says: "Hmm, yes, actually I have something for you, but would you please give me the description of the Dongjia first? You may find the Dongjia upon your head." Keith finds out the Dongjia and writes down the description of it. After Keith completed the quest, Patrick gives Keith a reward and tells him "You have identified every important and meaningful artifacts for the government, well done, the government and the national palace museum have notified us that the first troop is on their way to protect this historical site, Teng-Fang Li's house, it's great! Thank you, thank you so much for helping us. We definitely will see you again to protect national treasure from the grave rubbers at somewhere in the future. Hope we can have a drink together next time. See ya~"

## Conclusions

According the academic research outcome, games have positive influences in improving students' learning motivations. This research summarizes the literatures of narrative elements in games and analyzes three necessary narrative elements for developing educational mobile game. With the analyzed narrative elements,

students can really get involved in the game story and learn the knowledge. In this research, we design the narrative elements of an imaginary educational mobile game for Teng-Fang Li's House to show the readers how to combine the narrative elements with the educational mobile game. Also, we describe a scenario to show the possibility of how students can get knowledge about the historical and cultural contents with the educational mobile game. In the future, we will implement this education mobile game and design the experiment to use this system in Teng-Fang Li's House for elementary school students. After the experiment, we hope the results can discover that the educational mobile game has positive influences in improving students' learning motivations.

There are still some research issues existed. First of all, the reward system and competition mechanism can be added to increase the students' learning motivations. Second, the learning information and materials should be able to retrieve directly from the learning object or from the internet with students' mobile phones and can reduce the teachers' efforts in designing mobile educational games.

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