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# The effects of a peer-tutoring strategy on children's e-book reading comprehension

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Reading competence is one of the most critical skills for children's academic success. In the study reported on here we proposed an integrated peer-tutoring strategy for reading comprehension that employs e-books for elementary school students. The effects of this strategy on children's reading comprehension were investigated using a quasi-experimental design. Three classes of 11–12-year-old students ($n$ = 73) participated in the study for 12 weeks. Compared to the control group, students in the experimental group, who engaged in peer tutoring with e-book reading, showed significant gains in reading comprehension. Students' perceptions of the benefits of the peer-tutoring resources to their reading are discussed. The findings demonstrate that the integration of peer tutoring in e-book reading results in an effective instructional model for the enhancement of elementary school students' reading.

**Keywords:** e-book; elementary school children; mobile learning; peer tutoring; reading comprehension

## Introduction

Due to their interactivity and multimodal features such as sound, animation, video and narration, electronic books (e-books) have affected the way in which students read. The growing prevalence of e-books may promote children's language learning, including vocabulary acquisition (Korat, 2010), motivation (Huang, Liang & Chiu, 2013; Kao, Tsai, Liu & Yang, 2016) and early literacy development (De Jong & Bus, 2003; Schugar, Smith & Schugar, 2013). Some researchers, however, argue that the interactive features of e-books may distract children (De Jong & Bus, 2003; Schugar et al., 2013). A meta-analysis showed that the interactive elements of e-books did not contribute significantly to children's story comprehension or expressive word learning (Takacs, Swart & Bus, 2015). De Jong and Bus (2003) found that children spent 43% of their engagement with e-books playing games rather than reading text. Several researchers argue that adaptive reading instruction is necessary to facilitate children's involvement in e-book reading (Korat & Shamir, 2007). Segal-Drori, Korat, Shamir and Klein (2010) indicate that children who read e-books with adult instruction achieved greater progress in word reading and phonological awareness than did students who read e-books independently. These observations point to new requirements and expectations for instructional design regarding e-books for children.

In the Progress in International Reading Literacy Study (PIRLS), 8% of fourth- and sixth-grade benchmark participants reported that they did not engage in reading classes (Mullis, Martin, Foy & Drucker, 2012). According to the 2006 PIRLS report, family reading involvement tends to differ between Chinese and non-Chinese populations, with Chinese parents engaging in fewer reading activities with their children; instead, most such activities occur in schools (Ko & Chan, 2009). In 2001 the Ministry of Education in Taiwan implemented a large-scale project called "Promoting K-12 Students' Reading Education." The aim of the project was to enhance students' reading engagement and literacy. Taiwan participated in PIRLS assessments in 2006, 2011 and 2016, and ranked 22nd, 9th and 8th, respectively among participating countries and districts (Mullis, Martin, Foy & Hooper, 2017). In terms of reading progress, students showed improvement in "retrieving and straightforward inferencing" from 2006 to 2016, but no significant change in "interpreting, integrating, and evaluating" between 2011 and 2016 (Ko, Chang, Chan & Chiu, 2017). However, only 37% of fourth-grade students in Taiwan reported that they liked reading (Mullis et al., 2017). Thus, the enhancement of students' attitudes toward reading remains a challenge for reading education in Taiwan.

Previous studies have indicated that typical reading instruction provides insufficient engaged reading opportunities to facilitate growth for many students (Mathes, Howard, Allen & Fuchs, 1998). Teachers generally report that they remain unsure about how to teach comprehension (Liang, LA & Dole, 2006), and they are unaware of existing comprehension instructional strategies (Klapwijk, 2012). Many teachers are uncertain about how to best meet the literacy needs of their diverse students (Mathes et al., 1998). Teachers in Taiwan are less familiar with student-centred approaches to self-engaged learning, preferring to use teacher-dominated classroom practices and activities (e.g. reading aloud) (Tse, Xiao, Ko, Lam, Hui & Ng, 2016). Chinese children prefer to do their own work and figure out problems on their own in the classroom (D'Ailly, 2003). In the 2016 PIRLS survey, only 67% of students in Taiwan agreed that their teachers told them how to do better when they made reading mistakes (Mullis et al., 2017). These observations reflect greater reliance on teachers than on peers for help and guidance,

particularly when figuring out problems and completing assignments. Only 40% of students in Taiwan who participated in the 2016 PIRLS survey agreed that their teachers encouraged them to say what they thought about what they had read (Mullis et al., 2017). Teachers do not have time for individual instruction in general classrooms in Taiwan. Thus, an effective instructional strategy that facilitates elementary students' participation and engagement in reading classes is needed.

Peer tutoring has been widely reported to have beneficial effects on the reading achievements of students with different abilities (e.g. Mathes et al., 1998; Thurston, Duran, Cunningham, Blanch & Topping, 2009). Because the application of reading strategies requires active monitoring of the reading process, peer tutoring is considered to create a powerful learning environment for the acquisition of reading comprehension skills (Van Keer & Verhaeghe, 2005). It increases the proportion of instructional time with all students engaging in academic behaviour, and provides pacing, immediate feedback, high levels of mastery, and content coverage (Greenwood, Delquadri & Hall, 1989). Advantages for teachers include the reduction of time spent monitoring students.

Research has revealed that elementary school students' development of reading competence can be encouraged by interaction with peers (Mathes et al., 1998; Thurston et al., 2009; Van Keer & Verhaeghe, 2005). Recently, Taiwan's Ministry of Education (2017) implemented the large-scale "Mobile Learning Project for K-12 Education," which provides opportunities for students to use tablets in the classroom and for teachers to implement reading instruction with e-books. Surprisingly, however, little is known about how peer tutoring can be integrated into the e-book reading environment. Despite increased interest among education professionals in the use of e-books for children's learning, research examining the potential of the adoption of a peer tutoring strategy for children's e-book reading comprehension is extremely limited. In the study reported on here, we aimed to design an integrated e-book peer-tutoring (eBPT) strategy and to investigate its effects on children's reading comprehension and perceptions of its benefits for their reading.

## Literature Review

### *E-book reading*

E-books are becoming increasingly sophisticated, with in-text features aimed at supporting comprehension. These features include interactive multimedia, hypermedia, embedded questions, highlighted information and annotated summaries. When reading e-books, however, students reported that they did not engage in behaviour (e.g. annotating, bookmarking, highlighting) that may facilitate the use of reading strategies such as summarisation and the identification of main ideas (Schugar et al., 2013). Studies of the effects of interactive e-book features in supporting children's literacy have produced mixed results. Sackstein, Spark and Jenkins (2015) report that high-school and university students reading text on paper do not comprehend the material better than those reading text on iPads. They also found that the majority of participating students read faster on iPads. Smeets and Bus (2012) indicate that children learned more vocabulary words when presented with interactive e-books with multiple-choice questions than when using e-books without this feature. Shamir and Shlafer (2011) found that e-books with narration, dictionaries and interactive hotspot modes improved performance in phonological awareness and comprehension for preschool-aged children with reading disabilities. Kelley and Kinney (2017) found no difference in word learning or story comprehension among young children reading interactive and non-interactive versions of e-books. Chen and Chen (2014) developed an annotation system with seven scaffold types for children to use while reading digital text. They observed significantly greater gains in reading comprehension among fifth-grade students using these texts than among students using print-based texts.

However, some researchers argue that the interactive features of e-books need to be accompanied by the implementation of instructional methods to improve children's reading (Underwood & Underwood, 1998). TH Liang (2015) developed keyword cues for e-books and integrated a "read, recite and review" strategy to enhance children's phonological performance and reading comprehension, and found that this strategy effectively guided children's reading of e-books. Ortlieb, Sargent and Moreland (2014) found that explicit instruction as part of an e-book comprehension strategy enhanced students' reading comprehension more than did the e-book intervention alone. These findings suggest that the use of an instructional strategy with e-books plays an important role in facilitating children's reading.

### *Peer tutoring and reading*

Children's reading competence is of crucial importance to ensure success in secondary school (Völlinger, Supanc & Brunstein, 2018). Peer tutoring is one form of instruction used to increase students' practice in the classroom setting. It is effective for the acquisition of reading comprehension skills because students' reading activities are monitored. Perspectives on peer tutoring have been influenced by the theory of socially mediated learning (Vygotsky, 1978). Peer tutoring has been demonstrated to have positive effects on several measures of academic achievement in the areas of reading, spelling and vocabulary (e.g. Delquadri, Greenwood, Whorton, Carta & Hall, 1986). Tutoring activities also positively influence reflective knowledge building, comprehension monitoring and

the elaboration of explanations (Roscoe & Chi, 2008). Peer tutoring activities involve the joint construction of text meaning by appropriate application of relevant reading strategies to a wide range of texts. Teachers can engage all students in a classroom by allowing students to work with partners using guiding scripts.

Peer tutoring is characterised by specific role taking aimed at the enhancement of learning, motivation and achievement. Fantuzzo, King and Heller (1992) developed reciprocal peer tutoring (RPT), an intervention that maximises group reward and the interdependence of learning components. They assessed the ability of same-age dyads (tutors and tutees) with comparable abilities to follow structured guidelines to augment academic progress. RPT is characterised by the structured exchange of the tutor role between or among peers in a pair or group (Duran, D & Monereo, 2005). It has been shown to significantly increase academic motivation, academic self-conception and metacognitive regulation (De Backer, Van Keer & Valcke, 2015; Ginsburg-Block & Fantuzzo, 1997). Class-wide peer tutoring (CWPT) is a form of same-age, intraclass reciprocal peer-tutoring instruction focused on social and point reinforcements. With CWPT in reading instruction, children work in pairs; one child reads a text aloud and the partner corrects errors. The partner then asks the reader "who, what, where and when" questions. Then, the students change roles and repeat the activities. In a twelve-year longitudinal experiment, CWPT effectively increased students' achievement gains in reading, mathematics and language (Greenwood et al., 1989).

D Fuchs, Fuchs, Mathes and Simmons (1997) proposed peer-assisted learning strategies (PALSs) for structured activities, which provide detailed guidelines for elementary school students in class-wide settings. PALSs, that use the format of CWPT and RPT, provide elementary school teachers with an effective and feasible class-wide intervention that could be used in regular education while accommodating mainstreamed special education students (Fuchs, LS & Fuchs, 2000). PALSs for reading activities, including reading with story retelling, summarisation of main ideas, paragraph shrinking and prediction making, emphasise important reading skills (e.g. fluency, decoding and comprehension) that are presumably addressed in core reading curricula (McMaster, Fuchs & Fuchs, 2007). PALSs have improved reading abilities in first- to sixth-grade students (Mathes et al., 1998; Völlinger et al., 2018).

Group composition is the main variable affecting learning dialogues between students in the peer-tutoring process (Tsuei, 2011). Gros (2001) demonstrates that academic discussion and peer interaction in heterogeneous groups promotes the development of effective reasoning strategies more successfully than such activities in homogeneous groups. Studies of elementary school children have indicated that peer-mediated instruction has greater benefits for high and low achievers relative to average achievers (Fuchs, D et al., 1997). RT Duran and Gauvain (1993) indicate that the most effective dyads are composed of students of the same age, but with different skills levels. Tsuei (2011) found that elementary school students performed better in mathematics reasoning when paired with less capable peers. Thus, the employment of grouping principles is important in the planning of peer-tutoring activities.

The aim of our study was to extend the CWPT and PALS research on the use of the peer-tutoring strategy for children's reading activities (e.g. Greenwood et al., 1989; Mathes et al., 1998). Tsuei (2011) indicates that students benefited by providing help with instruction-guiding, question-posing and feedback tools in online peer-tutoring activities. We examined the use of the eBPT strategy in a class-wide reciprocal peer tutoring model, in which the tutor and tutee roles are switched in each section, and guiding and question-posing cards are provided to support children's peer tutoring in e-book reading. The tutors and tutees made annotations using the interactive features of e-books during the tutoring process. The effects of the eBPT strategy on elementary school students' comprehension and their perceptions of the benefits of the strategy on their reading were investigated.

## Method

### Participants

Three classes of fifth-graders ($n$ = 73) in an elementary school in Taipei, Taiwan, participated in this study for twelve weeks. Using a quasi-experimental design, two classes were assigned as the experimental group (48 students) and one class was assigned as the control group (25 students). An e-book peer-tutoring instructional strategy (eBPT) with 10 reading passages was implemented in the experimental group. Students in the control group read the same passages, and the teacher implemented whole-class reading strategies teaching. Students in both groups were provided with a mobile tablet for reading.

Three teachers, each with a master's degree and between ten and fifteen years of teaching experience in reading participated in the study. Prior to the interventions, we clarified the theoretical background and design of the instructional procedures with each teacher individually. All teachers who participated in the study were trained for the workshops before the experiment started.

### E-books

The SimMAGIC e-book editing software was used to develop 10 e-books used in the study. Eight elementary school teachers with twenty years of instructional experience selected the 10 passages for the e-books from 96 literary passages.

Children could use various interactive tools on the mobile devices while reading the e-books; these included page-turning, annotation, highlighting, audio recording, taking of photographs, and bookmarking (Figure 1). Students downloaded the e-books from the e-book management system and read them offline. The management system recorded students' notations during use of the interactive tools. We provided two versions of each e-book (with and without phonetic notation) for students with different reading proficiencies (Figure 2).

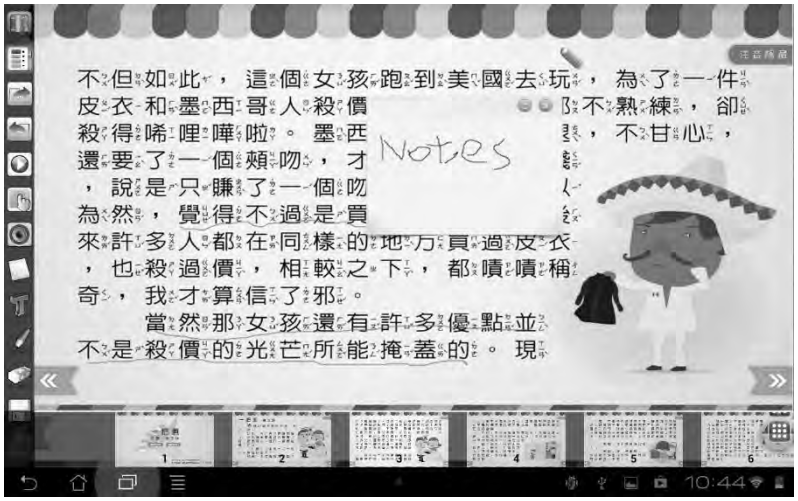


**Figure 1** The e-book interface

**Figure 2** E-book pages with (top figure) and without (bottom figure) phonetic notation

### eBPT Instructional Strategy

The eBPT instructional strategy was designed by integrating the peer-tutoring and reading-instruction strategies for e-books. The teacher participating in the e-book group used the four eBPT strategies sequentially for each passage. In some instances, se-

quences were adjusted according to the content of the passages. The eBPT instructional strategy comprised the following four strategies.

*Prediction strategy*

A prediction strategy is generally considered to be crucial for comprehension (Pressley, El-Dinary, Gaskins, Schuder, Bergman, Almasi & Brown, 1992). First, student tutors used e-book stickers to hide story outcomes. Tutees read the paragraphs and made predictions. After removing the stickers, tutors compared these predictions with actual story outcomes and asked tutees to explain the reasons for their predications. Students then worked together to highlight keywords and/or sentences in the text that helped them to make predications.

*Summarisation strategy*

The summarisation strategy refers to readers' dismissal of unnecessary information, selection of topic sentences, and maintenance of the sequence of events (Boulware-Gooden, Carreker, Thornhill & Joshi, 2007). Tutees used the e-book pen tool to delete unnecessary sentences in the first paragraph of a text passage, then identified important information (who, what, why, and/or where) and restated main ideas in 10 or fewer words using voice recording. When tutees' responses were incorrect, tutors used the pen tool in another colour to delete truly unnecessary information. Tutees then repeated the voice recording of main ideas to the tutor until it was approved by the tutor. For the next paragraph, students in each pair switched roles. After completing all paragraphs, students used the notation tool to write summaries in their own e-books.

*Monitoring and regulation strategy*

Reciprocal questioning played an important role in the monitoring and regulation strategy. King, Staffieri and Adelgais (1998) indicate that questioning promotes critical thinking with the development of skills focusing on the construction of meaning and interaction with the text. In this study, students asked the following questions reciprocally to monitor comprehension and regulate understanding of content:

- How are the problems of the event solved in the text?
- Which characters play important roles in the text?
- What is the most important thing (person) in the story?
- If you were the (role) in the story, how would you deal with the event?
- Can you ask 5 "W" (when, who, where, why, and how) questions in reference to the text?

Tutees' answers to these questions were registered by e-book voice recording or annotation.

*Association strategy*

The association of students' experiences and aspects of a story are important for recall. After reading the text, students reflected on what they had learned from it. They shared their experiences relating to the text with their peers. Tutees used the pen tool to draw their experiences on sticker notes or took photographs of paper drawings. Tutors asked tutees to title their stories and explain their ideas.

Procedure

Two 40-minute reading instruction sessions per week were conducted with each group. Students in both groups learned the same content. The eBPT strategy was implemented for the experimental group. The control condition involved whole-class instruction and individual reading of e-texts.

*Experimental condition*

Students in the experimental group were paired randomly for eBPT implementation. The teacher conducted heterogeneous pairing based on students' reading performance of the previous semester. The learners' reading performances were divided into quarters – from highest to lowest. The top-ranked student was paired with a student whose performance was ranked in the third quarter. The second-ranked student was paired with a student in the fourth quarter. This procedure was followed until all students were paired.

Prior to the implementation of each eBPT strategy, the teacher modelled the main ideas of the reading strategy for 20% of each session. The teacher used the e-book on the tablet projected onto a large screen. Students then engaged in the eBPT activities for 70% of each session. Each student used the tablet for e-book reading activities.

We provided instruction-guiding and question-posing cards for the tutors' use during the eBPT activities. The tutors followed the step-by-step instructions and posed questions for the tutees to answer. The tutees could request more detailed instructions from the tutors. Based on the instruction-guiding cards the tutors provided feedback to the tutees. After the completion of each section, the roles of tutor and tutee were reversed.

The teacher observed student tutoring behaviour and corrected misconceptions as needed. Ultimately, the teacher awarded the dyads bonus points for correct answers and procedures.

In the final 10% of the session, the teacher asked students to share what they had learned with the class and to draw conclusions. Students were regrouped bi-weekly.

*Control condition*

In the control group each student used the tablet for e-book reading activities. Furthermore, we provided the teacher in the control group with the instruction-guiding and question-posing cards used in the eBPT group. The teacher used the instruction-guiding cards for traditional reading instruction. This instruction typically involved teacher-led whole-class activities employing the four reading strategies (prediction, summarisation, monitoring and regulation, and association).

Firstly, the teacher used the e-book on the tablet, projected onto a large screen. The teacher explained the four reading strategies, which were implemented for 20% of each session. Secondly, for 70% of each session, the teacher asked questions to evaluate students' comprehension of the text. The teacher chose specific children to answer questions and compared these answers with those of the entire class. The reading instructions in the control group were the same as for the eBPT strategy but were given by the teacher instead of peer tutors.

#### Prediction strategy

The teacher used e-book stickers to hide story outcomes on the projected content, then asked the students to read the paragraphs and make predictions. After removing the stickers, the teacher compared these predictions with actual story outcomes and asked the students to explain the reasons for their predications. The students then individually highlighted keywords and/or sentences in the text.

#### Summarisation strategy

The teacher asked the students to use the e-book pen tool to delete unnecessary sentences in the first paragraph of a text passage and then identify important information (who, what, why and/or where). The teacher asked one student to restate the main ideas of the text in 10 or fewer words. Then, the teacher used the pen tool to demonstrate deleting unnecessary information. After completing all paragraphs, the students used the notation tool to write summaries in their own e-books.

#### Monitoring and regulation strategy

The teacher asked the same questions used in the eBPT groups to monitor comprehension and regulate students' understanding of the content. After the students had answered, the teacher made any necessary corrections.

#### Association strategy

After the students had read the text, the teacher asked them to reflect on what they had learned from it. They shared their experiences related to the text. Students used the pen tool to draw pictures representing their experiences on sticker notes or took photographs of paper drawings. The teacher asked the students to title their stories and explain their ideas.

For the remaining 10% of the session, the teacher drew conclusions with the whole class.

The same learning content was used in the experimental and control groups. To ensure that the instructional procedures and sequencing were implemented correctly, we performed and recorded the classroom observations to ensure that the same total amount of time was spent on reading comprehension in both groups.

The instructional procedures for the experiment are summarised in Table 1.

**Table 1** Instructional procedures for the control and experimental group sessions

| % time | Reading material | Instruction procedures by the control group | Reading material | Instruction procedures by the experimental group |
|---|---|---|---|---|
| 20 | Students read from the large projection. | The teacher modelled the main ideas of the reading strategy. | Students read from the large projection. | The teacher modelled the main ideas of the reading strategy. |
| 70 | Every student was provided with a tablet for e-book reading. | The teacher posed questions to the entire class and evaluated students' answers by picking specific student. | Every student was provided with a tablet for e-book reading. | eBPT activities were implemented. Students used the e-books for reading and writing notes. |
| 10 | Students read from the large projection. | The teacher guided conclusions. | Students read from the large projection. | The teacher guided conclusions. |

#### Measures

##### *Reading comprehension tests*

Reading comprehension tests from the PIRLS, which measure reading literacy achievement, were used in this study. The PIRLS provides internationally comparative data on students' reading achievement. The PIRLS target population is the grade that represents four years of schooling, which corresponds to the fourth grade in most countries (Martin, Mullis & Kennedy, 2007). PIRLS reading comprehension consists of two parts: an assessment of direct and explicit comprehension focusing on the retrieval of information (RI) and straightforward inference (SI), a portion assessing the interpretation and integration of ideas and information (II), and the evaluation of content, language and textual elements (EC). As most elementary teachers in Taiwan assess students' reading comprehension according to the direct retrieval of information from texts, students are not familiar with answering constructed-response comprehension questions. In our study, the PIRLS construct was adopted to facilitate the assessment of children's reading comprehension.

We invited eight elementary school teachers who were trained experts in PIRLS reading instruction to create five reading comprehension tests. Two teachers reached consensus on each test. These tests were administered bi-weekly after the experiment. Each test comprised multiple-choice, fill-in-the-

blank, and short-answer items. Eight to 14 test items corresponded to each passage, according to the content of the passages. For fill-in-the-blank and short-answer questions, comprehension was rated on a scale ranging from 0 to 3 according to the scoring guidelines. The scoring guidelines were developed by six elementary school teachers who had been teaching reading for more than ten years. After the development of the scoring guidelines, three teachers reviewed each test to ensure content validity.

Before the experiment, five reading comprehension tests were administered at other elementary schools where 10 classes (308 children) participated. Every class completed two reading comprehension tests. The same reading comprehension tests were administered to the same students after three weeks. One hundred and eleven items from five reading comprehension tests were used for item analysis. The item difficulty indexes ranged from 0.48 to 0.72, and item discrimination indexes ranged from 0.33 to 0.46. The test-retest reliability coefficients ranged from 0.66 to 0.78 ($M = 0.73$, $p < 0.01$). Chinese-language achievement scores for the semester were used to examine criteria-related validity. The average validity indexes for the reading tests were 0.50–0.70 ($M = 0.65$, $p < 0.01$). The average validity indexes for the reading tests and the reading components of the Chinese-language achievement assessments were 0.82–0.88 ($M = 0.84$, $p < 0.001$).

To eliminate the effects of reading comprehension item difficulty on students' performance, our calculations of students' scores were weighted according to the item difficulty indexes (Table 2).

**Table 2** Weights of item difficulty indexes for the text passages

| Text passage | Item difficulty index | Weight |
|---|---|---|
| A | 0.79 | 1.00 |
| B | 0.77 | 1.03 |
| C | 0.71 | 1.11 |
| D | 0.65 | 1.22 |
| E | 0.48 | 1.66 |

## Results

### Reading Comprehension

The results of repeated-measures analysis of variance in reading comprehension between groups are shown in Table 3. The data fit the Mauchly's sphericity test (Mauchly's W = 0.84, $p = 0.18$). Students' reading cores increased gradually over time in the experimental group relative to the control group ($F(1, 4) = 2.80$, $p < 0.05$). The phenomena fit the linear trend ($F = 7.65$, $p < 0.01$). Overall, students in the experimental group outperformed those in the control group on the reading comprehension tests ($F = 4.27$, $p < 0.05$).

**Table 3** Reading comprehension test scores according to treatment conditions

| | Text passage | | | | | |
|---|---|---|---|---|---|---|
| Group | A | B | C | D | E | Test × group |
| Experimental | 65.49(16.43) | 77.32(16.39) | 72.08(17.59) | 92.77(15.63) | 107.63(18.03) | $F = 4.27$* |
| Control | 64.60(19.41) | 74.64(18.95) | 66.64(23.51) | 81.45(30.03) | 91.41(32.93) | |

*Note*. Scores are presented as *M* (*SD*). *$p < 0.05$.

### Reading Comprehension Processes

Students in the experimental group performed significantly better than did those in the control group on the "direct and explicit comprehension focusing on the retrieval of information" ($F = 4.58$, $p < 0.05$) and "interpretation and integration of ideas and information" ($F = 4.34$, $p < .05$) assessments (Table 4). No significant difference in straightforward inference or evaluation of content, language, and textual elements was observed between groups.

**Table 4** Results of repeated-measures analysis of variance for the four types of comprehension processes

| | Experimental group | | Control group | | |
|---|---|---|---|---|---|
| Assessment type | *M* | *SD* | *M* | *SD* | *F* |
| RI | 79.27 | (2.04) | 71.80 | (2.83) | 4.58* |
| SI | 71.99 | (2.45) | 66.28 | (3.40) | 1.86 |
| II | 61.98 | (3.07) | 51.07 | (4.25) | 4.34* |
| EC | 56.46 | (2.72) | 55.47 | (3.77) | 0.05 |

*Note*. Scores are presented as *M* (*SD*). *$p < 0.05$.

### Students' Perceptions of the Benefits of Reading

Figure 3 presents students' perceptions of the benefits of different resources for reading according to reading ability. We identified students with high ($n = 7$), middle ($n = 10$), and low ($n = 7$) reading ability by ranking their average reading comprehension scores. Overall, students indicated that all three resources were helpful for reading (*M* scores: e-book, 3.49; peer tutoring, 4.12; teacher, 4.36). High-achieving students indicated that peer tutoring was most beneficial. Interestingly, the middle-achieving students were more satisfied than the other students with all of the resources. Low-achieving students indicated that the teacher's instruction was the most helpful for their reading.

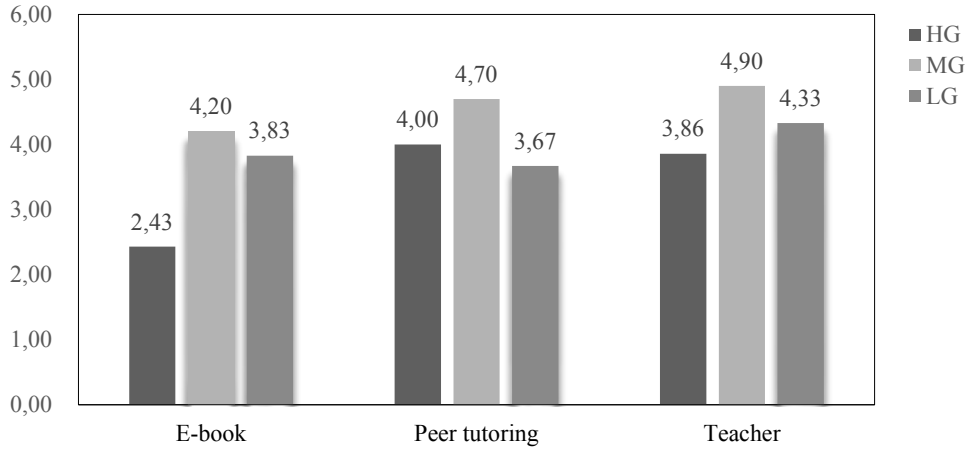


**Figure 3** Students' ranking of the degrees of benefit to reading of different resources
*Note*. HG = high-achieving students, MG = middle-achieving students, LG = low-achieving students.

## Discussion and Conclusion

The results from our study show that the eBPT strategy significantly benefitted children's e-book reading. Students in the experimental group showed significantly greater increases in reading comprehension, especially in "direct and explicit comprehension focusing on the retrieval of information" and "interpretation and integration of ideas and information," compared with students in the control group. As Reinking (2005) states, simply exposing students to digital reading does not guarantee improvement of their reading comprehension. These results agree with those of previous research (Segal-Drori et al., 2010), which show that the use of e-books with instruction effectively promoted young children's phonological awareness and word reading. In this study, the eBPT instruction model was a main factor associated with students' reading comprehension. This finding, and those of previous studies (e.g. Fuchs, D, Fuchs, Thompson, Svenson, Yen, Al Otaiba, Yang, McMaster, Prentice, Kazdan & Saenz, 2001), demonstrate the importance of peer-led interaction in structured reading activities. Tanner (2012) indicates that asking learners what they find to be difficult and why can foster metacognitive skills. Students in the e-book group reported that explanations to dispel their misconceptions were beneficial for their reading. For example, when David and Ted (students' names have been changed for privacy) engaged in peer tutoring on e-book text H (a story about a father who made sun cakes diligently to encourage his son to study hard), David played the tutor's role and said: "*I do not see your annotations on the sections about the son's crying*." Ted responded: "*Please tell me why?*," and David responded: "*This section means that the son was touched by the sun cakes made by his father. This is the evidence*." In comparison, students in the control group discussed the main idea of the text by stating as follows: "The father loves his son because he made the sun cakes and encouraged him," ignoring connections within the text. During the eBPT process, tutors use the e-books to ask questions and detect main errors, and then inform tutees immediately. Tutees can reflect on their answers and make corrections on the screen. Compared with verbal discussion, the mobile tablets facilitate concrete error indication and correction. As Topping (2009) suggests, the benefits of on-screen peer tutoring lie in students' self-regulation of learning, which peer support may facilitate in relation to reading comprehension. The eBPT instruction facilitated peer tutors' use of the e-book features to discuss, explain, clarify and correct during the reading process. These non-threatening evaluation practices in peer tutoring have been found to be important for the academic success of elementary school students (Graham, Harris & Mason, 2005). Although eBPT was confirmed to be an effective reading instruction strategy, the ways in which it can facilitate other aspects of the reading process require further investigation.

The findings in our study expand the relevance of previous research by indicating that the e-book intervention improved the interpretation and integration of ideas and information. We attribute these effects to the multimodal e-book annotations used during peer tutoring. Previous research has shown that children who were given explicit e-book reading instruction were more able to use digital features to support meaning-making tasks (Christ, Wang & Erdemir, 2018). In our study, students in the peer-tutoring group used more annotation and highlighting tools than did students in the teacher-led e-book reading setting. According to Marshall (1998), annotation tools on computers effectively reduce readers' cognitive overload by allowing them to write short notes related to the reading of passages. The use of highlighting tools to underline key concepts has also been found to promote students' reading comprehension (Chang, Chen & Chen, 2006). The

identification of key concepts in text passages has been regarded as an effective strategy for the strengthening of reading comprehension and summarisation capabilities (Watts & Zimmerman, 1986). In the eBPT process, students used the highlighting tool in prediction and summation activities. This tool helped them to focus on and retrieve information from several locations efficiently. Students can use various highlighting colours for different components, such as keywords and sentences, and to distinguish tutors' and tutees' actions. These features are helpful, not only for attracting attention to important information, but also for increasing information capacity (Alessi & Trollip, 2001). In addition, our study showed that elementary school students can easily input text using tablets' voice recognition tools. This feature particularly reduced the barrier of Chinese character typing for young children and facilitated their focus on answering tutors' questions. The voice-recording feature may provide a comfortable means of answering questions, in which students are not afraid that a lack of skill will be revealed to an entire class of peers, as could happen under the control condition.

According to Allington (2002), the assessment of students' reading progress is key for reading success. In this study, teachers used written quizzes instead of traditional quizzes and multiple-choice instruments to assess students' reading comprehension. In the PIRLS assessment, multiple-choice and constructed-response comprehension questions accompany each passage. This format requires students to construct written responses, enabling the assessment of their interpretative processes. In this study, we randomly selected assessments for three passages in comparing students' responses between the experimental and control groups. Students in the experimental group used more words and elaborated content in their responses to constructed-response items relative to those in the control group. Low-achieving and average-ability students wrote more in expressing their ideas on the seventh passage than they did in writing about the first passage. Peer tutoring may have enhanced these students' confidence when answering questions. Thus, teachers should use constructed-response comprehension questions in reading classes, as this approach results in the deepest meaning making.

Students' academic ability is a main concern in peer-tutoring research. The results from our study provide additional evidence that high- and middle-achieving students perceived more benefits of peer tutoring than did low-achieving students. Christ et al. (2018) report that students participating in app-based buddy book reading showed a strong desire to engage with the tablets. They found that a collaborative social interaction style resulted in higher-order responses to the text and in the correction of misinformation. E-books alone cannot be assumed to support students' positive attitudes toward reading; students' social relationships with peers are critical for motivation and, in turn, academic success (Wentzel, 1999). The results from our study were inconsistent with those of a review conducted by Robinson, Schofield and Steers-Wentzell (2005), which showed that low-achieving students benefitted from tutoring. A meta-analysis also indicated that peer tutoring involving tutors with low ability levels yielded results with larger effect sizes than for students at other academic ability levels (Leung, 2015). Our results may be in accordance with those of McMaster et al. (2007), who report that an estimated 20% of low-achieving students do not respond to PALSs for language acquisition; they relied more on instruction and guidance from teachers. Whether students of different abilities benefit from peer tutoring in e-book reading remains unclear. Educators must assess whether individual students' comprehension is improved effectively through the use of digital texts (Sackstein et al., 2015).

Several limitations of our study should be taken into account. Firstly, the small sample limited the power of the statistical analyses. Additional studies should be conducted with larger samples to enable sufficient re-examination of these findings. Secondly, as our research did not include more experimental groups for comparison, determination of which factors contributed most to the effects of the eBPT instructional strategy was difficult. The inclusion of additional experimental groups in future studies might clarify the results of this study. Thirdly, the "straightforward inference" and "evaluation of content, language and textual elements" processes on the reading comprehension tests were comparable in the two groups. Future studies should thus further explore the effects of the eBPT strategy on these reading skills. Fourthly, our research did not involve documentation of the children's e-book reading process, which might have clarified the results. Future studies should thus include content analysis.

The results of our study suggest that the incorporation of the eBPT strategy increases elementary school students' reading comprehension and fosters positive perceptions of these learning activities. eBPT instruction as part of the overall reading curriculum appears to have promise in promoting reading among elementary school students.

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**Authors' Contributions**

Mengping Tsuei was the lead researcher who conducted the instrument, data collection and statistics.

Hsiu-Wen Huang and Shu-Fen Cheng worked on the literature review and examined the instrument. All authors reviewed the final manuscript.

## Notes

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