Combining e-books with mind mapping in a reciprocal teaching strategy for a classical Chinese course

Ting-Ting Wu[*], An-Chi Chen

Graduate School of Technological and Vocational Education, National Yunlin University of Science and Technology, No. 123, Sec. 3, University Rd., Douliou, Yunlin, 64002, Taiwan, ROC

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ABSTRACT

Chinese texts contain the essence of traditional Chinese culture and humanistic spirit, although they are obscure and difficult to understand. The integration of e-books into language learning can play a positive role and improve reading comprehension because of the diversified support tools and features of multimedia interaction in e-books. Therefore, this study investigated the teaching of classical Chinese with a combination of e-books, reciprocal teaching, and mind mapping; the effects of this approach on reading comprehension and knowledge sharing were explored. The sample consisted of two tenth-grade classes of a vocational school. Both groups received the reciprocal teaching strategy with mind mapping. The control group received traditional paper books; the experimental group received e-books. Quantitative and qualitative analyses were used in this study. The results were as follows. (1) Classical Chinese reading comprehension aspect: The experimental group performed more satisfactorily than did the control group, indicating that the integration of the e-book resulted in this measurable improvement by enhancing learners' reading comprehension. (2) Knowledge sharing aspect: The pretest and posttest scores significantly differed between the experimental and control groups, indicating that diversified support tools can promote knowledge sharing. (3) Mind-mapping aspect: the scores of the whole structure (color and image), association skills, and the contents of the articles were more satisfactory in the experimental group than in the control group. (4) Learners had a positive attitude toward the combination of e-books, reciprocal teaching, and mind mapping.

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1. Introduction

With the continuous advancement of technology, our lives have become increasingly convenient, and teaching methods have also been evolving toward diversity and innovation (Jeng, Wu, Huang, Tan, & Yang, 2010). The development of mobile devices has aided in overcoming the limitations of traditional teaching; mobile devices offer advantages, such as portability, interaction, and immediacy, that have various applications in education (Chang, Lan, Chang, & Sung, 2010; Huang, Kuo, Lin, & Cheng, 2008; Hwang, Yang, Tsai, & Yang, 2009). The increasing use and popularity of mobile devices have led to the development of new approaches and trends in learning.

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* Corresponding author.
E-mail address: danytingting@gmail.com (T.-T. Wu).

In recent years, with the emergence of e-books, numerous studies have investigated the applications of e-books in education from different perspectives (Bennett, 2011; Grimshaw, Dungworth, McKnight, & Morris, 2007; Kang, Wang, & Lin, 2009; Korat & Shamir, 2008; Korat, 2010; Shamir & Shlafer, 2011; Shamir, Korat, & Barbi, 2008; Sung, Chang, Lee, & Yu, 2008; Woody, Daniel, & Baker, 2010). Among them, studies on the integration of e-books in language learning have reported that diversified support tools and multimedia interaction features in e-books could play a positive role in language learning in terms of vocabulary, comprehension skills, and reading (Korat & Shamir, 2008; Korat, 2010; Shamir et al., 2008). Numerous language textbooks in the e-book format have been found to be helpful in enhancing learners' capacities for interpreting texts, understanding words, and applying sentence structures and grammar learning, all of which are vital aspects of language learning (Day & Bamford, 1998; Gehard, 1996).

In Chinese learning, students often find classical Chinese texts obscure and difficult to understand. However, sentences in classical Chinese texts contain the essence of traditional Chinese culture and therefore constitute a crucial part in the cultivation of one's humanistic spirit (Feng, 1994; Ivanhoe, 2001). To read classical Chinese texts, a reader must have exceptional capacities for word association and logical judgment (Huang, 1982), which are similar to those required for mind mapping, which works through free associations with keywords and features such as logical memory (Buzan, 1995). Mind mapping enables learners to have open and critical thinking and to acquire capacities for information integration, reasoning, and creation. This study was conducted by blending mind mapping into teaching activities. By drawing mind maps, learners were encouraged to associate concepts with the interpretation of knowledge, thus enhancing their capacities for critical thinking, integrated thinking, creativity, and reasoning (Davies, 2011; Kokotovich, 2008; Mueller, Johnston, & Bligh, 2002; Sabbah, 2015).

A message becomes information, and this information in an arranged format becomes knowledge (Nonaka & Takeuchi, 1994). Students gain knowledge through learning and understanding. Sharing increases the value and flow of the knowledge, multiplying it further (Huysman & Wit, 2004; Nousala & Miles, 2009). Therefore, if members have higher willingness to share their knowledge, a greater benefit of knowledge would be produced (Bock, Zmud, Kim, & Lee, 2005). The knowledge sharing-mechanism is mainly based on knowledge exchange and communication. Students use structured mind mapping to present the comprehension and concept of knowledge, and mind happing helps students communicate and exchange their knowledge, which contributes to knowledge transmitting and sharing (Andy, 2004; Leonardi, 2017; Tang & Chiang, 2009). Moreover, because each person has its own cognitive process, students can be able to jump out of original knowledge categories through knowledge sharing and then create new knowledge and ideas (Drucker, 1999).

Considering that teaching strategies used in the course of learning activities affect learners' selection, acquisition, and construction of information, learners' behaviors and thinking can also be affected during the course of learning (Weinstein & Mayer, 1986). Thus, teachers should provide learners with instructional scaffolding and help the learners to improve their reading in a gradual manner with the ultimate aim of enhancing their comprehension skills. The following four main teaching strategies of reciprocal teaching were chosen as methods to be used in the process of classical Chinese teaching: predicting, questioning, summarizing, and clarifying (Salyer, 2015; Blanch Gelabert, Corcelles Seuba, Duran Gisbert, Dekhinet, & Topping, 2014). By using these four main strategies, learners can obtain clear instructions during their reading, and with appropriate guidance and assistance, their prior knowledge can be invoked to facilitate their mastery of key points in texts. During this process, details scattered throughout texts can be integrated and summarized, thus helping learners in their development of metacognition and relevant skills (Nina, Nadine, & Joachim, 2013; Rashina, Annette, Shiree, Bridget, & Jason, 2014).

This study integrated an e-book learning system into the teaching of classical Chinese reading; the immediate and interactive multimedia support services in the e-book learning system were able to provide learners with rich, diversified learning content and teaching activities. In terms of the design of teaching strategies, reciprocal teaching was used as the basic method; it was complemented by scaffolding oriented mind mapping. This helped learners develop their capacities for metacognition, critical thinking, and reading comprehension. This study combined multimedia e-textbooks with reciprocal teaching and mind mapping for classical Chinese teaching; the main purpose of this study was to investigate the effects of applying this combination on learners' capacities for reading comprehension and knowledge sharing.

2. Literature review

2.1. Applications of reciprocal teaching in reading

Reciprocal teaching is a common strategy for teaching reading. Reciprocal reading was proposed by Palincsar and Brown (1984) to promote the dialog between teachers and learners who could then establish the text together. By using instructional scaffolding, teachers can help learners with their reading in a gradual manner. In dialog with teachers, learners can learn to apply the four reading strategies of predicting, questioning, clarifying, and summarizing to actual reading scenarios, thus enhancing their capacities for reading comprehension (Nina et al., 2013; Palincsar & Brown, 1984; Rashina et al., 2014; Teele, 2004; Yang, 2010).

In recent years, numerous studies have been conducted on the applications of reciprocal teaching in different fields, involving research participants from all walks of life. Most academic studies on reciprocal teaching have examined English teaching; some information science publications have studied Spanish teaching and German teaching. The greatest number of past research subjects were primary school students; smaller numbers of preschool students, middle school students, and university students have also been studied. The research mostly focused on reading comprehension, writing, reading fluency,

and reading motivation (Thibaut, Curwood, Carvalho, & Simpson, 2015; Salyer, 2015; Rashina et al., 2014; Dabarera, Renandya, & Zhang, 2014; Shadiev et al., 2014).

Currently, reciprocal teaching is most widely used in studies of reading, which have reported that appropriate guidance and assistance can enhance learners' capacities for reading comprehension and application (Rashina et al., 2014; Topping, Dehkinet, Blanch, Corcelles, & Duran, 2013). For example, Yang (2010) conducted a study on the combination of remedial instruction and reciprocal teaching of English and included college students as the research participants. The author reported that reading step-by-step in accordance with reciprocal teaching can not only enhance learners' capacities for reading comprehension but also can increase their abilities for problem solving. Moreover, the mutual support and discussion among peers during the implementation of reciprocal teaching were found to facilitate the communication and interaction between different social groups. In the context of the online international reciprocal teaching of Spanish and English, Topping et al. (2013) investigated the effects of peer tutoring on primary school students. They reported that learners can acquire different learning activities according to their levels of learning. Furthermore, through communication with and help from peers, these learners can enhance their capacities for learning a second language. In addition, students serving as tutors were required to provide detailed opinions and feedback; in this process, they could also enhance their capacities for reading and consolidate what they learned before. In addition, Schuenemann, Spoerer, and Brunstein (2013) conducted a study on the German curriculum for fifth graders by including reciprocal teaching as an integrated element. They demonstrated that compared with traditional language courses, reciprocal teaching could enhance learners' mastery of the reading strategies and improve their comprehension of written textbooks, thus increasing their self-efficacy in terms of reading. Moreover, because learners could learn to adjust their learning strategies during the course of reciprocal teaching, their reading comprehension could be enhanced and their delayed memory could be preserved. Rashina et al. (2014) integrated reciprocal teaching into their study on pre-school children when considering life-themed reading, numbers, and measurements. They reported that under the gradual guidance of reciprocal teaching, learners could understand the reading content and its knowledge structure as they were playing. Their communication and interaction with peers were also increased in this process. On the basis of these studies, it can be concluded that reciprocal teaching is useful in enhancing capacities for reading comprehension and in sustaining the retention and transfer of texts (Schuenemann et al., 2013; Palincsar and Brown, 1984). Furthermore, learners' reading comprehension and communication skills can be effectively improved by providing a clear instructional procedure in the teaching process and by using the four strategies of clarifying, summarizing, questioning, and predicting (Frances & Eckart, 1992).

Most of these current studies have focused on reading comprehension, reading outcomes, and manifestations of self-efficacy; rarely have studies considered classical Chinese texts. Most studies have examined primary school students; fewer studies have considered preschool children and middle school students; very few studies have examined college students. Therefore, in this study, vocational high school students were included as research participants. This study applied reciprocal teaching in classical Chinese reading courses; the aim was to understand the effects of reciprocal teaching on learners' reading comprehension in the process of guided reading.

2.2. Applications of mind mapping in teaching

Mind mapping is a comprehensive expression mode integrating images and words and a unique thinking pattern beyond traditional linear thinking and note taking. Mind mapping allows an individual to think, recall, and organize, after which everything can be taken down as notes. Therefore, although mind mapping is a simple and brief process, it is an organized and a structured method of knowledge presentation (Annemarie, 2015; Noonan, 2012; Ritchie, Della, & McIntosh, 2013; Somers, Passerini, Parhankangas, & Casal, 2014).

Buzan and Buzan (1996) suggested that mind mapping can enhance learners' memory and knowledge cultivation by emphasizing on the use of graphs and images. Moreover, the process of mind mapping can motivate learners to probe into the structures and extensions of concepts, and can increase their capacities for expressing themselves through multiple means. Kern, Bush, and McClesh (2006) applied mind mapping to the teaching of nursing courses. They suggested three advantages of implementing teaching through mind mapping: (1) mind mapping can help nursing students in the examination of a patient's overall condition, (2) schedules made by nursing students with mind mapping turned out to be more humane and structured, and (3) nursing students acquired considerable capacities for critical thinking from mind mapping. Boley (2008) reported that compared with nursing students learning without using mind maps, the learning outcomes of those learning with mind maps were more favorable. The results of this study confirmed the advantages of applying mind mapping in education. Somers et al. (2014) demonstrated that mind mapping represents the visualization of our thinking process; mind mapping allows the radiation or expansion of a core problem or an issue, thus building connections between different concepts and ideas. Mind mapping can be used as a learning tool to promote thinking in both the left and right brain hemispheres of a learner. Furthermore, the results indicated that mind maps can shed light on how a learner tends to integrate information and to apply knowledge in practice. Mind maps can help learners to retain information and to learn to think critically (D'Antoni, Pinto Zipp, Olsen, 2010). Annemarie (2015) used mind mapping to assist teaching and reported four advantages of the method: (1) it helps instructors to provide systematically organized teaching activities; (2) it improves learning environments and motivates learners to learn; (3) it is a learning method that learners can easily learn; and (4) it provides opportunities for learners to explore concepts and express themselves.

Most results and outcomes of recent studies integrating mind mapping into the teaching of reading have been positive (Alina, Dana, & Marioara, 2014; Jeon and Ma, 2015; McTigue, Douglass, Wright, Hodges, & Franks, 2015). The advantages of using mind mapping in teaching are as follows: mind maps provide simple teaching strategies that can be learned easily; mind maps improve capacities for self-expression and critical thinking; mind maps promote personalized learning and exploration; mind maps promote knowledge and memory retention; and mind maps combine words and images to produce strong comprehensive expressions (Buran & Filyukov, 2015; McTigue et al., 2015; Noonan, 2012). Although most studies have investigated learning outcomes, reasoning skills, creativity, writing skills, and teaching designs, few studies have focused on how mind mapping affects knowledge sharing when it is integrated into the teaching of reading. In addition, most research participants in these studies were college students; hence, studies including high school and vocational high school students are scant. Therefore, this study was conducted with vocational high school students who used mind mapping to learn classical Chinese reading. The effects and outcomes of mind mapping on reading comprehension and knowledge sharing were examined.

2.3. Applications of E-books in reading

With the continuous development of technology, changes are observed in the integration of information technology into teaching. Therefore, both learners and teachers must adopt new teaching and learning methods with open minds (Alur, Fatima, & Joseph, 2002). With the increasing popularity of smart phones, tablets, and notebook computers, digital learning is becoming more and more frequent. As a result, learning is now not limited by place and time; students can feasibly attempt to learn anytime and anywhere. With the help of technology, digital media, and digital textbooks, we now have an improved learning environment, which is still evolving toward diversity, pluralism, and richness (Girgin, Kurt, & Odabasi, 2011).

In recent years, with the emergence of e-books, numerous studies have investigated the applications of e-books in education from different perspectives (Bennett, 2011; Grimshaw et al., 2007; Kang et al., 2009; Korat & Shamir, 2008; Korat, 2010; Scheidlinger, 2004; Shamir & Shlafer, 2011; Shamir et al., 2008; Sung et al., 2008; Wilson, 2003; Woody et al., 2010). Among them, studies on the integration of e-books in language learning have reported that the diversified support features of e-books can play a positive role in Chinese learning in terms of vocabulary, comprehension skills, and reading (Korat & Shamir, 2008; Korat, 2010; Shamir et al., 2008). Bierman, Ortega, and Rupp-Serrano (2010) investigated the feelings of college teachers by using a questionnaire after the integration of an e-book into their teaching and work. They reported that college teachers tended to have a positive attitude toward the integration of the e-book into their work. In terms of teaching, they believed that e-books would be more useful than traditional paper books if they could provide extra reading or serve as teaching aids. Korat (2010) attempted to understand the changes in learners in terms of word recognition, reading comprehension, and reading texts aloud by including learners of different ages as research participants and by integrating e-books into the teaching of reading. The author indicated that with the assistance of an e-book, learners in all age groups were found to make progress in their capacities for word use, reading comprehension, and reading texts aloud. Huang, Liang, Su, and Chen (2012) established an interactive multimedia e-book learning system that was designed using various means of note taking, memorizing, and rich multimedia content. They reported that the integration of e-books could help learners work out their personalized ways of learning effectively and enhanced their capacities for reading comprehension and word learning significantly. In addition, Li, Chen, and Yang (2013) demonstrated that software applications in e-books, by providing features such as note taking, search, retrieval, dynamic content, and management, enabled learners to become more focused and sustained in their reading. Thus, they suggested that e-book systems should be designed to have additional features such as note sharing, cooperative discussion, and interaction. In this manner, learners can be more focused, can acquire greater capacities for reading comprehension, and can seize more opportunities to communicate and interact with other learners (Wolfe, 2008).

In the context of the previously mentioned advantages of e-books, an interactive multimedia e-book system was integrated into this study and applied in the reading of classical Chinese texts together with reciprocal teaching and mind mapping. This study analyzes and investigates how learners can be influenced in terms of their capacities for reading comprehension and sharing with the assistance of e-books.

3. Research design

3.1. Experimental procedures

The experimental classical Chinese course lasted for 14 weeks, with five 50-min sessions per week. In Weeks 1–6, learners in both groups were lectured in a traditional classroom. In Week 7, they were put through the first sectional examination, which was used as the means to evaluate their reading performance levels and as a pre-test for the knowledge-sharing scale of this study. A test designed to assess learners' capacities for reading comprehension and knowledge sharing was given for 100 min (70 min on reading comprehension and 30 min on knowledge sharing). Starting from Week 8, the experimental activities were implemented. Teachers elaborated and explained the experimental procedure to learners in the control and experiment groups so they could understand the entire procedure, thus facilitating the smooth implementation of the experiment. Meanwhile, to conduct the experiment in a more comprehensive manner, students in the experiment group were instructed to familiarize themselves with the operations of the e-book and mind mapping software in order to adjust

themselves to the interfaces, and students in the control group were instructed to familiarize with the teaching strategy and mind mapping in order to understand the drawing ways on the paper. In this manner, normal teaching activities proceeded without interruptions and the teaching schedule was not delayed, thus preventing scheduling problems that might impair the objectivity of the experiment. In Weeks 9–12, experimental activities were implemented; during this period, the control and experiment group used the four strategies of reciprocal teaching (questioning, summarizing, clarifying, and predicting) in combination with mind mapping to help learners in reading. Learners in the control group were required to draw mind maps on a notebook and then present the notebook to their peers to share their maps with each other. After some discussion, they were required to draw mind maps collaboratively on a piece of paper. By contrast, learners in the experiment group were required to draw mind maps on a tablet with the help of mind mapping software. These maps were then sent to their peers as email attachments to be shared and discussed. In Week 13, learners were put through the second sectional examination, which together with the posttest of the knowledge-sharing scale of this study, assessed learners' capacities for reading comprehension and knowledge sharing after the experiment. The test lasted for 100 min (70 min on reading comprehension and 30 min on knowledge sharing). In Week 14, interviews were conducted with teachers and students to understand and reflect on how the experiment had proceeded. The interviews with learners were conducted to investigate dimensions that could not be understood with only quantitative information, such as interaction between peers and learning difficulties, and to evaluate whether reciprocal teaching and mind mapping are suitable teaching strategies for learners. The suggestions or opinions of teachers were used together with the results of this study as explained in later sections. Fig. 1 presents the overall experimental procedure.

3.2. Participants

The participants of this study were first-year business administration students from two classes in a senior business vocational college who had classical Chinese in their curriculum. Within the class, these students were divided into two groups: the control group (consisting of 9 boys and 29 girls) and the experiment group (consisting of 18 boys and 24 girls). The average age of the students was between 16 and 17 years, and the majority of the participants were girls. The number of girls was higher because the fields of business and economy are dominated by girls. In the experimental process, learners in the
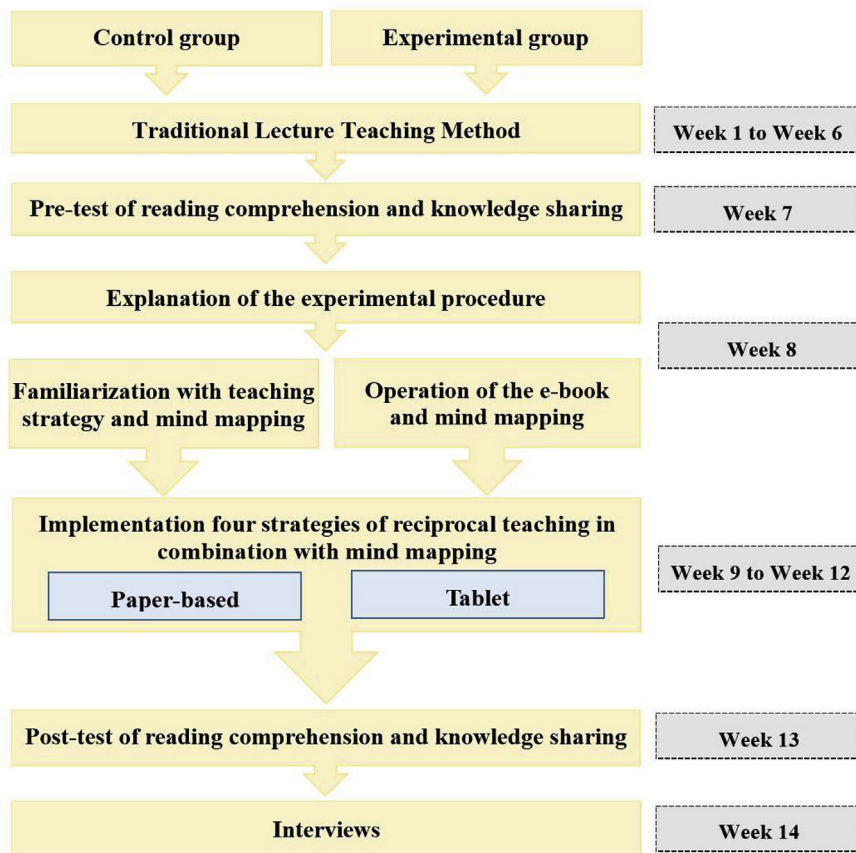

Fig. 1. Experimental procedure.

control group were required to use traditional paper classical Chinese textbooks and draw mind maps on a paper with the help of reciprocal teaching. By contrast, learners in the experiment group were provided electronic classical Chinese textbooks and asked to draw mind maps with mind mapping software on mobile devices (tablets) with the help of reciprocal teaching. In addition, texts used in the two groups were the same, namely four modules of classical Chinese reading materials. The learning situation is shown in Fig. 2.

3.3. Design of reciprocal teaching activities

Because the four strategic teaching activities involved in reciprocal teaching can be followed in various combinations, the teaching activities of this study were implemented in specific ways in the following three stages.

(1) Stage 1

In Stage 1, the two strategies used by teachers were questioning and predicting. Questions were asked on the six Ws (what, who, where, when, why, and how) of the title, and the students in both the control and experiment groups were required to answer under the teachers' guidance. In this process, the students were also required to predict the content of the classical Chinese text yet to be read.

(2) Stage 2

Stage 2 involved the use of all four reciprocal teaching strategies: summarizing, questioning, clarifying, and predicting. Teachers were required to guide the reading of the texts in paragraphs. Before reading each paragraph, teachers guided the students to read the paragraph aloud first and to underline the key points. Learners were required to check whether their lines of thinking corresponded with the connotations of the text. Learners were permitted to ask questions about the parts they could not understand and have them clarified. The teachers would rephrase their observations and guide the students to think whether their understanding was in line with the meaning of the text. In this manner, the learners were able to confirm and clarify their thoughts and figure out the concepts they were not familiar with or confused about. After that, teachers guided students to predict the content of the next paragraph; the teachers only guided students to predict in such a manner that the students became more definite about their learning topics.

(3) Stage 3

The four activities of reciprocal teaching were used in turn until the reading of the entire text was finished. At that point, students in the experiment and control groups were required to form groups of three, discuss what they understood about the text, and finally draw their mind maps. The mind maps of students in the control group were handed in on paper to be graded by the teacher, whereas students in the experiment group were asked to draw their maps in mind mapping software and hand them in as PDF files.

3.4. Introduction to the application software

(1) E-book system

An e-book system developed by the Hamastar Technology Company was used in the teaching activities of this study. This e-book system allows for easy editing and production, convenient operations, and comprehensive editing features. Users can convert PDF or PPT files directly into an e-book; users can also insert videos, background music, recordings, hyperlinks, and multimedia illustrations into this widely compatible system. The e-book offers features for the preparation of tests or games, which can make the lessons more diversified and interesting.

Fig. 2. The learning situation.

The browser interface provides basic functions such as page addressing, bookmarking, and returning. Note-taking features are diverse. For example, a user can use a stylus to handwrite notes at any time. A palette can be used to highlight key points with different colors. Users can zoom handwritten sticky notes on the reading interface while not taking up any space on the interface. Typing can also be used to record notes. Users can record lectures, thus facilitating review. The camera can take photos of key points or images at any time. The erase feature can delete incorrect inputs or unnecessary files immediately. Fig. 3 shows the interface of this e-book system.

(2) Mind mapping application software

Draw Express, a free software application that can be downloaded from Google Play, was the mind mapping software used in this study. It is designed with simple features and thus allows for easy operations. Users can upload their maps as email attachments and share them with others, even when they are offline. Apart from common functions, it also enables rich and diverse features such as color changes, texting, and insertion of images, photos, and videos. Fig. 4 shows the mind mapping interface feature of Draw Express.

3.5. Assessment tools

(1) Reading comprehension tests

The tests are the first and second Chinese sectional examinations, and scores in reading comprehension were used as the basis of this study. The two tests were designed by lecturers according to their teaching schedules and goals but were the same in terms of the number of questions and the reading comprehension levels required of the students.

(2) Knowledge-sharing scale

Learners in this study were required to evaluate their own capacities for communication with peers by using the knowledge-sharing scale developed by Wiemann (1977). After some editing and modification by several experts in this field, the modified version of this scale satisfied the needs of this study. The scale consisted of a total of 27 questions, and a five-point Likert scale was used to analyze scores. The overall inner consistency of this scale as measured by Cronbach's α was 0.86.

(3) Mind mapping scoring form for teachers

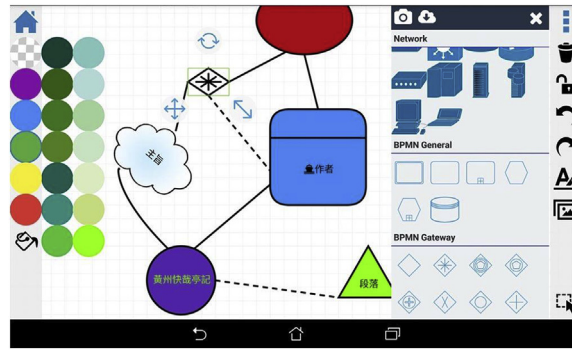**Fig. 3.** The interface of e-book system.

Fig. 4. The interface of Draw Express.

The mind mapping scoring form used in this study was developed on the basis of the form designed by Chen (2004) to facilitate teachers' consistent evaluation of the work handed in by learners. This scoring form divided mind mapping skills and items into 4 major categories and 10 scoring criteria (Table 1). The scores ranged from 0 to 4 for each criteria, making a total score of 40 points. According to Cronbach's α test, the overall validity of this mind mapping scoring form for teachers was 0.83.

(4) Interview

In this study, five students from the experiment group (provided with tablets) were selected randomly to be interviewed. The interviews were then coded, analyzed, and summarized on MAXQDA11 to make up for the information that could not be acquired by observers by using only quantitative data.

4. Research results

4.1. Reading comprehension outcomes

The reading comprehension tests were analyzed using three statistical methods. The first was the independent sample t-test, which was conducted to examine significant differences between the results of the reading comprehension pretest and posttest and between those of the experiment and control groups. The second was the dependent sample t-test, which was conducted to evaluate significant differences in the pretest results between the experiment and control groups. Finally, Pearson product moment correlation analysis was performed to determine significant differences in the correlation coefficients of the pretest and posttest results between the control and experiment groups. The results of these analyses are presented as follows.

(1). Results of the independent sample t-test for reading comprehension

On the basis of the results of the reading comprehension pretest of the experiment and control groups, an independent sample t-test was conducted; its results are listed in Table 2. The statistical results revealed that the results of the reading comprehension pretest did not significantly differ between the control and experiment groups ($t = -0.160$, $p > 0.05$). This

Table 1
The score criteria of mind mapping.

Categories	Criteria
The focus theme of the presentation	The focus theme is presented and the theme is placed in the center.
The overall structure of the presentation	Line use
	Use of color characteristics
	Image use skill
Use of association skills	The demonstration of creativity
	Keyword selection skills
The article structure of the context	The branch of article meaning
	Paragraphs are clear
	The subject of summary
	Cue induction

Table 2
The pre-test of reading comprehension.

Group	N	M	SD	t	p
Control	38	39.311	6.9074	−0.160	0.873
Experiment	42	39.086	5.6063		

finding indicates that before the implementation of teaching activities, levels of reading comprehension did not differ significantly between learners in the experiment and control groups.

On the basis of the results of the reading comprehension posttest of the experiment and control groups, another independent sample *t*-test was conducted; its results are listed in Table 3.

The statistical results revealed that the results of the reading comprehension posttest did not significantly differ between the experiment and control groups after the implementation of teaching activities ($t = 0.550$, $p > 0.05$). However, further examination of the average score of the two groups obtained in the reading comprehension posttest indicated that compared with the control group (M = 47.526), the experiment group performed more satisfactorily in the posttest (M = 48.505). Two reasons could be possible for significant differences between the experiment and control groups. First, the experiment lasted for only 6 weeks, and the outcomes might have been more significant if this duration could have been prolonged. Second, the experiment included the reading of difficult classical Chinese texts, and any improvements in outcomes might require considerable time to manifest.

(2). Results of the dependent sample *t*-test for reading comprehension

Table 4 shows the results of the dependent sample *t*-test for reading comprehension based on the pretest and posttest performance levels of learners in the experiment and control groups. The results of the dependent *t*-test demonstrated that the pretest and posttest scores significantly differed between the experiment and control groups, indicating that learners in the two groups performed significantly differently in the pretest and posttest. This shows that after the application of the same teaching strategies of mind mapping and reciprocal teaching, learners in both the experiment and control groups were significantly influenced in terms of their capacities for reading comprehension, which manifested as progress in reading. Further examination of the average scores of the two groups obtained in the pretest and posttest indicated that learners in the experiment group achieved a 9.419-point increase in the average score, which was higher than the 8.215 points achieved by learners in the control group. Although this difference is not considerable, considering that the same teaching strategies were applied, it can be concluded that the integration of the e-book resulted in this measurable improvement by enhancing learners' reading comprehension, which was then manifested in their performance.

(3) Results of the Pearson product moment correlation analysis of reading comprehension

Table 5 lists the results of the Pearson product moment correlation analysis conducted in the control group based on their scores in the pretest and posttest for reading comprehension. The results of the correlation analysis revealed that the correlation coefficient ($r = 0.474$) was significant ($p < 0.01$). On the basis of the strength of correlation as suggested by Cohen, the scores of learners in the control group in the pretest and posttest of reading comprehension had a moderately positive correlation, indicating that the higher a learner scores in the pretest, the higher he/she will score in the posttest. The results of the Pearson product moment correlation analysis of the experiment group's pretest and posttest scores for reading comprehension are listed in Table 6. The results revealed that the correlation coefficient ($r = 0.547$) was significant ($p < 0.01$). This finding indicated that the reading comprehension scores of the experiment group in the pretest and posttest were highly correlated.

The correlation coefficient in the experiment group was higher than that in the control group, indicating that the integration of the e-book in the experiment group facilitated reading comprehension when the same teaching strategies were applied.

4.2. Capacities for knowledge sharing

The knowledge-sharing scale was analyzed statistically using two tests. The first was the independent sample *t*-test, which was conducted to examine significant differences in capacities for knowledge sharing between the experiment and control groups during the course of the teaching experiment. The second was the dependent sample *t*-test, which was conducted to investigate significant differences in capacities for knowledge sharing between the two groups before and after the experiment. The results of these analyses are presented as follows.

(1). Results of the independent sample *t*-test for knowledge sharing

Table 3
The post-test of reading comprehension.

Group	N	M	SD	t	p
Control	38	47.526	9.5358	0.550	0.584
Experiment	42	48.505	6.1855		

Table 4
Dependent sample *t*-test of two groups.

Group	Test	N	M	SD	t	p
Control	Pre-test	38	39.311	6.9074	−5.802	0.000***
	Post-test	38	47.526	9.5358		
Experiment	Pre-test	42	39.086	5.6063	−10.835	0.000***
	Post-test	42	48.505	6.1855		

***$p < 0.001$.

Table 5
Correlation analysis of the control group.

	Pre-test	Post-test
Pre-test	—	0.474**
Post-test	0.474**	—

**$p < 0.01$.

Table 6
Correlation analysis of the Experiment group.

	Pre-test	Post-test
Pre-test	—	0.547**
Post-test	0.547**	—

**$p < 0.01$.

On the basis of the results of learners in the control and experiment groups in the knowledge sharing pretest, a dependent sample *t*-test was conducted; its results are listed in Table 7. The statistical results revealed that the results of the knowledge sharing pretest did not significantly differ between the control and experiment groups ($t = -0.949$, $p > 0.05$). This finding indicates that before the implementation of teaching activities, capacities for knowledge sharing did not significantly differ between the two groups.

On the basis of the results of learners in the control and experiment groups in the knowledge sharing posttest, another independent sample *t*-test was conducted; its results are shown in Table 8. The statistical results demonstrated that the results of the knowledge sharing posttest did not significantly differ between the control and experiment groups ($t = 0.319$, $p > 0.05$).

Further examination of the average scores of the two groups obtained in the knowledge sharing posttest indicated that, compared with the control group (M = 3.497), the experiment group performed more satisfactorily in the posttest (M = 3.524). In addition, the comparison of the average scores obtained in the knowledge sharing pretest and posttest demonstrated that learners in the experiment group performed more satisfactorily in the posttest than in the pretest, whereas learners in the control group performed more satisfactorily in the pretest than in the posttest. Therefore, it can be concluded that the use of the e-book system in the reading of classical Chinese texts, together with reciprocal teaching and mind mapping, enhanced capacities for knowledge sharing among peers in the experiment group. In other words, learners in the experiment group were more willing and happy to share their thoughts with peers.

(2). Results of the dependent sample *t*-test for knowledge sharing

Table 7
The pre-test of knowledge sharing.

Group	N	M	SD	t	p
Control	38	3.513	0.3095	−0.949	0.346
Experiment	42	3.452	0.2634		

Table 8
The post-test of knowledge sharing.

Group	N	M	SD	t	p
Control	38	3.497	0.4070	0.319	0.751
Experiment	42	3.524	0.3334		

On the basis of the results of learners in the control group in the knowledge sharing pretest and posttest, a dependent sample *t*-test was conducted; its results are listed in Table 9.

The statistical results of the dependent *t*-test revealed that the scores of learners in the control group did not significantly differ between the knowledge sharing pretest and posttest ($t = 0.357$, $p > 0.05$), indicating no significant performance difference for learners in the control group for the knowledge sharing pretest and posttest. Detailed examination of average scores shows that capacities for knowledge sharing of learners in the control group decreased during the course of the experiment.

The results of learners in the experiment group in the knowledge sharing pretest and posttest, as well as those of the dependent sample *t*-test, are listed in Table 10. These results indicated that the scores of learners in the experiment group significantly differed between the knowledge sharing pretest and posttest ($t = -2.052$, $p < 0.5$), indicating a significant performance difference for learners in the experiment group in the knowledge sharing pretest and posttest. Therefore, it can be concluded that after the integration of the teaching experiment through tablets, capacities for knowledge sharing increased in learners in the experiment group. With the assistance of tablets, peers learned in groups and circulated their notes to their peers through the Internet. The tablets removed limits to learning and knowledge sharing.

4.3. Scores generated in the mind mapping scoring form for teachers

On the basis of scores given by the teacher for mind maps drawn by learners in the control group in their study of four stories, a one-way analysis of variance (ANOVA) was conducted. The four content titles were "Story of Old Tippler's Pavilion (醉翁亭記)," "Story of Kuaizai Koisk in Huangzhou (黃州快哉亭記)," "Travel Notes of the Six Bridges — Waiting for the Moon in the Evening (晚遊六橋待月記)," and "Selection from Yu Lizi (郁離子選)." As observed from the summary of the scores of learners in the control group listed in Table 11, the scores given to them by the teacher for the four texts were significantly different (F = 33.457, $p < 0.001$). Furthermore, the post hoc comparison summary revealed differences among scores for the four texts. The order of the differences was as follows: "Travel Notes of the Six Bridges — Waiting for the Moon in the Evening" > "Selection from Yu Lizi" > "Story of Old Tippler's Pavilion" > "Story of Kuaizai Koisk in Huangzhou."

On the basis of scores given by the teacher for mind maps drawn by learners in the experiment group in their study of four classical Chinese texts, a one-way ANOVA was conducted. Table 12 shows that the scores given to them by the teacher for the four texts were significantly different (F = 20.867, $p < 0.001$). Furthermore, the post hoc comparison summary revealed differences among the four texts. The order of the extent of differences was as follows: "Travel Notes of the Six Bridges — Waiting for the Moon in the Evening" > "Selection from Yu Lizi" > "Story of Old Tippler's Pavilion" > "Story of Kuaizai Koisk in Huangzhou."

The comparison of the results of the post hoc test between the experiment and control groups indicated that both groups were given the highest scores for "Travel Notes of the Six Bridges — Waiting for the Moon in the Evening." This outcome can be attributed to two reasons. First, "Travel Notes of the Six Bridges — Waiting for the Moon in the Evening" was the third content in the teaching schedule. During this period, students in both the groups had adequately mastered the teaching strategies and were familiar enough with the reading comprehension of contents and mind mapping. Second, "Selection from Yu Lizi" was the fourth content in the teaching schedule. During this period, students had the highest mastery of the content but not of its textual structure, which limits learners' performance in mind mapping. Thus, students were given the highest scores for "Travel Notes of the Six Bridges — Waiting for the Moon in the Evening" by their teachers according to the post hoc test.

The comparison of scores given to learners in the experiment and control groups for their mind maps in terms of the average score for each story indicated that learners in the experiment group performed better in all the four texts. The scores of learners in the experiment group were 2–8 points higher than those of learners in the control group, indicating that compared with learners in the control group who drew mind maps on paper, learners in the experiment group drew more informative mind maps on tablets after the integration of tablets into their teaching. In other words, with the assistance of the mind mapping software, learners drew mind maps that were richer in color and clearer in typography, images, and understanding of the textual structure. Fig. 5 presents the mind maps handed in by learners in the experiment group.

4.4. Interview results

The researcher randomly selected learners for interviews, designed interview questions on the basis of the Framework for the Rational Analysis of Mobile Education (FRAME), and analyzed the interview results by using MAXQDA11 from the perspectives of mobile devices, learners, and society. The results are presented as follows.

Table 9
The control group of the knowledge sharing.

Group	N	M	SD	t	p
Control	38	3.513	0.3095	0.357	0.3615
Experiment	38	3.497	0.4070		

Table 10
The experiment group of the knowledge sharing.

Group	N	M	SD	t	p
Control	42	3.452	0.2634	−2.052	0.0235*
Experiment	42	3.524	0.3334		

*$p < 0.05$.

Table 11
The statistical results of four texts in control group.

Text	Mean	N	SD	F	p	Levene
Story of Old Tippler's Pavilion	18.55	38	2.565	26.888	0.000*	9.531
Story of Kuaizai Koisk in Huangzhou	18.45	38	3.547			
Travel Notes of the Six Bridges	26.45	38	5.953			
Selection from Yu Lizi	20.09	38	5.132			

*$p < 0.001$.

Table 12
The statistical results of four texts in experiment group.

Text	Mean	N	SD	F	p	Levene
Story of Old Tippler's Pavilion	23.43	42	4.554	14.663	0.000*	1.989
Story of Kuaizai Koisk in Huangzhou	26.93	42	4.485			
Travel Notes of the Six Bridges	28.71	42	3.983			
Selection from Yu Lizi	23.79	42	4.176			

*$p < 0.001$.
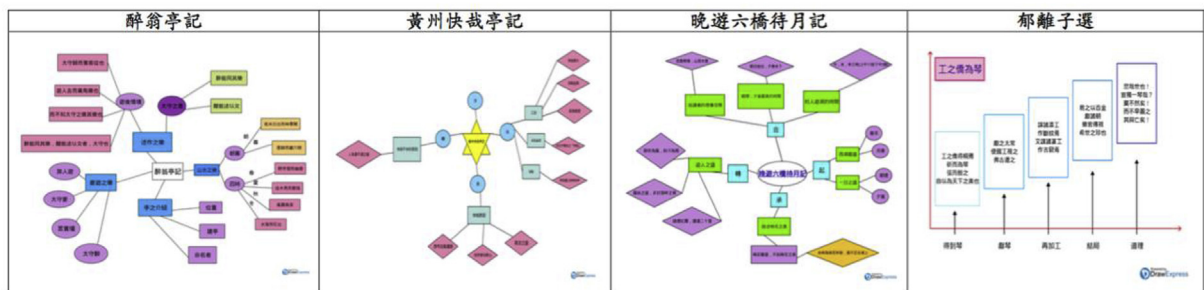
Fig. 5. The mind maps are drawn by learners.

(1) The mobile device dimensions

On the basis of interviews with learners, an analysis was conducted on mobile devices with the three dimensions of ease of use, usefulness, and interest value. Fig. 6 shows the results of the analysis.

The value placed on the dimensions of a mobile device by learners could be ranked as follows: ease of use (40%), usefulness (40%), and interest value (20%). In terms of ease of use, most learners considered that a mobile device should have simple features, touch-sensitive buttons, and flexible software applications in order to be used in their study. In terms of usefulness, most learners believed that mobile devices can be used to search for materials, take photos, learn things, and solve the problem of not being able to see the blackboard. In terms of the interest value, learners believed that the colors of interfaces, settings, and feature of inserting videos into an e-book are all useful in enhancing learners' interest in and motivation for learning.
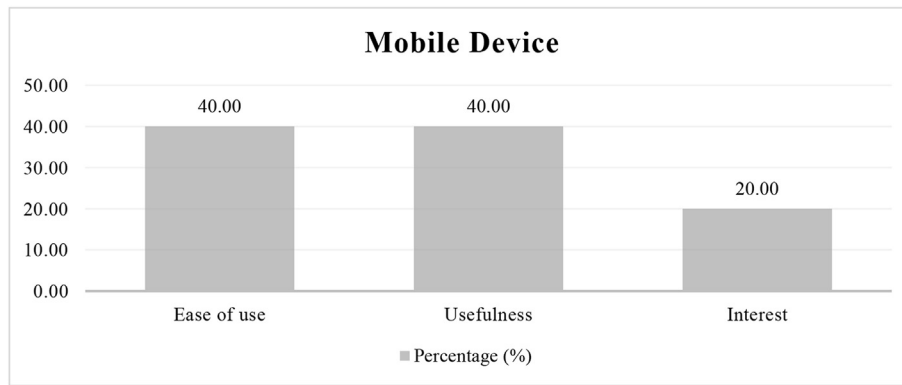
Fig. 6. The results of mobile device dimensions.

(2) The learners' dimensions

On the basis of interviews with learners, an analysis was conducted with the three dimensions of prior knowledge, textbooks, and teaching strategies. Fig. 7 shows the results of the analysis.

The results of the interviews with learners are presented in Fig. 7. The value placed by learners on the dimensions of teaching activities could be ranked as follows: teaching strategies (45.95%), teaching materials (43.24%), and prior knowledge (10.81%). In terms of teaching strategies, learners indicated that among the common strategies used in reciprocal teaching, they find summarizing and predicting to be most helpful in their reading. In terms of teaching materials, learners believe that when e-books are used as teaching materials, their convenient features and interfaces are highly conducive to learning. In addition, they stated that the effects would be even stronger if some modifications and improvements were made in teaching materials. In terms of prior knowledge, learners were aware of the importance of prior knowledge in their learning and suggested that the effects would be better if the interface were available in Chinese.

(3) The social dimensions

On the basis of interviews with learners, an analysis was conducted from the three social dimensions of learning effectiveness, knowledge sharing, and mobile device environment. Fig. 8 shows the results of the coded analysis.

The value placed by learners for the social dimensions can be ranked as follows: learning effectiveness (45.45%), knowledge sharing (27.27%), and mobile device environment (27.27%). In terms of learning effectiveness, learners specified that compared with traditional lecturing, the learning effectiveness of teaching with e-books are better. Moreover, by using the teaching strategies of mind mapping and reciprocal teaching, learning outcomes can be enhanced to an even higher extent. However, according to some learners, learning outcomes would be more satisfactory if the experiment duration were prolonged. In terms of knowledge sharing, learners believed that the easily portable tablets make it easier for them to discuss stories with peers. By working together with peers to solve problems, learners not only improved mutual understanding with other group members but also increased their capacities for knowledge sharing and communication. This shows that learners tended to have a positive attitude toward the increase in their capacities for knowledge sharing. In terms of mobile device environment, learners tended to think that tablets might be damaged in the course of delivery and it would be a waste of time to distribute them to the students at the beginning of each class. In addition, learners reported that the stability of e-books as a platform is the key reason why they are willing to use them.

5. Discussion

This study integrated e-books, reciprocal teaching, and mind mapping into the teaching of classical Chinese texts, and investigated the effects of that integration on learners' reading comprehension and knowledge sharing.

No significant differences were observed between the experiment and control groups in terms of their reading comprehension scores in the pretest and posttest. However, the average scores indicated that compared with learners in the control group, learners in the experiment group " made considerable progress in this aspect. Furthermore, Pearson product moment correlation analysis demonstrated that the scores of learners in the reading comprehension pretest and posttest were moderately correlated in the control group and highly correlated in the experiment group. Considering the above-mentioned results and that the same teaching strategies were used in both the groups, it can be concluded that the integration and assistance of the highly interactive, multimedia e-book learning system enhanced students' reading comprehension of classical Chinese texts.
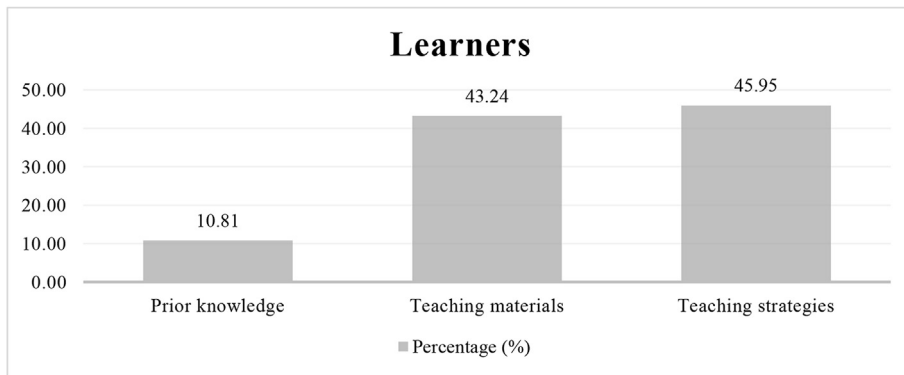
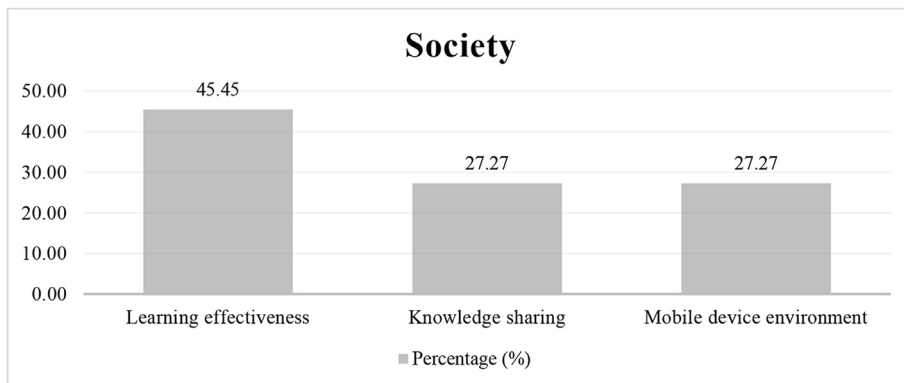**Fig. 7.** The results of learners' dimensions.

Fig. 8. The results of social dimensions.

The results of the independent sample *t*-test revealed that capacities for knowledge sharing did not significantly differ between the two groups. However, the average scores of the two groups indicated that learners in the control group regressed in terms of their capacities for knowledge sharing, whereas those in the experiment group progressed in this aspect. Furthermore, the results of the dependent sample *t*-test demonstrated that pretest and posttest scores did not significantly differ among learners in the control group, whereas these scores significantly differed among learners in the experiment group. On the basis of these results, it can be concluded that after the integration of tablets in their study, learners in the experiment group were more willing to share knowledge with their peers compared with learners in the control group (Alhammad & Ku, 2016; Park, Sung, & Cho, 2015).

According to the average scores given to learners in the experiment and control groups by the teacher based on their mind maps concerning the four texts, learners in the experiment group performed better than those in the control group in all texts. This indicated that the integration of e-books helped learners in their reading of classical Chinese texts. By absorbing, internalizing, and reconstructing the texts as structural mind maps, learners enhanced their cognitive capacities for analysis and evaluation.

In accordance with the findings of numerous previous studies, the results of this study indicated that with their diversified features, multiple media types, and convenient assistance, e-books can not only effectively enhance learners' capacities for word recognition and application but also increase their interest levels and reading comprehension levels. In addition, e-books can provide notable visual stimuli and opportunities for interaction through their interfaces, thus promoting learners' motivation and willingness to use them. The convenient and immediate interaction features were also observed to contribute to interaction with peers, thus indirectly contributing to learning outcomes (Embon, Noor, Hashim, Ali, & Shaari, 2012; Huang et al., 2012; Kao, Tsai, Liu, & Yang, 2016; Liang & Huang, 2014; Shamir & Shlafer, 2011; Smith et al., 2013; Woody et al., 2010).

The results of qualitative interviews demonstrated that most learners had a positive attitude toward the integration of e-books into the reading of classical Chinese texts in combination with mind mapping and reciprocal teaching. In addition, learners believed that with advantages such as solving the problem of not being able to see the blackboard, simple features, portability, neat interface, and ease of reading, e-books could drive them to read use such devices in the long term. In particular, the feature of taking down notes and retrieving them later by touching the screen facilitated the reading experience considerably. When using e-books to read classical Chinese texts, the most popular teaching strategies among learners

were summarizing and predicting. The strategy of summarizing helped learners effectively in their reviews of key points, and simplified and accelerated their mind mapping. The strategy of predicting helped learners to effectively associate with the texts as well as modify and clarify them. This coincides with the results of the study of Yang (2010) who reported that the systematic integration and implementation of reciprocal teaching can effectively help learners in their mastery of key points and enhance their reading comprehension levels (Palincsar & Brown, 1984).

6. Conclusion and future studies

This study investigated the outcomes of learners in terms of their capacities for reading comprehension and knowledge sharing when e-books, mind mapping, and reciprocal teaching were integrated in their reading of classical Chinese texts together with mind mapping and reciprocal teaching. The results of this study show that the integration of e-books into the reading of classical Chinese texts can help learners enhance their capacities for reading comprehension and knowledge sharing. The mind maps drawn by the learners indicate that the integration of highly interactive multimedia tablets can enhance the overall structure (in terms of coloring and imaging, which software makes clearer and more easily understandable) and expressiveness of the mind maps.

The present study can serve as a point of departure for further studies on this topic. This study was carried out with first-year business students of a vocational college as the research subjects; future studies could be conducted on students of different ages, grades, and departments. In addition, this study was conducted on classical Chinese for humanities students at a vocational college; future studies might target other academic subjects. The knowledge-sharing assessment was evaluated based on students' own capacities and their communication process with peers. In the light of the sharing process, future studies should investigate the effectiveness of knowledge sharing. Lastly, mind mapping and reciprocal teaching were used as strategies for the teaching of reading; future studies could focus on other teaching strategies and other characteristics of the learners, such as motivation and attitude toward learning.

Acknowledgements

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.compedu.2017.08.012.

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