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Exploring the effectiveness of adopting anchor-based game learning materials to support flipped classroom activities for senior high school students

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ABSTRACT

In this study, a flipped classroom strategy was integrated into a comparative experiment to report on the performance of classical Chinese learning in two learning scenarios, using both game-based and animated story materials or only animated story materials as pre-course preview supports. A total of 75 senior high school students participated in the experiment. Overall, the findings showed that integrating e-learning materials with physical activities fostered flipped classroom learning, and learners had a deep impression of the targeted classical Chinese. The use of the game-based learning materials for preview triggered the students, especially the low-achievement students, to become active learners. It was found that the game-based learning materials helped the students to have a whole view of the article quickly, so it would be beneficial to provide learners with game-based learning materials at the beginning of introducing new classical Chinese units to arouse their learning motivation. Meanwhile, the animated-story materials were helpful for enhancing learners' concepts of important classical Chinese sentences and wording, and could be provided to learners according to the schedule of the course. The issues of how to run a flipped classroom with e-learning materials and further research directions are also discussed.

Introduction

A lecture-based class is a common teaching style whereby instructors transmit knowledge to students. However, in lecture-based classes where teachers speak and students listen, the involvement of the students is limited. Roy and Chi (2005) indicated that learners had better learning performance when they tried to explain the concepts taught in the textbook rather than read without self-explanation, and researchers have suggested that adopting learning technology and teaching strategies would help students achieve better cognitive engagement during learning (Mayer et al., 2009). How to motivate students to learn and achieve self-regulated learning are issues that teachers and educational researchers continue to work on. Studies have shown that the flipped classroom strategy encourages students to preview before class, and they have to play the roles of self-paced learners to make full use of the learning technology provided by instructors to become active learners. This could thus increase their active learning (Hwang, Lai, & Wang, 2015; Stone, 2012). In short, the flipped classroom is a pedagogical approach by which teachers provide learners with proper learning materials and encourage them to conduct self-learning (Kim, Kim, Khera, & Getman, 2014). A previous study found that mobile technology that is welcomed by teenagers may be a facilitator to enhance

flipped learning. However, in Asian countries, some teenagers are not allowed or have very limited time to use their mobile devices because their parents worry about them playing instead of learning. This might hinder instructors in designing pre-course flipped classroom activities (Wang, 2016). Based on related research findings, how to design and organize learning materials well to arouse students' motivation for pre-class self-directed learning within their very limited internet access authorization time might be a factor in whether the flipped classroom could be conducted successfully.

After studying related teaching and material design strategies, the integration of multimedia content, game-based learning, and anchored instruction caught the researcher's attention. Studies have revealed that information presented in text, spoken, graphic, and video formats creates an authentic and attractive learning context for learners (Kim & Gilman, 2008). Researchers (Grimshaw, Dungworth, McKnight, & Morris, 2007; Pearman, 2008) have indicated that the elements in computer-based learning media such as animation help learners have better comprehension than when reading paper-based stories, and it can also improve learners' motivation (Baturay, Daloglu, & Yildirim, 2010). Besides, anchored instruction advocates using meaningful contexts to provide students with macro-contexts (Leonard, Davis, & Sidler, 2005) and researchers have revealed that this has a positive impact on students' learning (Gunbas, 2015). On the other hand, studies have demonstrated that using game-based learning materials in teaching has the power to enhance learners' learning performance (Chiang, 2012), and the repetition of gameplay is the driving force that motivates learners to search for target knowledge through the chance of learning by playing (Coyne, 2003). According to the above-mentioned research findings, multimedia with anchored instruction and game-based content design seem to be the factors required to get learners to learn enthusiastically and autonomously (Hong et al., 2009).

Research purpose and questions

This study aimed to take advantage of the abovementioned elements in developing pre-course reading materials to support a flipped classroom in classical Chinese learning. The study was conducted in several stages; first, the researcher collected and analyzed Chinese instructors' opinions and teaching needs, and then designed and developed the pre-course learning materials accordingly. Second, the researcher integrated the developed learning materials with the flipped classroom strategy into the classroom for educational evaluation. The following research questions guided this study:

(1) How can the developed learning multimedia with anchored instruction and game-based content design be integrated to support a flipped classroom learning?
(2) What is the learning effectiveness of integrating the developed learning content combined with the flipped classroom approach?
(3) How do students and the teacher perceive using the developed learning materials for flipped classical Chinese learning?

Literature review

Game-based learning

Games have the power to engage learners in learning, and using games as learning media to assist teaching could address the pitfalls found in traditional education. Games have been proved to be beneficial for learning (Prensky, 2001). Researchers believe that educational games could be learning aids used as reinforcement to support traditional learning (Li, Yan, & Hou, 2017; Tsai, Yu, & Hsiao, 2012) because they can lower anxiety and make learning acquisition more likely. Many studies have been conducted through integrating game elements to assist teaching and learning. For example, Cheng, Lu, Chang, and Yang (2015) designed a game-based learning system to assist

students in clarifying their misunderstandings of concepts in mathematics. Shih, Chuang, Tseng, and Shih (2010) developed a 3D role-playing game to assist students in learning history in an interesting and challenging way, and indicated that characters and storylines are two important elements in such games (Rollings & Adams, 2003; Shih et al., 2010). Randi and Carvalho (2013) used a role-playing game to assist undergraduate medical students in Brazil in learning the concepts of cellular biology. Their study compared the learning effects of the game-based model and lecture mode and found that the role playing game (RPG) game-based approach was an effective learning method. It also helped the students to achieve better learning retention. Although the study did not find major differences in the learning test results for knowledge acquisition, it suggested that the game-based learning improved the students' acquisition of skills such as creativity and cooperation. Further, it fostered students' sense of belonging. In sum, studies have stated that students who learn with games are able to move at their own pace to complete the learning, and educational games have positive impacts on supporting instructors to engage students of various proficiency levels in a more enjoyable way of learning (Chiu, Kao, & Reynolds, 2012; Decarrico, 2001). What makes the game appealing is the processes that gamers have to struggle through in order to reach the goals (Costikyan, 2002; Crawford, 1982). Despite it being found that using games during instruction might result in teachers taking more time to prepare their classes, game-based learning is still welcomed by many teachers and course designers since the students will be active participants through the repetition of gameplay (Randi & Carvalho, 2013).

Anchored instruction

The Cognitive and Technology Group at Vanderbilt (CTGV) introduced the anchored instruction approach around 1990. This is an approach which aims to provide students with learning scaffolding through creating a macro context to situate knowledge. Anchored instruction uses videodisc-based or narrative formats to present the learning content. The learning information could be embedded in the media presentation, such as stories, and students could acquire knowledge from exploring in the contexts (Shyu, 2000). A good anchor will sustain learners' interest over time and encourage them to delve into the learning topics (CTGV, 1990). Many studies have explored the effectiveness of using anchor instruction for learning different subjects, such as English, chemistry, and language arts. They have also compared anchored instruction and other approaches, such as Thomas (2008), who studied the effects of using various methods including teacher-directed, lecture- and text-based instruction, the analogue video method, and the multimedia anchored instruction method to promote preservice teachers' knowledge, beliefs, and teaching skills. The related studies have all revealed that the students with anchored instruction performed better than those who learned with other methods. Moreover, research has proved that using technology-enhanced anchored instruction is effective for learning (Elcin & Sezer, 2014; Shyu, 2000). For example, Hochholdinger and Schaper (2013) adopted a situated e-learning environment to train mechatronic apprentices' troubleshooting skills. The study compared the effects of adopting anchored instruction and a simulation environment for assisting learning, and found that learners who learned with the anchored instruction module improved their performance and their strategic behavior. Gunbas (2015) explored the effectiveness of using anchored instruction to assist learning, and found that sixth-grade students with anchored instruction in a computer-based story had better mathematics performance than students learning with paper-based stories. Furthermore, Zydney, Bathke, and Hasselbring (2014) intended to find the optimal guidance for enhancing anchored instruction, and suggested that anchored instruction with structured problem-solving guidance can improve students' problem-solving performance. It has also been revealed that using teacher-generated worksheets is helpful for keeping students focused on the learning tasks (Zydney et al., 2014). Hence, following the reviewed literature, the current study intended to adopt anchored instruction to develop the learning materials, and to use worksheets as learning support for helping the teacher conduct the flipped classroom learning.

Media modality for content design

Studies have stated that integrating interactive multimedia content into learning can motivate students to learn, and adopting various multimedia modalities in content design can assist students' learning (Baturay et al., 2010). The media elements include text, audio, graphics, animation, and videos, and according to the cognitive theory of multimedia learning (Mayer, 2005), learning information presented in both textual and graphic modes can help students learn better than with the information presented via a single modality. This is supported by the Dual Coding Theory (DCT), which states that learning will be more effective when information is presented dually through the verbal and nonverbal symbolic systems than when presented through a single channel (Paivio, 1986). For example, studies have revealed that words presented with imagery or offering graphics to illustrate the meanings of the words help students learn more easily than when words are presented in a single modality (Kim & Gilman, 2008). However, it should be noted that not having so many media elements in the content design will help learners achieve better performance. Paas et al. (2003) indicated that learners with low cognitive ability performed worse when pictures were added to the learning content, and Acha (2009) demonstrated that low-ability learners performed worse when pictures and text were presented simultaneously rather than separately because the pictures created a higher cognitive load than the words and led to less effective learning. It is therefore proposed that presenting too many multimedia elements at a time is not always effective for learning as the extraneous memory overload may lower learning performance. Following the reviewed literature, media elements were adopted to develop the learning materials to provide students with more than textual-based learning support for conducting the flipped classroom learning.

Flipped classrooms

In the flipped classroom, students take control of their learning, but they have to come to the class prepared (Fulton, 2012). Teachers walk around the class to help individual students with their learning problems and engage in discussion (Stone, 2012). Recently, the advanced learning technology has shed light on the implementation of flipped classroom learning. Giannakos, Krogstie, and Sampson (2018) conducted a system review of studies on flipped classrooms, and found that most studies adopted video lectures for pre-course learning, and some used animated reading materials or simulation. For example, Lawrence and Sankey (2013) used open-source resources such as audio material on TED together with PowerPoint presentations to provide learners with learning materials for flipped classroom learning. Davies, Dean, and Ball (2013) adopted media tools together with the learning platforms to achieve flipped classroom interaction. Gregorius (2017) used a flipped classroom learning strategy through animation materials to assist college students taking a chemistry program, and the study showed that learners in the traditional taught course had higher withdrawal rates than the learners with the flipped classroom approach. Moreover, the learners in the flipped classroom reflected that since the content was more accessible and easy to review, there was a good chance to achieve learning. Jensen, Holt, Sowards, Ogden, and West (2018) explored adopting three methods of pre-class content learning including interactive online tutorials, video lectures, and textbook readings to support flipped classroom learning, and found that the use of video lectures was superior to the others in terms of raising the grade of final summative assessment. The reason might be that the students had to make decisions on where to watch and to replay in the video, and these decision-making processes made them become active learners, and solidified their understanding of the targeted knowledge. Moreover, several researchers have found the potential advantages of integrating game-based learning into flipped classrooms such as Hung's (2018) study which indicated that using technology-enhanced board games for English flipped classrooms is beneficial for reducing learners' speaking anxiety, and that it also promoted motivation more than non-gamified flipped classroom strategies did. Lin, Hwang, Fu, and Chen (2018) explored the learning effect of using game-based learning methods with and without the flipped classroom strategy, and found that learners with flipped contextual

game-based instruction produced fewer writing errors than those learning with the conventional game-based learning approach. Despite the fact that studies revealed that students perceived positive feedback and were more engaged in the activities, still some research found that learners' learning performance with the flipped classroom strategy might stay on the same level compared to the traditional instruction approach. The possible reasons might be that learners are initially unreceptive of the changed course mode (Giannakos et al., 2018). In sum, researchers have suggested that flipped learning promotes learners' active learning, but the cost of developing the materials and the school policy are challenges for conducting flipped learning (Giannakos et al., 2018). Besides, when preparing the pre-class study materials for the flipped classroom, the design of the materials could consider the use of pictures, graphs and figures to emphasize complex or important concepts (Persky, 2015).

Summary of the literature

After reviewing the related literature, using multimedia and game-based learning materials with anchored instruction might be a way to promote active learning (Grimshaw et al., 2007; Leonard et al., 2005; Pearman, 2008). Thus, this study aimed to adopt the above theory in designing learning materials together with teacher-generated learning worksheets (Zydney et al., 2014) to structure and support flipped classroom activities. The researcher attempted to answer the questions of whether integrating the developed learning content into the course could encourage students to become active learners, and whether it could foster flipped classroom activities.
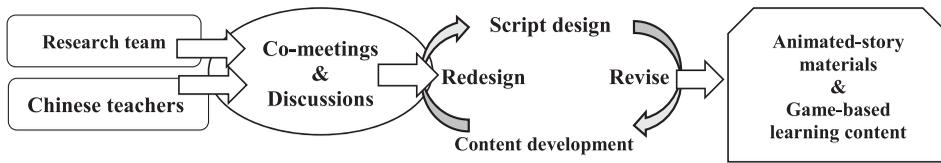
The development and design of the classical Chinese learning materials

The researcher invited Chinese teachers to co-design the learning content. After several discussions, the classical Chinese unit, Trip to Beitou Sulfur Caves, was chosen. The lesson is a story about a person who traveled from China to Taiwan in order to look for sulfur for the government. During his journey, he recorded all he saw and experienced in classical Chinese. According to the context of the classical Chinese unit, the story started by describing how the author prepared the equipment and found the co-partners for the journey. The journey then began with the difficult situations that the author met and his mood transition during the exploration process. The special landscape and how the environment changed according to their journey to the Sulfur were also described. When the author finally got to the destination, he described how the Sulfur looked and used the recall approach to summarize the whole journey as the ending. For example, during the journey, the author went into a forest and found that trees wound around each other as if encircled by a giant dragon. These experiences and the author's mood transitions were recorded in classical Chinese. The learning purposes of the lesson are that, firstly, students had to understand the background and history of the article, and secondly, they had to acquire the classical Chinese sentences and wording. Lastly, it aimed to promote the affective domain of classical Chinese learning.

In order to fulfil the various learning purposes, the anchored instruction was integrated into the design of two types of learning materials, animated-story materials and game-based learning materials. The animated-story provided the learners with a scenario-anchor, and the game-based learning materials encouraged them to make decisions in the anchor task. The content scripts of the materials were developed and modified according to several discussions with the Chinese teacher. The animated story materials were developed using Flash, and the game-based learning materials were developed using an HTML5 game creator, Construct 2, which is a cross-platform engine for developing 2D games (Figure 1).

Introduction of the animated story materials

The structure of the animated story materials was organized according to the sections of the classical Chinese unit including paragraph animation and author's information animation (Figure 2(a)). The

Figure 1. The development progress of the learning content.

animation illustrated what the author saw and experienced during the journey as described in classical Chinese in the textbook article to provide the learners with the scenario anchor. In each animation, the original classical Chinese paragraph was provided, and the translations of specifically important classical Chinese words or sentences were given to help the learners understand and contrast the meanings of classical and vernacular Chinese (Figure 2(b)).

Introduction of the game-based learning materials

The researcher designed the game-based learning materials according to the storyline of the classical Chinese lesson. Several learning anchors were embedded in the game as if the main character of the story, Mr. Yu, faced these problems during the journey to find the cave (Figure 3). The aims of the game-based learning materials were to assist students in understanding the context of the classical Chinese through gameplay. There were several challenges designed as anchors in the game, and the learners had to answer the questions or make a choice at each level in order to continue the story (Figure 4). The anchor tasks in the game to form situated learning included preparing for the trip, choosing the form of transportation, walking into the forest, finding the fountain, getting close to the cave, arriving at the cave for close observation, overlooking the journey and reviewing the trip. The question items in the game were designed according to the content of the classical Chinese lesson such as the author's information or the meaning of sentences or specific wording, and the players had to make a choice to continue the game. For example, the learner played the role of the story's main character on his trip to Beitou. At the beginning of the game, the player had to answer the learning questions regarding the lesson such as the information about the author in order to collect the required equipment (Figure 5(a)) and invited a partner through choosing the role from the correct era according to the article to join the journey. Then, the game followed the storyline presenting a picture to the learners, and asked them to use a noun to describe the scenario (Figure 5(b)). The learners had to choose the answer from the candidate list, and if they got the wrong answer, the game would provide them with hints or the original classical Chinese paragraph to assist them in understanding and reminding them of the important concepts, meanings of the words, and sentence structures in the content (Figure 5(c)). The learners had to correctly answer the questions in the game and overcome all the tasks to get to the destination and finish the game.
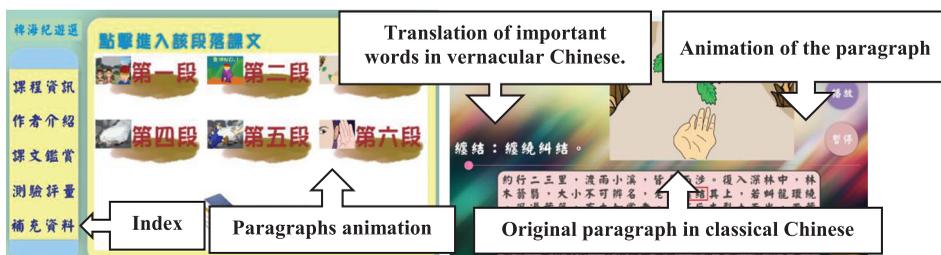
(a) The index of the materials; (b) Animation illustrating the meaning of the paragraph and the translation of the important words

Figure 2. The printed screen of the multimedia learning materials. (a) The index of the materials; (b) Animation illustrating the meaning of the paragraph and the translation of the important words.
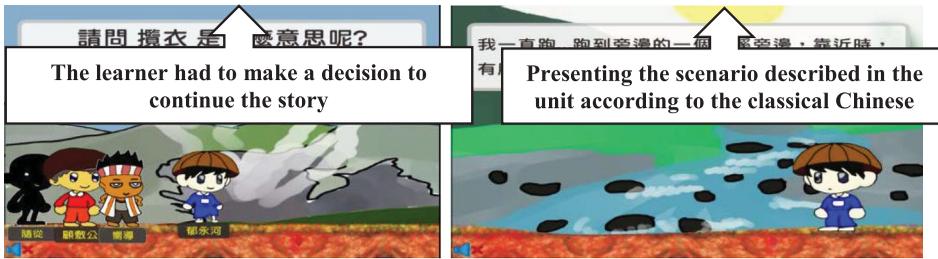
Figure 3. The printed screen of the multimedia learning materials.

Methodology

In this study, a flipped classroom strategy was integrated into a comparative experiment to report on the performance of classical Chinese learning in two learning scenarios, using game-based and animated story materials as pre-course preview supports or only with the animated story materials. The purpose of the study was to explore whether integrating various pre-course preview materials would affect students' active learning. The animated-story materials provided the learners with scenario anchors for promoting their reading comprehension of the classical Chinese, and the game-based learning materials encouraged them to make decisions in the anchor tasks according to their understanding of the classical Chinese context. Both qualitative and quantitative approaches were employed, and the duration of the experiment was about 2 weeks. The teacher encouraged the students to do the preview before each class, and all learners in the control group (C.G.) and experimental group (E.G.) received animated-story materials as pre-course preview materials, but the E.G. students were given extra game-based learning materials. After the experiment, the teacher administered a Chinese unit test and questionnaires to collect the students' learning performance and feedback, respectively. Furthermore, several students were invited to participate in individual interviews to gather qualitative data to buttress the quantitative information derived from the questionnaire and the quantitative test.

Participants and the process of the experiment

A total of 75 senior high school girl students, tenth graders (aged 15–16), participated in the experiment, and were divided into two groups. The E.G. consisted of 38 learners and the C.G. of the other 37. The learners in both groups were further divided into three subgroups based on their pre-semester Chinese grades. The high-achievement learners were the students whose grades were in the top one third of the class. The grades of the low-achievement learners were in the bottom one third of the class, and the remaining students were categorized as medium-achievement learners. The experiment was conducted for about 2 weeks and each week included five Chinese classes. Before the class, the teacher made an advance announcement of the next class' learning schedule and encouraged students to do the preview. Then, the two groups got their specific learning materials for the previous class. In the formal class, the teacher reviewed the students' learning results through
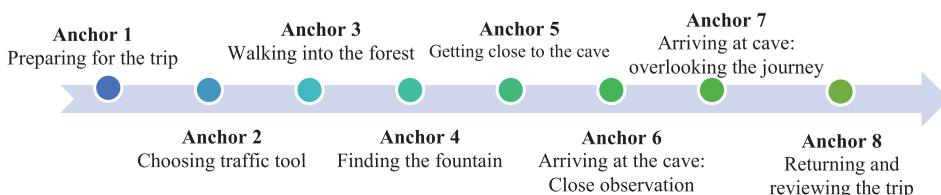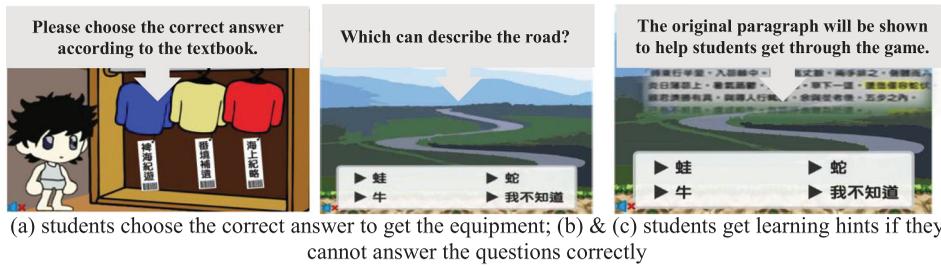

Figure 4. The anchored design in the game-based learning materials (the eight levels in the content).

(a) students choose the correct answer to get the equipment; (b) & (c) students get learning hints if they cannot answer the questions correctly

Figure 5. The print screen of game-based learning materials. (a) students choose the correct answer to get the equipment; (b) & (c) students get learning hints if they cannot answer the questions correctly.

conducting various learning activities such as cooperative tasks to draw out the story according to the context, and personal tasks in filling out the worksheets. The teacher then clarified and summarized the important learning concepts again after the activities. After the experiment, the Chinese unit test, and questionnaires and interview were conducted to understand the learners' learning performance and feedback on the experiment (Figure 6).

The pre-semester grades, Chinese unit test, learning worksheets, questionnaires, and interviews

The students' previous semester grades for Chinese were collected to confirm that the learners of the two groups had an equal learning starting point. The Chinese unit test consisted of 20 multiple-choice questions, 10 tick-all-that-apply questions, four word and sentence explanations, and 10 matching items that related to the background knowledge of the targeted lesson. The total score of the Chinese unit test was 100 and the time limitation of the test was about 40 min. The test questions were designed from the school's textbook organization, and the Chinese teacher had reviewed and confirmed that the wording and the level of the items fulfilled the learning purpose. The test was a summative evaluation that helped the researcher to examine how much the students had gained through the experiment. Besides, the teacher-generated learning worksheets were designed to examine the learners' acquisition through the preview work of the flipped classroom activity (Zydney et al., 2014). There were three worksheets during the experiment, and the students had to finish the worksheets before each class to demonstrate how well they had previewed and
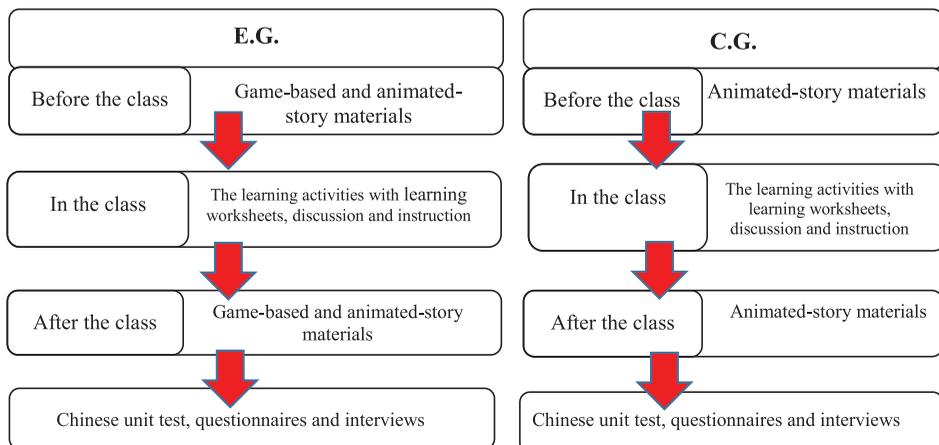
Figure 6. The process of the experiment for E.G. and C.G.

reviewed the paragraph. The learning worksheets included multiple-choice questions, cloze questions, short-answer questions, and matching tests. The multiple-choice questions and cloze tests focused on examining whether the learners knew the background knowledge of the targeted classical Chinese paragraphs, and the short-answer and matching tests focused on examining whether the learners comprehended the specific meanings of the classical Chinese paragraphs. The total score of each learning worksheet was 100.

Questionnaires were conducted after the experiment. They consisted of items on a 5-point Likert scale (from 5 to 1: *strongly agree, agree, neutral, disagree, strongly disagree*) and open-ended questions to investigate how the learners perceived using the various learning materials for learning classical Chinese. The questionnaires included two parts. Part 1 was the evaluation of using the developed content for Chinese learning (consisting of 10 items), and both E.G. and C.G. had to complete Part 1. Part 2 was the evaluation of the game design in the learning materials (consisting of 11 items), and only E.G. had to complete Part 2. A Cronbach's α test was used to measure the reliability of the questionnaires, where an α value of above .7 is usually considered to indicate good reliability. The coefficient α of the measures of the questionnaires from the E.G. and C.G. were .96 and .90, respectively. Moreover, the wording and meanings of the items in the questionnaires were reviewed by one Chinese teacher and an e-learning technology expert before being administered to the participants. In order to understand the students' and instructor's perceptions, opinions, and experience of using the developed learning materials with the flipped classroom strategy that could not be observed by the researcher, the cooperating Chinese teacher and students were invited to take part in an individual interview. The interview questions for the teacher were: 1) How do you perceive integrating the game-based and multimedia learning materials for teaching the course? 2) Do you agree that the use of the abovementioned learning materials fosters flipped classroom learning? and why? 3) Do you have any suggestions for how to revise the developed materials to achieve better teaching and learning? 4) Do you have any other feedback or suggestions after the experiment? During the interview, the teacher was also encouraged to share the feedback of the experimental activity. Besides, 12 students were invited to participate in the interview session and were selected according to their login records. The students who accessed the learning materials the most and least times were invited. The interview questions for the students were: 1) Please share your feedback of learning with the game-based or animated-story learning materials. 2) Did the learning materials help you understand the classical Chinese unit? and why? 3) What did you do when you got stuck in the game? Did you use the textbook or ask for help from your teacher or peers? Please share your experience (for the E.G. only).

Data analysis and results

The data were analysed and presented according to the research questions. The processes of how to integrate the developed learning materials into supporting the flipped classroom are described to answer the first research question. The data from the Chinese unit tests, the learning worksheets, as well as the responses to the questionnaires and interviews were analysed to answer the second and third research questions. SPSS was used as the major software for statistical analysis. Descriptive statistics were calculated to describe the means and standard deviations, and an independent samples *t* test was adopted to compare the final learning results and questionnaire results of the two groups. For the qualitative data from the instructor and students, the researcher translated the feedback from the interview into raw data files for each participant, and re-coded the raw data according to different themes. The final qualitative data were organized and displayed as reduced data from which the findings for each question could be highlighted.

Integrating the learning materials to support the flipped classroom

The processes of how to adopt the developed learning content for conducting a flipped classroom are described in this section to answer the first research question. The researcher designed the
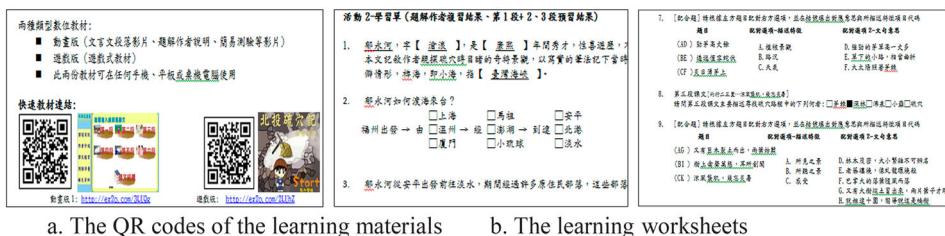
a. The QR codes of the learning materials   b. The learning worksheets

Figure 7. Print screens of the learning materials and data. (a) The QR codes of the learning materials. (b) The learning worksheets.

flipped classroom activities with the support of developed learning materials based on the reviewed literature, and used the data from the interviews, students' course products, and the learning worksheets to answer the first research question. The Chinese teacher adopted the developed learning materials to support the Chinese course according to the following steps: First, before the first formal experiment class, the teacher gave the students handouts that embedded with QR codes of learning materials and introduced the functions of the learning materials to the students (Figure 7(a)). The learners were then encouraged to do the content preview and were given learning missions to be completed before starting the next classes. The purpose of the learning missions was to trigger the students to pre-study the assigned Chinese classical paragraph and to let the teacher understand how they learned the content as well as to further hold teaching discussion accordingly. Then, the four learning activities were conducted in the formal class during the experiment. The design of the learning activities is presented in Table 1.

Activity 1 was a cooperative task. The students were separated into groups and the students had to complete the preview work before the class so that they would be able to present the interpretation of the classical Chinese. During the class, they were required to cooperatively draw out the story according to the context (Figure 8(a)) and the Chinese teacher walked around the class to check the main ideas in the drawings and also to give the students some hints or suggestions to help them correctly translate the meanings of the classical Chinese. Then, the students had to make a presentation to demonstrate how they comprehended the content, and the teacher provided feedback to them for further improvement (Figure 8(b)). Activities 2–4 were personal tasks which were conducted for the following classes. The students were required to complete the learning worksheets before the class. The instructor then clarified and highlighted important learning information that the students had missed, and gave further explanations of the concepts that were difficult to understand (Figure 9). After the classes, the students reviewed the learned content and previewed the next class content with the developed materials accordingly.

Table 1. Descriptions of the class activities.

Learning activities
- Activity 1

Group activity: Students were separated into groups and asked to draw pictures collaboratively to demonstrate how they understood the story and the important concepts of the assigned classical Chinese contexts.
- **Activity 2**

Personal activity: Students had to finish learning worksheet A to demonstrate how they understood the background information of the author and paragraphs 1–2. The items in the article included short answer, matching, and fill-in-the-blank questions.
- **Activity 3**

Personal activity: Students had to finish learning worksheet B to demonstrate how well they previewed paragraphs 3 and 4 and reviewed paragraphs 1–2. The items in the article included multiple-choice and matching questions.
- **Activity 4**

Personal activity: Students had to finish learning worksheet C to demonstrate how well they previewed paragraphs 5 and 7 and reviewed paragraphs 3–4. The items in the article included multiple-choice and matching questions.

(a) The students working in groups to complete the learning activities

(b) The students presenting their work in front of the class
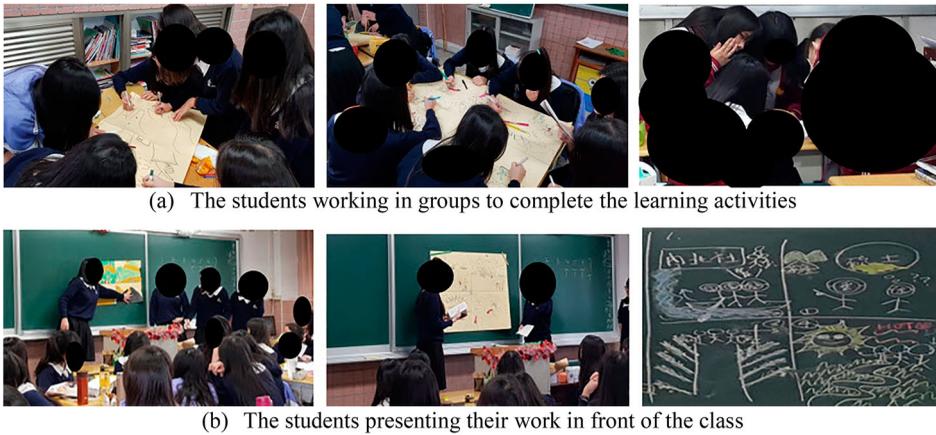
Figure 8. Activity 1: The learners drawing the picture and sharing their learning thoughts. (a) The students working in groups to complete the learning activities. (b) The students presenting their work in front of the class.

Learning effectiveness

The scores of the pre-semester grades, Chinese unit tests, and learning worksheets were analyzed to answer the second research question. The results of the Levene's test of the pre-semester confirmed that the data of the two groups met the equality of variance assumption. According to the results of the descriptive statistics, it was found that the learners in the E.G. who used both the animated-story and the game-based learning materials for course preview got better average scores then the learners in the C.G. with only the animated story materials. However, there was not a significant difference according to the independent samples *t* tests (Table 2(a)) and when the three learning worksheets were analyzed it was found that the learners in the C.G. performed better on the worksheets than the learners in the E.G., and the scores achieved significant differences. Further analysis was conducted through analyzing the learners' various learning achievements between the groups (Tables 2(b–d)). The results indicated that the students' various learning achievements on the worksheets in the C.G. were better than those of the learners in the E.G. in general. However, the results were the opposite when analysing the Chinese unit test. It was found that the learners with game-based and animated story materials performed better on the Chinese unit test than the learners who only worked with the animated story materials.

Students' perceptions

The data from the questionnaires and interviews were analysed to answer the third research question. Descriptive statistics and an independent samples t test were conducted to analyse the two groups' feedback after the experiment. The questionnaire results are presented in Tables 3 and 4.

For the results of part one, analysis of the independent samples t test revealed that the students had different average scores for Questions 1, 2, 4, 5, and 6 (Table 3) and they achieved statistical differences. This indicated that the learners in the E.G. with both kinds of materials had better

Figure 9. The instructor clarifying and highlighting important learning information after the activities.

Table 2. Independent samples *t*-test results of learning performance.

Tests		Mean	S.D	t	P
(a) The whole					
Chinese achievement test	E.G.	85.38	7.84	1.13	.25
	C.G	83.54	6.13		
Learning worksheet A	E.G.	89.75	7.50	−3.51	.00
	C.G.	94.80	4.65		
Learning worksheet B	E.G.	88.38	9.89	−3.57	.00
	C.G.	94.53	3.57		
Learning worksheet C	E.G.	81.75	8.81	−6.75	.00
	C.G.	93.38	5.86		
(b) The high achievement learners					
Chinese achievement test	E.G.	87.31	8.07	.76	.45
	C.G	85.20	4.02		
Learning worksheet A	E.G.	89.38	7.04	−2.70	.01
	C.G.	96.00	3.94		
Learning worksheet B	E.G.	89.38	8.92	−1.90	.06
	C.G.	95.00	3.33		
Learning worksheet C	E.G.	84.06	9.34	−2.80	.01
	C.G.	93.50	6.36		
(c) The intermediate achievement learners					
Chinese achievement test	E.G.	85.50	8.20	.34	.73
	C.G	84.69	3.73		
Learning worksheet A	E.G.	90.00	8.16	−1.76	.09
	C.G.	94.53	5.01		
Learning worksheet B	E.G.	89.00	11.00	−1.90	.04
	C.G.	95.16	3.70		
Learning worksheet C	E.G.	78.50	6.68	−8.08	.00
	C.G.	95.31	3.96		
(d) The lower achievement learners					
Chinese achievement test	E.G.	83.07	7.237	.2	.41
	C.G	80.36	9.157		
Learning worksheet A	E.G.	90.00	8.086	−1.47	.15
	C.G.	94.09	4.908		
Learning worksheet B	E.G.	86.79	10.671	−1.89	.07
	C.G.	93.18	3.552		
Learning worksheet C	E.G.	81.43	9.288	−2.68	.01
	C.G.	90.45	6.966		

learning motivation and willingness to do the preview than the learners in the C. G.. Besides, the students in the E.G. reflected that the learning materials helped them understand the background knowledge, the character, pronunciation, and meanings of the classical Chinese article. The researcher further analysed the data of the learners at various achievement levels (Table 3(b)) and the findings showed that there was no different feedback of the intermediate achievement students for the two groups. However, it was found that the high-achievement and low-achievement students in the E.G. had more positive learning feedback than those in the C.G., and some results achieved significant differences (Table 3(b-i and b-iii), Questions 1, 4, 5, and 6). Moreover, it was found that the low-achievement students in the two groups had different average scores for Questions 2, 8, 9 and 10 as well (Table 3(b-iii)), and they also achieved statistical differences. These results indicated that the game-based learning materials plus the animated-story materials promoted the high- and low-achievement students' pre-course learning motivation for classical Chinese, and they were more helpful for the low-achievement learners.

For the results of part two, the evaluation of the game-based learning materials is presented in Table 4. The learners gave positive feedback on the game design, and reflected that the content of the game was related to the classical Chinese learning, and they were familiar with the operational functions of the game. Besides, the game scenario stimulated the situation of the article, and this helped them to be more familiar with the targeted classical Chinese through complementing the tasks in the game. Meanwhile, it was noticed that two items were scored below 3.5. These questions were targeting the evaluation of learning immersion (Table 4, Q10 and Q11).

Table 3. Questionnaire results: part one.

Question items-Part one	Group	Avg.	S.D.	T	p
(a) The results of the whole					
1. I had better learning motivation than prior to the course with the learning materials	E.G.	3.33	.72	3.20	.00
	C.G	2.83	.56		
2. The learning materials helped me understand the background of the article	E.G.	3.69	.60	2.39	.01
	C.G	3.34	.59		
3. The learning materials helped me have better content comprehension	E.G.	3.64	.49	0.10	.91
	C.G	3.63	.59		
4. The learning materials helped me understand the classical Chinese regarding the character, pronunciation, and meanings	E.G.	3.51	.68	4.00	.00
	C.G	2.86	.69		
5. I like to learn classical Chinese with the learning materials	E.G.	3.59	.68	2.81	.00
	C.G	3.11	.71		
6. I would be willing to do the class preview with the learning materials	E.G.	3.36	0.73	3.58	.00
	C.G	2.74	.70		
7. The learning material was a good tool for self-learning	E.G.	3.50	.59	1.14	.25
	C.G	3.31	.75		
8. The learning material was a good tool for in-class learning	E.G.	3.61	.67	0.46	.64
	C.G	3.54	.61		
9. The learning materials were good for after-class learning	E.G.	3.43	.80	0.46	.64
	C.G	3.11	.58		
10. The learning materials were good for pre-class learning	E.G.	3.44	.76	1.05	.29
	C.G	3.26	.70		

Question items	(i) H. L.					(ii) I. L.					(iii) L. L.				
	Group	Avg.	S.D.	T	p	Group	Avg.	S.D.	T	p	Group	Avg.	S.D.	T	p
(b) The results of the learners at various achievement levels															
1	E.G.	3.08	0.79	2.39	0.02	E.G.	3.25	0.82	0.67	0.50	E.G.	3.62	0.50	3.77	0.00
	C.G	2.29	0.48			C.G	3.07	0.47			C.G	2.86	0.53		
2	E.G.	3.46	0.58	0.93	0.36	E.G.	3.60	0.69	0.99	0.33	E.G.	3.96	0.47	2.78	0.01
	C.G	3.14	0.9			C.G	3.36	0.49			C.G	3.43	0.51		
3	E.G.	3.42	0.55	−0.04	0.96	E.G.	3.65	0.47	0.02	0.97	E.G.	3.85	0.37	0.8	0.43
	C.G	3.43	0.53			C.G	3.64	0.74			C.G	3.71	0.46		
4	E.G.	3.25	0.58	2.6	0.01	E.G.	3.40	0.81	1.13	0.27	E.G.	3.85	0.55	4.18	0.00
	C.G	2.43	0.78			C.G	3.07	0.61			C.G	2.86	0.66		
5	E.G.	3.42	0.66	2.41	0.02	E.G.	3.55	0.76	0.42	0.67	E.G.	3.77	0.63	2.79	0.01
	C.G	2.71	0.48			C.G	3.43	0.64			C.G	3.00	0.78		
6	E.G.	3.21	0.75	2.14	0.04	E.G.	3.20	0.91	0.66	0.51	E.G.	3.62	0.50	3.93	0.01
	C.G	2.43	0.78			C.G	3.00	0.55			C.G	2.64	0.74		
7	E.G.	3.33	0.61	1.16	0.26	E.G.	3.55	0.68	−0.06	0.95	E.G.	3.62	0.50	1.91	0.06
	C.G	3.00	0.57			C.G	3.57	0.93			C.G	3.21	0.57		
8	E.G.	3.54	0.72	0.35	0.72	E.G.	3.45	0.68	−1.63	0.11	E.G.	3.81	0.63	2.18	0.03
	C.G	3.43	0.53			C.G	3.86	0.53			C.G	3.29	0.61		
9	E.G.	3.25	0.81	0.71	0.48	E.G.	3.40	0.81	−0.09	0.92	E.G.	3.62	0.82	3.14	0.00
	C.G	3.00	0.57			C.G	3.43	0.64			C.G	2.86	0.36		
10	E.G.	3.17	0.77	0.49	0.63	E.G.	3.45	0.72	−0.39	0.69	E.G.	3.69	0.75	2.35	0.02
	C.G	3.00	0.57			C.G	3.57	0.75			C.G	3.07	0.61		

*H. L.: higher-achievement learners.
*I. L.: intermediate-achievement learners.
*L. L.: lower-achievement learners.

The students' and teachers' qualitative interview data were re-coded and organized into Table 5. The students gave reasons for enjoying reading the game-based and animated-story materials such as watching the animation helped them understand the classical Chinese more easily than reading the text. The students indicated that the clear illustrations of the animation helped them understand the background story of the article more easily. Some learners reflected that the way of previewing the e-learning materials was more helpful than the way of reading the textbook only since the vivid animation was better than expressionless text. Besides, they stated that using the game-based learning materials made them feel as though they were not just studying but also acquiring knowledge through playing, and they would know how they comprehended the meanings of the article through the processes of making choices in the game tasks. It was great to notice that when the students got stuck in the game, some reflected that they would read the textbook carefully again or

Table 4. Questionnaire results: part two.

Question items-Part two	Avg.	S.D.
1. I can play the game even though no one told me how to play it.	3.66	.76
2. I operated the game well with the guiding functions.	3.80	.63
3. Most tasks in the game were related to learning.	3.89	.63
4. The level of the game is good for me.	3.51	.74
5. The story in the game helped me to know the learning purpose of the target lesson.	3.69	.63
6. The game gave me feedback whenever I finished or failed in the tasks.	3.57	.73
7. The game gave me hints to help me overcome the challenges.	3.69	.71
8. The multimedia content in the game helped me overcome the challenge.	3.66	.68
9. I always knew how to do the next steps in the game.	3.66	.72
10. I forgot the time when I was playing the game	3.11	.86
11. I ignored what happened when I was playing the game.	3.11	.86

discussed with their peers in order to find answers to overcome the challenge. Integrating the game-based learning materials for preview made the students not only read the content passively, but triggered them to become active learners. What is more, the students were quite impressed with the flipped classroom learning approach, especially for participating in Activity 1. They felt that it was really a nice way to motivate them to preview before the class without feeling stressed.

However, despite the positive feedback collected above, the researcher also noticed that several students pointed out that the flipped classroom activity was good, but if it was conducted too often, they would feel learning pressure. Other comments indicated that several students were not willing to adopt e-materials for course preview since they were afraid that their parents thought they were playing instead of learning. The students also reflected that they were more used to reading the textbook and taking notes by hand instead of on the e-materials since the slow speed of the Internet or the instability of the learning devices were the reasons to stop them wanting to read the e-materials. Besides, one advanced learner suggested that the learning content in the game could be deeper, as the current content was too easy. The students also reflected that the process of the game was too slow (such as the walking speed of the character), and hence some learners enjoyed the multimedia content more than the game-based materials most of the time. These comments might explain why the average scores of the questionnaire feedback in Table 4 ranged between 3.5 and 4 points (positive) but not above 4 points (very high). Several suggestions regarding improving the learning materials were collected as below. Students suggested that 1) the figures of the animation in the game-based and multimedia materials could be improved; 2) the process of the game could be modified, such as the walking speed of the characters and the playing speed of the animation could be faster.

Teacher's perceptions

The data from the teacher interview were analyzed to answer the third research question. The instructor reflected that it was a good way to conduct a flipped classroom for classical Chinese learning with the supports of the e-materials compared to previous teaching experience through lectures. The students looked forward to the classes and they were more impressed with the targeted contexts since they had to read the paragraph first, and then organize and present their comprehension of the paragraph through drawings. Participating in these activities made them become active learners. The teacher also explained the possible reasons why the learners with the animated-story learning materials performed better on the learning worksheets than the learners with both the game and the animated-story learning materials. It might be because the range of the animated-story materials focused on a single paragraph, whereas the game-based learning materials focused on the whole text of the article. For the C.G., each time students previewed the course, they would clearly know the important and detailed concepts of the target paragraph, while the content of the game-based material focused on the whole text of the article instead of explaining single sentences or word meanings, thus tending to let the learners become familiar with the processes and situations of the whole article instead of focusing on a particular single paragraph. Besides, one point worth

Table 5. Organization of the learners' feedback in the interviews.

A. Feedback on the game-based learning materials	B. Feedback on the animated story materials
• The game-based learning material was interesting. It makes me feel not just that I am learning, but I could find the missing learning concepts during the game. EG-145 • I tend to use figures to understand the concepts, and the materials helped me to know what I missed and to review the concepts. EG-145 • It is helpful to me. I liked to overcome the challenge step by step slowly, and this helped me to remember the context clearly. EG-165 • The design of the game is good. For example, it is cool to answer learning questions through finding the clothes for the character. EG-176 • I liked the game-based learning materials since I like to 'play.' The animated materials were not so interactive. EG-172 • I would find the answer in the textbook if I met questions in the game. But one time, there was a question that I could not find in the textbook, so I asked classmates for help. EG-145 • Actually, I played the game and read the textbook at the same time because I did not really understand the context at the beginning. EG-165 • I understand all the meanings of the classical Chinese, so I did not need the assistance of the game. EG-135.	• I enjoyed the animated story materials, the presentation was very clear, and I felt relaxed while reading. EG-157 • I liked the part that introduced the background information of the article and the author. I often missed this part and watching the animation impressed me more. EG-172 • The animation helped me to understand the story and the meanings of the classical Chinese more easily. EG-157 • The design of the animation was good. It was easier for me to remember the article. EG-145. • The illustration of the animation is like translating the classical Chinese into vernacular Chinese. EG-161 • The animation helped me to understand the textual context. CG-026 • Watching the animation helped me to comprehend classical Chinese. It was more useful to me to watch the animated materials for after-class reviewing than writing the homework test. CG-004 • The materials were good and I would use them for class preview, because I usually cannot understand the meaning if I only read the text. The animation helped me to understand the meanings. EG-172 • It is good to use the materials for previewing or review. CG-009.
C. Feedback on the flipped classroom activities	D. Other feedback and suggestions
• I liked the group discussion time, and I like to share my ideas and answers with others. EG-016 • The activity was really interesting. I liked the activities, learning materials, and the game. I have not tried this learning way ever before. This method promoted my learning motivation and I also found that I missed some concepts that I had not found before. EG-172 • I enjoyed the drawing activity. We discussed and drew the picture together. It helped me to understand the context. EG-171 • I like the activity of drawing the picture. It increased my interest in the class and also helped me to get a better impression of the context. CG-001 • The activity was really helpful, especially for the long paragraphs. CG-053 • The activity of drawing the picture made me understand the context more. CG-019 • The interaction in the class was lively. CG-038 • The group discussion about drawing the picture of the paragraph was more useful to me than watching the animated materials. CG-017	• The explanation was very good, although the figures of the characters were not so good. EG-167 • I think the materials were better for after-class review. CG-025 • I would like to use the materials for pre-course reading because sometimes I can't understand the classical Chinese, and to read with the materials was much easier to understand. EG-172 • It took time to load the game. EG-152 • I liked to read the textbook. I am not interested in watching the animation. CG-004 • I like the textbook, because taking notes by hand helps me to have a deeper impression of the content. CG-012 • I think to have this activity sometimes is good, but if it was held too often, I would lose interest because it would just be like the usual way. EG-159 • Well …. I think it was inconvenient for me to use the eLearning materials. CG-001 • I don't want to use the e-materials for preview, because it takes time and my parents would think I am watching cartoons instead of reading. CG-003 • I like to read the textbook more, because the e-materials are inconvenient and I have to connect to the Internet. CG-026

noting is that the teacher stated that despite using the e-learning materials to support flipped classroom learning being an effective way of promoting students' learning motivation and self-directed learning, the learners in the current stage of education, namely senior high school, put more focus on entering university. Hence, sometimes, the teachers have to choose the quickest way, lectures, to transmit the learning knowledge because the teaching time is quite limited but a great deal of material needs to be taught. This is a dilemma that the teachers have to face and overcome. Moreover, the instructor suggested that the game could be improved through including deeper concepts of classical Chinese. The teacher also suggested that the topics to conduct the flipped classroom with

e-learning materials could include classical Chinese stories such as Dream of the Red Chamber. Since the content of the classical works is rich, more extracurricular concepts could be included in the e-learning materials to help the students achieve further learning acquisition.

Discussion

The anchored-based learning contents support flipped classrooms

After analyzing the data, it was found that the learners in both groups had positive feedback regarding participating in the flipped classroom activities, and they were more impressed with the classical Chinese article through the activity than the lecture. The game-based and animated-story learning materials were helpful tools for comprehension of the classical Chinese, and it was found that despite the learners in the two groups not showing different learning performance in the Chinese unit test, the learners with both game-based and animated-story learning materials, especially for the low-achievement students, showed more positive feedback on the questionnaires than the learners with the animated-story material only. This finding is similar to Randi and Carvalho's (2013) and Giannakos et al.'s (2018) study, which indicated that despite there being no major differences in the test results, students reflected that the game-based learning fostered their self-directed learning. Furthermore, the learners were active in finding answers from the textbook or discussing with their peers in order to pass the challenges in the game. The findings were similar to those of previous studies which indicated that what appeals about learning games is the process of struggling toward the goal (Costikyan, 2002; Crawford, 1982). These were triggers that promoted students' learning motivation and helped them become active learners. This finding was also similar to the game-based research (Coyne, 2003) which found that the repetition of gameplay is the driving force that motivates learners to search for target knowledge through the chance to learn by playing.

On the other hand, students reflected in the interviews that using the game-based learning materials assisted them in clarifying the concepts of classical Chinese more easily than only reading the textbook. These findings echo Mayer's (2005) and Paivio's (1986) studies which indicated that the use of multimedia elements to present information in a dual way helped students acquire the targeted content better than the single modality. Moreover, the findings were consistent with the studies stating that technology-enhanced anchored learning is an effective way of learning (Elcin & Sezer, 2014; Shyu, 2000) since a good anchor will sustain learners' interest and encourage them to delve into the learning topics (Bransford et al., 1990; CTGV, 1990).

Suggestions for arranging various materials to support learning

According to the quantitative results, it was found that despite the learners in the two groups not showing different learning performance in the unit test, it was noticed that the learners with only the animated-story materials performed better on the three learning worksheets than the learners with both the game-based and the animated-story materials These findings might be explained by the instructor's feedback on the range and purpose of the materials. The game-based learning materials were focused on the whole story of the lesson, which might be more helpful for understanding the whole lesson context. In contrast, the animated-story materials were separated into several sub-sections, with each animation illustrating a single paragraph. Despite the E.G. learners being provided with both kinds of materials, according to the questionnaires, they tended to read the game-based materials more, and sometimes did not read the animated-story materials. This might be the reason for the worse learning performance of the E.G. students on the three learning worksheets as each worksheet targeted a learning subsection of the classical Chinese article.

Based on the above findings, it is suggested that both sets of materials could be provided to assist learners in doing course preview for different learning purposes at various times. The game-based learning materials could be used at the beginning of the unit to arouse students' learning motivation

through giving them a quick holistic view of the article. The animated-story materials could then be provided according to the teacher's schedule to enhance the learners' concepts of the important classical Chinese sentences and wording in detail. At the end of the course, the teacher and students could then be encouraged to learn with the game-based learning materials together in the class to clarify the concepts again, and as a review of the whole classical Chinese lesson.

The dilemma of flipped classroom learning

Despite the instructor giving quite positive feedback and agreeing that the approach promoted learners' learning motivation after the experiment, whether the way of integrating the e-learning materials with flipped classroom learning is a feasible way in Asia country especially for the senior high school is issues that need to be further explored. Since most senior high school put focus on helping learners to go to better college and most effective teaching methods is lecture within the vary limited teaching time. This finding echoed the previous research which indicated the challenges of conducting flipped classrooms such as school policy (Giannakos et al., 2018). Besides, the current findings are also consistent with a previous study (Wang, 2016) which found that some teenagers have very limited time to use their mobile devices as their parents are worried about them playing instead of learning. This might hinder instructors in designing pre-course flipped classroom activities. Hence, how to design appropriate e-material content and integrate the e-materials to support students in achieving self-directed learning through flipped classrooms might need the school, teachers, and students to find a balance and feasibility.

Conclusions and future work

This study aimed to take advantage of the game-based and animated-story learning materials with the flipped classroom strategy to assist senior high school students' classical Chinese learning. According to the results of the data analysis, there was not a significant difference between the E.G. and C.G. regarding students' learning performance. However, the questionnaire results revealed that the learners in the E.G. had better learning feedback such as better learning motivation and willingness to do the preview than the learners in the C.G., especially for the low-achievement students. The qualitative data from the students confirmed that the e-learning materials were more helpful than the way of reading the textbook only. The animated story materials with vivid animation helped them understand the background story, and the game-based materials made them feel as though they were not just studying but also acquiring knowledge through playing.

In answering the first research question, the study designed physical course activities and e-learning materials together with teacher-generated learning worksheets to conduct a flipped classroom. The anchored instruction was integrated into the design of two types of learning materials. The animated story materials provided the learners with a scenario anchor, and the game-based learning materials encouraged them to make decisions in the anchor task. The integration of the animated-story and game-based content with the flipped classroom activities brought positive effects on the classroom atmosphere. Besides, according to the findings of the questionnaires and the teacher's feedback, the animated-story learning content could be used as pre-course learning materials to help the students construct detailed and basic understanding of a single paragraph, and the game-based learning materials would be a good support to arouse students' learning motivation, especially for the low-achievement students, as well as to help them have a holistic view of the targeted classical Chinese unit.

To answer the second question, the scores of the Chinese unit tests and learning worksheets were analyzed. The results showed that the learners in the two groups did not differ in their learning performance in the overall Chinese unit test, but the learners with the animated-story materials had higher average scores on every single learning worksheet. This indicates that the animated-story learning materials were more helpful in terms of assisting students in comprehending each sub-

section paragraph since the content presented clear and detailed descriptions of the important classical Chinese sentences and wording, whereas the game-based learning materials focused on overcoming the tasks after they understood the whole article.

To answer the last research question, the evaluation of subjective measures of user feedback based on both the quantitative and qualitative data collected through the questionnaires revealed several positive aspects. According to the questionnaire results, it also revealed that the students, especially the low-achievement students, in the E.G. with both game-based and animated-story learning materials had better learning feedback than the learners in the C.G. with animated-story learning materials only. The teacher also gave positive feedback after the experiment, indicating that integrating the game-based learning materials for preview made the students not only read the content passively, but also triggered them to become active learners. This is what teachers and researchers want to see, and it is also the purpose of flipped classroom learning, that is, encouraging students to learn through knowing what they do not know and then finding the answers on their own instead of letting teachers ask them to learn. Meanwhile, after the experiment, the teacher also indicated thoughtful issues about hosting the flipped classroom activity in a senior high school class. The teacher suggested that flipped classroom activities might be good for students' self-directed learning, but due to the limited course time and the tight school schedule arrangement, the learning topics could focus on classical stories of classical Chinese instead of a single unit. Besides, it is suggested that the flipped classroom be run as a whole semester activity, and that the students be encouraged to achieve further extracurricular concept acquisition through self-study.

Limitations and future work

The main limitation of this study is that the participator were girls, and the results of the study cannot be generated to other scenarios. Besides, due to considering the real classroom learning scenario and the teacher's routine instruction, a pre-activity Chinese unit test was not collected as the pre-test for statistical analysis. Further work could firstly improve the game-based learning materials regarding the game speed, and secondly, integrate deeper and wider learning concepts into the learning tasks of the game. Besides, the next topic could focus on designing coherent classical literature and creating diversified e-learning units to support a longer term flipped classroom activity. More results of this series of studies will be reported in the future.

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