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## **A systematic review of research on e-book-based language learning**

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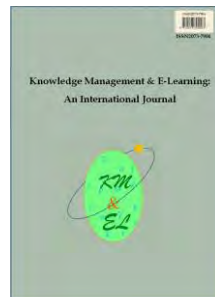
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## **A systematic review of research on e-book-based language learning**

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**Abstract:** This study presents a systematic review of previous research on e-book-based language learning. E-book-based language learning has been increasingly investigated in the field of language education, whereas previous review studies of relevant literature were relatively low in volume and incomprehensive from aspects of research participants and research perspectives. In the present study, we identified 52 relevant journal articles on e-book-based language learning published in the recent decade, coding them from three dimensions: methodology, e-book devices and features, and research issues and findings. The results indicated that: (a) most studies on e-book-based language learning were of a large sample size and one-session investigation; (b) pre-school children and university students were the most frequently investigated sample groups; (c) computers and tablets were the most frequently used devices; (d) multimedia, feedback giving, gamification and

personalisation were the four features most frequently applied in enhancing the efficiency of e-book-based language learning; (e) researchers collected and processed data mainly through pre- and post-tests and group comparisons; (f) learning outcomes, learning behaviours and learners' psychological states were investigated in most studies, whereby the findings indicated overall positive effects of e-book on language learning.

**Keywords:** E-book; Language learning; Mobile learning; Review; Technology-assisted learning

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## 1. Introduction

The electronic storybook, or more commonly named as the e-book, refers to the content presentation based on technological/digital application such as tablet computers and mobile phones and of a format similar to the printed books (Smeda, Shiratuddin, & Wong, 2017; Yin & Hwang, 2018). With the integration of innovative technologies such as multimedia, digital games, augmented reality, and mobile technologies to language learning (Chen, Wang, Zou, Lin, & Xie, 2019; Chen et al., 2020), the mobile devices render the e-book reading of various “enhanced features” that traditional reading based on printed pages could hardly afford (Wood, Fitton, Petscher, Rodriguez, Sunderman, & Lim, 2018, p. 1947), such as mobility, audio narration, multimedia annotation, feedback-giving, gamification and immediacy (Dore et al., 2018; Takacs, Swart, & Bus, 2015). These “enhanced features” make the e-book a promising tool for the contextualisation, ubiquity and “edutainment” in the field of language education, and thereby to be a feasible tool for learners, educators and researchers to enhance language learning efficiency (Parette, Blum, & Luthin, 2015).

Along with the rapid development of multimedia, Internet and mobile technologies, the recent decade has witnessed the accumulating contributions devoted to the use of e-books for enhancing language learning (Connor et al., 2019; Richter & Courage, 2017; Zou, Xie, & Wang, 2018). The researchers searched for the journal articles that investigated e-book-based language learning (hereafter, EBLL), and found that most studies in this field were published in the recent five years, indicating the tendency of increasing scholarly attention to this field. For instance, Strouse and Ganea (2017a, 2017b) investigated the language learning behaviours of two groups of young children's reading, respectively through e-books and printed books. They reported that those learning through e-books outperformed their counterparts in terms of the rate and duration of learning concentration. In Huang (2013a, 2013b), the researcher developed a series of e-book-based reading programmes and surveyed the participants before and after their learning in the programmes. The collected feedbacks indicated the overall positive attitudes students held towards e-book-based language learning and reading as well as their higher motivation.

Nonetheless, despite the remarkable numbers of academic devotions in the EBLL studies, there remained a lack of review papers of the previous literature to our knowledge, except a few as followed. Zucker, Moody, and Mckenna (2009) systematically reviewed 27 studies published during 1997 and 2007 that investigated the EBLL of 2- to 12- year-old children. The results showed the overall positive effects of EBLL on children's language comprehension, although the effects were found to range from small to medium. Moreover, the researchers identified the feedback-giving as an essential feature of e-books as the immediate feedback/guidance giving during the process of EBLL was conceivable to largely enhance learners' reading comprehension, literacy and language development. Reich, Yau, and Warschauer (2016) reviewed the studies that focused on the comparisons between the e-book and the printed-book in pre-school-aged children's learning. A total of 54 articles were identified in all-year time span, on PsycInfo, ERIC, and Google Scholar. They found that EBLL had an overall positive influence on the pre-school children, except those younger than two years old. However, the influence may decline when there was an overload of multimedia embedded in the e-books, such as sound effects, animations, and games, which might distract the young learners from the language instructions. This review also found that children could have their reading comprehension and language proficiency remarkably enhanced when learning through e-book devices and interacting with their parents and teachers, indicating the significance of adults' company in children's EBLL.

In addition to the limitation in number, there were some research gaps in previous reviews of EBLL studies. Firstly, almost all the reviews of EBLL studies focused on young children as participants, leaving the language learners of other age groups beyond consideration. However, advantageous in flexibility and multimedia presentations, the e-book is supposed to be facilitative for the language learning of a broader learner group of various ages and educational backgrounds, and thereby is investigation-worthy in larger sample groups than the extant ones (Jansen, 2019). A holistic examining of EBLL studies regardless of participants' ages was believed to be necessary to provide a complete picture of the field of EBLL. Secondly, most reviews of EBLL studies, focusing on those of language learners and instructors, left the perspective of researchers beyond consideration, whereas their perspective is believed to be very important. In order to promote the explorations of EBLL in their future projects, researchers are expected to have a panoramic view of the aims, methods and designs of the previous studies. Therefore, in the reviewing of previous EBLL studies, items at the methodological level deserved more attention, including the research methods and instruments, the information of participant groups, the types of technologies integrated into the e-books, and the current findings and implications. Thirdly, to our knowledge, there was no review in the field of EBLL that was published after 2016, meaning that a large number of latest EBLL studies remained un-reviewed. Such absence of the review studies of the recent three years was incommensurate with both the rapid development of technologies for language pedagogy and the prosperity of EBLL studies. So long as the gap remained open, there was a risk that future researches would be impeded by their delayed understanding of the current situation of EBLL and the retarded responses to the newly made progress. Hence it was essential to conduct a new review of these latest studies.

In an attempt to fill in these gaps, this study conducted a systematic review of the studies on EBLL published during 2009 and 2019, regardless of the participants' age and education. The review was from the perspective of researchers with three dimensions of coding items: research methodology, devices and features of investigated e-books, and the research issues and findings. In following many of the previous high-quality review studies in the field of technology-enhanced language learning (e.g., Shadiev, Hwang, & Huang, 2017; Hwang & Fu, 2019; Hwang & Xie, 2018), we conducted a three-step method for article review: searching, selecting and coding. It was expected that our review could present a comprehensive view of the developments in technologies, use of instruments and methods for data collection and processing, research perspectives and tendencies of the EBLL studies for the past decade and identify some possible directions for future educators and researchers. Three major research questions were proposed:

***RQ1:** How did the previous researchers investigate EBLL?*

***RQ2:** What devices and features of e-books were investigated?*

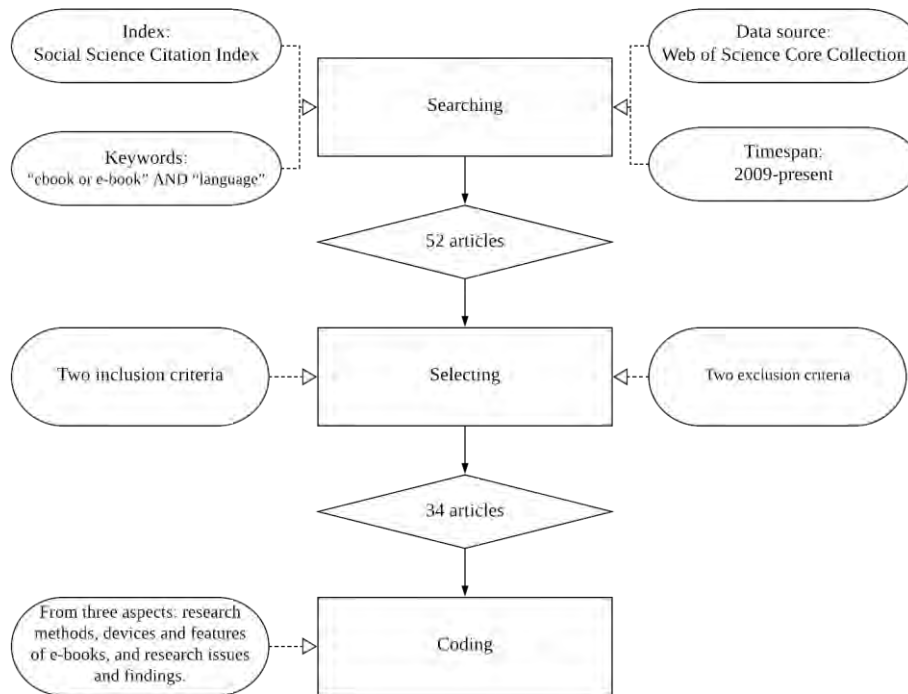
***RQ3:** What are the research issues and findings of the previous studies on EBLL?*

## **2. Research methodology**

This study used a three-step method of review: searching, selecting and coding, as illustrated in Fig. 1.

*Searching.* We searched for the articles to review in Web of Science Core Collection, with “2009-present” as timespan, English as language, article as document type, “ebook or e-book” AND “language” as topic keywords. Social Science Citation Index (SSCI), a widely used database in the academic community, was chosen as the

index, the same as those chosen in Zou, Huang, and Xie (2019). Up until July 26, 2019, 52 articles were identified.



**Fig. 1.** Research methodology

*Selecting.* In order to assure the close relevance of articles to the concerned topic, the researchers selected the studies to be reviewed out of the 52 articles based on two inclusion criteria and two exclusion criteria. The inclusion criteria were: (a) The main research topic of the article should be using e-book for language learning; (b) The article should be of original research. The exclusion criteria were: (a) The research participants should not be special learners; (b) The article should not be meta-analysis or review study. 18 out of the 52 were excluded in this step. For example, Mims, Browder, Baker, Lee, and Spooner (2009) was excluded because the e-book they proposed was to enhance the language comprehension of children with intellectual disabilities and visual impairments; Turel and Sanal (2018) was excluded because the e-book was developed for Mathematics learning rather than language learning; Reich et al. (2016) was excluded for being a review paper rather than an empirical research. Thirty-four articles were finalised to be coded (see the Appendix I).

*Coding.* This step was to extract the essential pieces of information from the 34 articles for further analyses. Aligned with the research questions, the selected articles were analysed from three aspects: research methods, devices and features of e-books and research issues and findings. The researchers examined five articles together first to decide the coding scheme and then analysed the remaining articles independently. The coding categories were developed in correspondence with the three research questions.

**RQ1:** *How did the previous researchers investigate EBLL?*

This research question is about the methodologies in the previous studies and involves four sub-aspects, including methods and instruments, sample sizes, research lengths and participants' education levels.

- 1) "Methods and instruments". It refers to the major instruments and techniques used in investigations for data collection and data processing (Kothari, 2004). This information was collected based on the authors' specifications.
- 2) "Sample sizes". This term was about the numbers of research participants. The sample size of an investigation determined the amount of data to be collected and processed as well as the universality and reliability of the results (Morse, 2000). Following Burston (2015), researches of participant number less than 15 were grouped as "Very small", 15~25 as "Small", 25~49 as "Medium", 50~64 as "Big", more than 64 as "Large".
- 3) "Research lengths". It was about research time span, a factor closely related to the scope of the study and the retention of the results (Morse, 2000). Also following Burston, (2015), researches of one session was grouped as "One-session", within 10 weeks as "Short-term", of 11~16 weeks as "Intermediate", of longer than 16 weeks as "Long-term".
- 4) "Participants' education levels". It was about participants' educational backgrounds specified in the articles, which, according to Fu and Hwang (2018), could be categorised into "Pre-school", "Primary", "Secondary", "Tertiary or higher education", "The mixed" (if variation existed).

**RQ2:** *What devices and features of e-books were investigated?*

- 1) This research question is about the technologies of the e-books used in the previous studies and involves two sub-aspects, including devices of e-books and features of e-books. "Devices of e-books". It was about the electronic instruments on which the e-book was based in the researches, as directly specified by authors. As for this category, the desk-top and lap-top computers were categorised as "Computer"; tablet computers, mobile phones, iPads and Kindles were categorised as "Tablet". The mixed uses of the two types of devices were classified as "The mixed". The devices other than the two were categorised as "Others".
- 2) "Features of e-books". It was about the major features of the investigated e-books that were developed or chosen by the researchers to enhance language learning efficiency.

**RQ3:** *What are the issues and findings of the previous study on EBLL?*

This research question is about the research issues and the corresponding findings of the previous studies and involves four sub-aspects, including learning outcomes, learning perceptions and learning behaviours. This three-step method is found to be effective in helping researchers identify the articles for reviewing and is widely employed in the review studies of technology-enhanced language learning, such as Shadiev et al's (2017) review of journal articles published from 2007 to March 2016 on mobile language learning in authentic environments, Fu and Hwang's (2018) review of 90 articles on collaborative mobile learning in various disciplines (including language learning), and Hung, Yang, Hwang, Chu, and Wang's (2018) review of 50 publications on game-based language learning that were published from 2007 to 2016.

In the present study, the coding scheme was developed based on discussions among the five researchers. Two researchers coded the articles independently, the inter-rater reliability of which is .93.

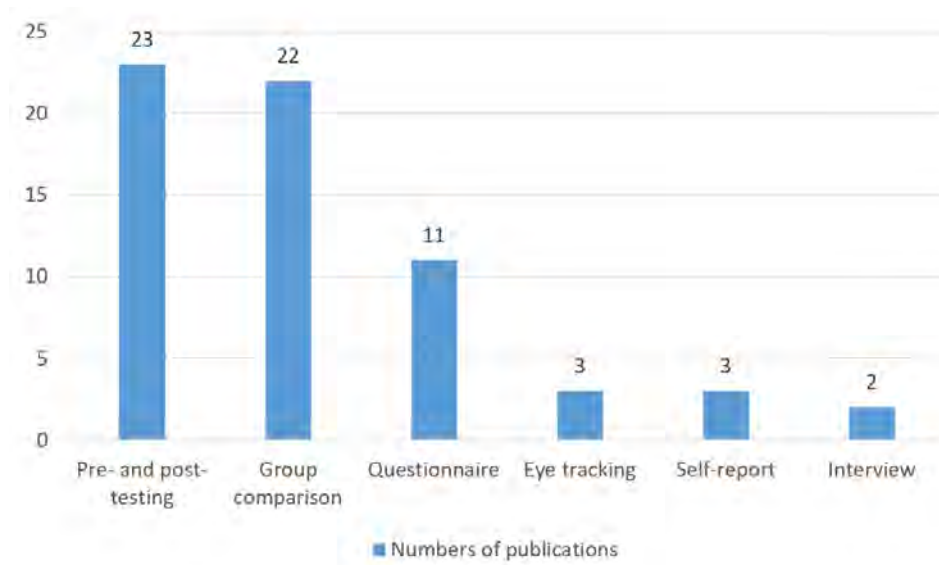
### 3. Results and discussions

#### 3.1. Research methodology

In this section, a review of the methodologies of previous EBLL studies is presented from four dimensions: methods and instruments used for data collection and processing, the sizes of research samples, the research lengths and the education levels of the investigation participants.

##### 3.1.1. Methods and instrument

The present review found that the current EBLL studies had taken multiple types of methods and instruments for data collecting and processing. As illustrated in Fig. 2, seven major types were found in the reviewed studies: 23 out of the 34 studies conducted pre- and post-testing; 22 conducted group comparison; 11 conducted questionnaires; 3 used eye-tracking technology; 3 collected data through self-reports; 2 organised interviews. Since many studies employed multiple methods and types of instruments for data collection and processing, the total number of publications of methods was bigger than the sum 34.



**Fig. 2.** Methods and instruments

The method used most frequently in previous EBLL studies is pre- and post-testing, usually in the attempt of assessing the participants' language proficiency before and after the learning and thereby facilitating researchers to observe the possible effects



of the proposed learning methods. Connor et al. (2019), for instance, used pre-tests to assess the language proficiency of all the participants, then divided them into two groups and provided them with two different language learning methods. One group had language learning based on e-books while the other did based on printed instructions. After the treatment, the researchers required the participants to have post-tests of the language knowledge in order to collect data about the respective learning outcomes of these two groups.

The group comparison, the second most frequently used method in EBLL studies, was usually employed to test a particular variant that may influence the effect of EBLL. Frequently applied in companion with pre- and post-testing, this method is supposed to facilitate researchers' observation and analyses of the possible differences in learning outcomes and behaviours between different participant groups, and to substantiate the influences of EBLL. Martin-Beltrán et al. (2017) was a typical example. They hypothesised that the age of learners may influence their perceptions of EBLL. To test this hypothesis, the researchers grouped the participants with age as the variant, required them to complete the e-book reading tasks and compared the performances of different age groups in post-tests.

The questionnaires, self-reports and interviews were the frequently used instruments for collecting qualitative data. In the reviewed studies, these instruments were applied for facilitating researchers to understand the learners' psychological states in EBLL, such as motivation, satisfaction, attitudes toward language learning activities and the target languages. Chou (2016), for instance, required the participants to make self-report about their attitudes to and experiences of EBLL after the treatment in order to collect the comprehensive data of their perceptions of the e-book as a language learning tool.

Among the parallel of methods and instruments often used for investigating EBLL, the eye-tracking may be a very innovative type. In this field, this is used to record the movement learners' gaze during the process of EBLL, and therefore helps researchers collect the data about the participants' distribution and change of learning attention and cognitive activities in the experiment. For example, Liang and Huang (2014) had a blended use of eye-tracking and reading rate tracking in order to record the learners' behaviours in EBLL.

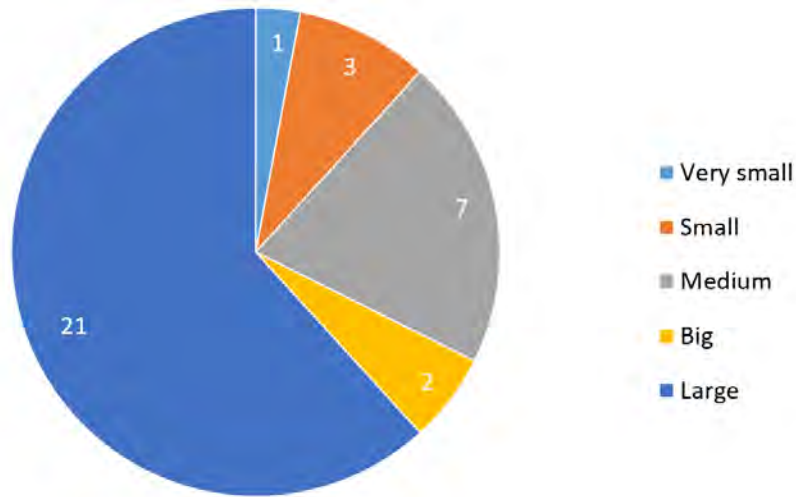
### *3.1.2. Sample sizes*

The review of the sample sizes of the previous EBLL studies found that studies of the large sample size were the most, occupying 21 out of the 34 reviewed articles; 7 studies were of medium size; 3 were of the small sample size; 2 were of the big size; one was of the very small size (see Fig. 3 and Table 1).

A large number of participants conceivably assured that individual varieties within the sample groups would have been holistically considered, and the data for further processing and analysing have been provided in sufficient quantities (Morse, 2000). In this case, the overall large sizes of samples investigated in previous EBLL studies implied the comprehensiveness, universality and reliability of the extant research results in this field. Future researchers interested in EBLL were suggested paying particular attention to the empirical studies of large participant groups in this field.

Moreover, the wide implementations of EBLL investigations with huge participant groups indicated that this type of technology-enhanced learning method is

probably also feasible in real-world language classrooms in which a few teachers usually have to organise learning activities with and deliver instructions to a big number of students. Korat and Shneor (2019), for instance, researched the e-book-based vocabulary learning of a total of 192 participants, including 128 pre-school children and 64 mothers; Connor et al's (2019) study was conducted based on a sample group of up to 603 primary school students – both studies found the overall positive influence of e-books on a large number of language learners. In future studies, researchers were expected to have further exploration of EBLL in the integration with authentic language learning from the aspects of learning strategies and instructional design, so as to promote the application of EBLL among common teachers and learners in the everyday study.



**Fig. 3.** Sample sizes

**Table 1**  
Sample sizes

Sample sizes	References
Very small	Chou (2012)
Small	Jansen (2019); Chou (2016); Liang & Huang (2014);
Medium	Raynaudo & Peralta (2019); Skibbe et al. (2018); Wu & Chen (2018); Hwang et al. (2015); Homer et al. (2014); Smeets & Bus (2012); Korat (2010)
Big	Liu et al. (2019); Wang et al. (2019)
Large	Korat & Shneor (2019); Connor et al. (2019); Wood et al. (2018); Dore et al. (2018); Strouse & Ganea (2017a); Strouse & Ganea (2017b); Sung & Wu (2017); Martin-Beltrán et al. (2017); Liu & Leveridge (2017); Richter & Courage (2017); Wu (2016); Smeets & Bus (2015); Korat et al. (2014); Ihmeideh (2014); Lin (2014); Korat et al. (2013); Huang (2013a); Huang (2013b); Huang et al. (2013); Parish-Morris et al. (2013); Korat et al. (2009)

### 3.1.3. Research lengths

The present review of research lengths found that 12 out of the 34 reviewed articles conducted one-session investigations; 12 conducted short-term investigations; 7 had long-term investigations; 3 conducted intermediate investigations (see Fig. 4 and Table 2).

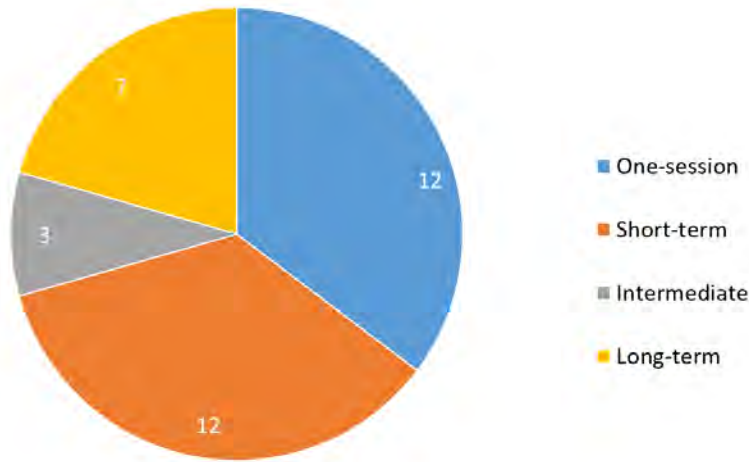


Fig. 4. Research lengths

**Table 2**  
Research lengths

Research lengths	References
One-session	Liu et al. (2019); Wang et al. (2019); Dore et al. (2018); Strouse & Ganea (2017a); Strouse & Ganea (2017b); Martin-Beltrán et al. (2017); Richter & Courage (2017); Korat et al. (2014); Homer et al. (2014); Parish-Morris et al. (2013); Korat (2010); Korat et al. (2009)
Short-term	Connor et al. (2019); Skibbe et al. (2018); Liu & Leveridge (2017); Smeets & Bus (2015); Hwang et al. (2015); Ihmeideh (2014); Lin (2014); Liang & Huang (2014); Korat et al. (2013); Huang et al. (2013); Smeets & Bus (2012); Chou (2012)
Intermediate	Wu & Chen (2018); Sung & Wu (2017); Huang (2013b)
Long-term	Korat & Shneor (2019); Jansen (2019); Raynaudo & Peralta (2019); Wood et al. (2018); Wu (2016); Chou (2016); Huang (2013a)

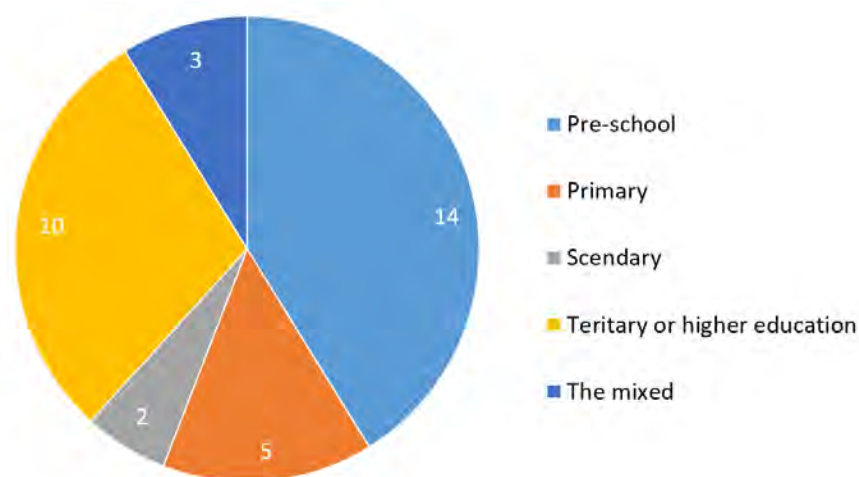
Out of the 34 reviewed studies, up to 24 were of short or one-session investigations. A probable reason for the overall short research lengths may lie on the overall large sample sizes of the studies as specified in the previous section. Typically, the larger the sample is, the greater the difficulty researchers may have in controlling different components of the investigations, such as the operation of the instruments, the training of the participants, the control over the variants and collection of data (Morse, 2000). As a solution, many researchers chose to shorten the lengths of the researches.

Connor et al. (2019), for instance, investigated a vast number of participants (n=603) and, perhaps for the sake of lowering the difficulty in research condition, employed a short-term investigation of three weeks.

The frequent conduction of short-term and one-session investigations, however, may result in the lack of investigation of the long-term effectiveness of EBLL, which, further, might lead to the inaccuracy and incompleteness of the extant research results. Language learning, for particular, is widely acknowledged to be a constant process of a long or even life-long period, during which learners would experience a series of ascending levels in the development of language knowledge and skills as well as changing attitudes and learning motivation (Foley & Thompson, 2017). Targeting at such a long and evolving process, researchers may not be able to observe all the details during the process and may miss some possible delayed influences of the EBLL in short and one-session investigations. Therefore, we suggested that future researchers devote more time to studies and investigate the effectiveness of EBLL in the long term.

### 3.1.4. Participants' education level

The present review of the participants' education levels found that 14 out of the 34 reviewed studies had pre-school children as research subjects; 10 studies investigated the participants of tertiary or higher education level; 5 investigated the participants of primary education level; 2 investigated the participants of secondary education level. Three studies investigated participants from various educational backgrounds (see Fig. 5 and Table 3).



**Fig. 5.** Participants' education levels

The most frequently investigated education group was pre-school. In the same line with Zucker et al. (2009) and Reich et al. (2016), the present review of participants' education level found that so far, the most significant target learners of EBLL were pre-school children aged between 3 and 6. Due to the education background and age of this learner group, the language type suitable for EBLL is conceivable to be L1. A possible explanation for the frequent investigations of pre-school children in EBLL might be the impressively positive effect of such learning method on this learner group. Richter and Courage (2017), for example, investigated 3- to 5- year-old children's attention,

engagement, and communication during the EBLL. The results showed that children devoted double time to language learning when using e-books than using printed books, and that children concentrated more on the learning activities and communicated more with their parents when having EBLL than they did through traditional learning methods.

**Table 3**  
Participants' education level

Participants' education level	References
Pre-school	Korat & Shneor (2019); Raynaudo & Peralta (2019); Wood et al. (2018); Dore et al. (2018); Skibbe et al. (2018); Strouse & Ganea (2017a); Strouse & Ganea (2017b); Richter & Courage (2017); Smeets & Bus (2015); Ihmeideh (2014); Korat et al. (2013); Parish-Morris et al. (2013); Smeets & Bus (2012); Korat et al. (2009)
Primary	Connor et al. (2019); Hwang et al. (2015); Korat et al. (2014); Liang & Huang (2014); Huang et al. (2013)
Secondary	Wu & Chen (2018); Lin (2014)
Tertiary or higher education	Jansen (2019); Liu et al. (2019); Wang et al. (2019); Sung & Wu (2017); Liu & Leveridge (2017); Wu (2016); Chou (2016); Huang (2013a); Huang (2013b); Chou (2012)
The mixed	Martin-Beltrán et al. (2017); Homer et al. (2014); Korat (2010)

Participants of tertiary or higher education level had also been investigated in EBLL studies, most of whom were L2 students on campus. These EBLL investigations were integrated with the curriculums of university L2 courses. For instance, Chou (2016) applied the EBLL in a one-semester-long L2 course in a Chinese university, in which students were required to develop L2 reading comprehension through BELL. The results suggested that before the broad application of EBLL, students should be given more time for adjusting to the strategies and habits of using technologies in language learning.

Compared to these two groups, learner groups of primary and secondary education level have received much less academic attention. However, primary and secondary school students are usually at their peak of learning motivation and learning ability (Muñoz, 2006), and therefore regarded to be investigation worthy in EBLL studies. Future researchers were suggested to pay more attention to these two learner groups by exploring the methods of enhancing their language learning through EBLL.

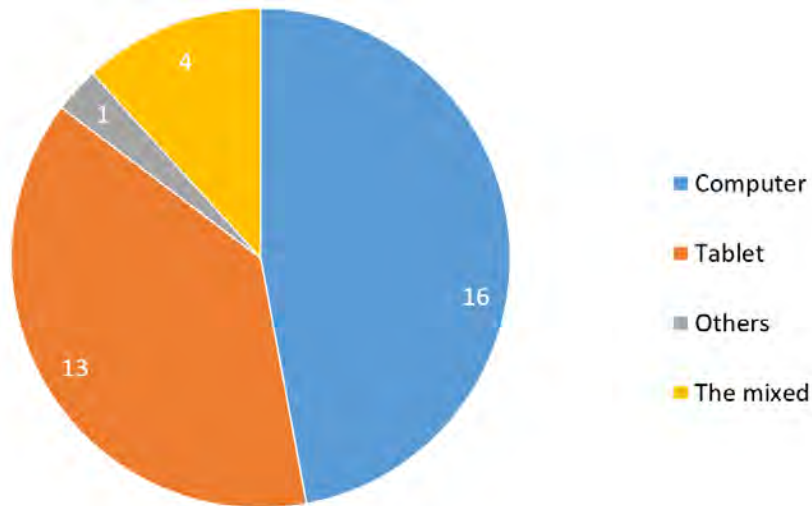
### 3.2. Devices and features of e-books

This section presents the review results of the devices and features of the e-books that previous EBLL studies investigated.

#### 3.2.1. Devices of e-books

The present review found that computers and tablets were the most frequently used devices for EBLL. As illustrated in Fig. 6 and Table 4, 16 out of the 34 EBLL studies

were based on computers; 13 on tablets; 4 based on the blended use of computers and tablets; one based on a tool other than the two, namely Xbox.



**Fig. 6.** Devices of e-books

**Table 4**  
Devices of e-books

Devices of e-books	References
Computer	Korat & Shneor (2019); Liu et al. (2019); Wang et al. (2019); Skibbe et al. (2018); Liu & Leveridge (2017); Smeets & Bus (2015); Hwang et al. (2015); Korat et al. (2014); Ihmeideh (2014); Korat et al. (2013); Huang (2013a); Parish-Morris et al. (2013); Smeets & Bus (2012); Chou (2012); Korat (2010); Korat et al. (2009)
Tablet	Jansen (2019); Raynaudo & Peralta (2019); Connor et al. (2019); Dore et al. (2018); Wu & Chen (2018); Strouse & Ganea (2017a); Strouse & Ganea (2017b); Sung & Wu (2017); Martin-Beltrán et al. (2017); Richter & Courage (2017); Wu (2016); Liang & Huang (2014); Huang et al. (2013)
Others	Homer et al. (2014)
The mixed	Wood et al. (2018); Chou (2016); Lin (2014); Huang (2013b)

Computers were found to be the most commonly used device for the e-book, probably due to the highest level of compatibility with other technologies and various softer ware. For instance, Liu et al. (2019) developed an online EBLL system based on computer, on which the Eyelink1000 eye-tracker was also equipped to monitor participants' gaze movement during the learning. This computer-based e-book system supported six types of multimedia presentations of word knowledge and reading comprehension and allowed the contents to be presented simultaneously or incrementally.

Based on the data collected through eye-tracker and pre- and post-tests, the researchers found that illustrations inserted in e-books played a significant role in learners' reading comprehension. It was also found that participants could concentrate better and learn more when the multimedia contents of word knowledge were presented incrementally.

The usage rate of tablets in EBLL narrowly seconded to that of computers. It was observed that the more recent the research was, the more likely it was that tablets were used for EBLL. This phenomenon evidenced the rapid development of mobile technology and the considerable potential in its integration with language learning (Fu, 2018), throwing out inspiration to the designer of e-book programmers for their future products. For instance, Sung and Wu (2017) developed a tablet-based EBLL integrated with game elements and the guidance system. The results showed that the proposed method was effective in personalising the learning and in enhancing learners' confidence and satisfaction in language learning activities.

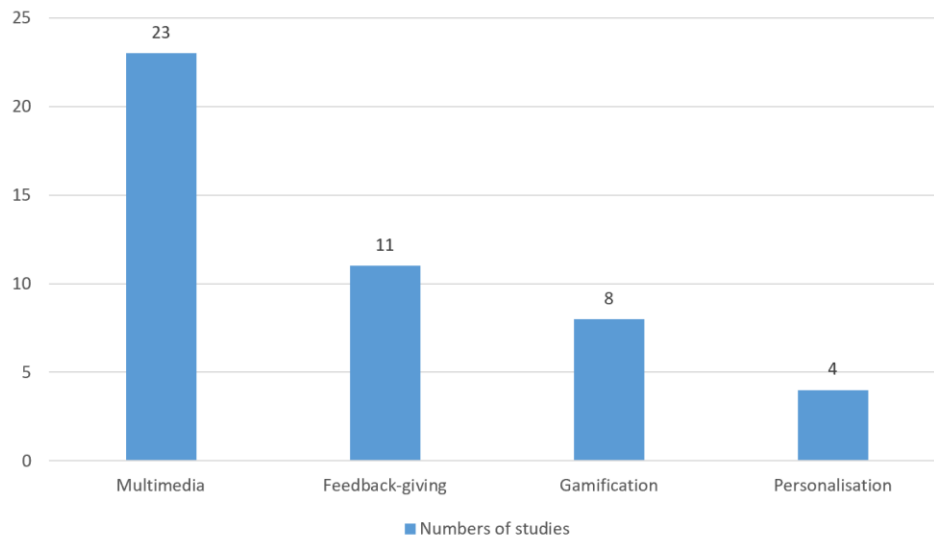
The mixed-use of both computers and tablets were applied for two primary purposes. One was to compare the effectiveness of the two devices in EBLL. For example, Lin (2014) assessed the effect of tablet-based and computer-based e-book on learners' reading skills and knowledge perceptions. The results revealed that the participants using tablet-based e-books outperformed their counterparts using PC-based e-books in post-tests and had better learning experiences. Lin postulated that the outperformance may result from the mobility and high accessibility of tablets, and suggested the broader application of mobile devices as the tool of EBLL for language students. The other purpose was to focus on the influence of EBLL on considerable common language learners in authentic setting regardless of the devices they used. Huang (2013b), for instance, required a large group of university students to read L2 novels online with their electronic tools for weeks and investigated their learning outcomes on L2 reading skills and the possible changes in learner motivation during the process. The results revealed the far-reaching positive effect of e-book reading on language learners from six dimensions: reading efficacy, challenge, curiosity, involvement, reading for grades, and integrative orientation. In particular, female learners of low language proficiency made impressive progress in EBLL.

Homer et al. (2014) innovatively took Xbox as the device of EBLL. Xbox is a type of electronic device for video games. Based on this device, the researcher developed a Kinect game in which the instructions were delivered in the form of game characters' storytelling and in the integration with game levels and tasks. The results showed that young children enjoyed the Xbox-based EBLL very much and felt more interested and motivated in future language studies than they used to be. It was also revealed in their performance in post-tests of vocabulary that children had their word knowledge significantly improved after the EBLL.

### *3.2.2. Features of e-books*

The present review found that many researchers attempted to enhance language learning efficiency mainly by integrating four "enhanced features" into the e-books: multimedia, feedback-giving, gamification and personalisation (Wood et al., 2018, p. 1947). As illustrated in Fig. 7, there were four primary features investigated in the field of EBLL: around 23 out of 34 studies investigated the multimedia of content presentation of e-books; around 11 investigated the feedback-giving system; around 8 investigated the gamification; around 4 investigated the personalisation system. Since some studies

researched multiple features, the sum number was bigger than the total number of reviewed articles.



**Fig. 7.** Features of e-books

Multimedia was about the e-books presented contents through multimedia, i.e., the blended use of texts, dynamic and static pictures, audios and videos. According to cognitive theory (Mayer, 2005), knowledge was processed and memorised through different cognitive channels in correspondence to the different media forms through which the contents were presented. When the contents were presented through multimedia, multiple channels were activated simultaneously so that the connections between different forms of knowledge were established and tightened, and the learning efficiency was significantly enhanced. As reflected in the present review, multimedia was the feature used most frequently by researchers and e-book developers to enhance the efficiency of EBLL. It was calculated that around 21 out of the 34 reviewed EBLL studies applied audio presentations of contents; around 20 applied static images; around 8 applied videos; around 2 applied dynamic images. For instance, Korat (2010) developed an e-book system in which word knowledge and reading materials could be presented in audio clips, along with illustrations to facilitate learners' comprehension. The researcher compared the learning efficiency of two groups of participants, one learnt through the proposed e-book system, and the other through the traditional printed book. The results showed that the group using the multimedia featured EBLL achieved more significant progress than the other group in vocabulary acquisition and reading comprehension. Korat et al. (2014) focused on the possible differences between texts, static and dynamic pictures as the media of e-books, by grouping the participants into (a) those who learnt through pure texts, (b) those who learnt through pure images, (c) those who learnt through pure dynamic pictures, (d) those who learnt through texts and images, and (e) those who learnt through texts and dynamic pictures. The investigation results showed that the participants tended to achieve better learning efficiency with multimedia than without, and that they could perceive the target knowledge best when learning with



dynamic pictures and texts. Among the groups who learnt through multimedia, the group that learnt with the pure use of static pictures had the least progress, the reason for which may lie in the more difficulty learners had in comprehending the static pictures without any textual explanation.

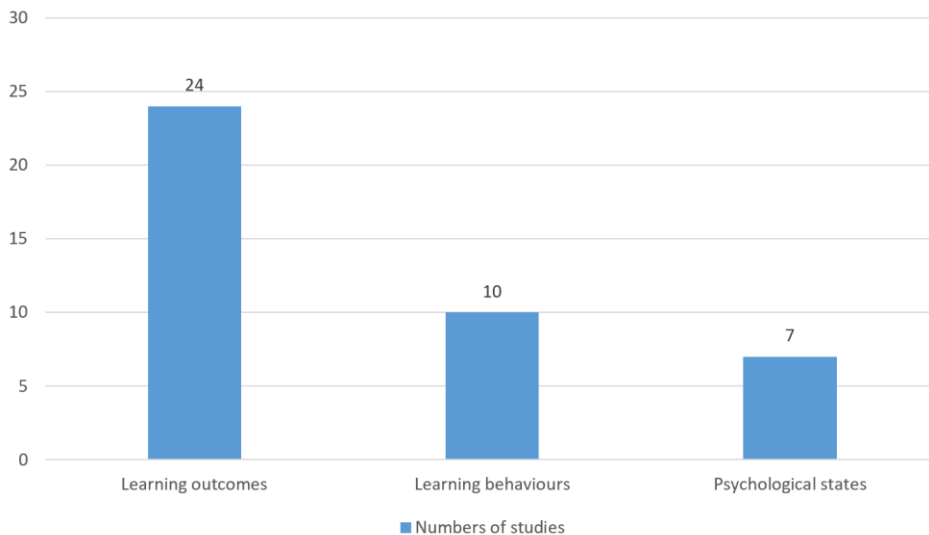
The second most frequently applied feature was feedback-giving. Based on the feedback-giving-featured e-books, language students would receive feedback on their learning performance, correction of mistakes and encouragements during their process of learning, and thereby achieved general improvement in learning attitudes and knowledge application (Van Lier, 2014). For instance, Smeets and Bus (2015) developed the EBLL system which would provide annotations and feedbacks to learners' questions during the learning. The results showed that this integration of EBLL with the feedback-giving system could largely enhance learners' vocabulary acquisition and was highly feasible in authentic pedagogy. Another example was Sung and Wu (2017), who developed a feedback-giving-featured EBLL that could track the participants' learning behaviours and offer immediate feedback and adaptive guidance according to their behaviours. The results revealed that this design of EBLL resulted in higher efficiency of reading comprehension and better quality of progressive learning. Sung and Wu (2017) also observed that the experimental participants using the proposed EBLL method tended to have more confidence and satisfaction in language learning activities.

Gamification was one of the most significant features that have been increasingly integrated into language learning for recent years (Ongoro & Mwangoka, 2019). In EBLL, it referred to the presentation methods of e-book contents in the integration of digital game elements, such as rules and goals, challenge, mystery/storyline and rewards (Flores, 2015; Tu, Zou, & Zhang, in press). Our review found that, based on gamification-featured e-books, language learners could receive, process and apply various aspects of language knowledge in an enjoyable process of game playing and thereby achieve higher levels of engagement and motivation in the learning activities and willingness to use the learnt knowledge (Hung, Yang, Hwang, Chu, & Wang, 2018). Lin's (2014) study was an example, in which L2 reading materials were presented in the integration with a mobile-based digital game. The participants could read the instructions texts along with the storyline of the game. The results of pre- and post-tests revealed that participants had achieved remarkable progress in the development of L2 reading comprehension by using the gamified e-books. It was also found in the questionnaires that EBLL learners tended to have better attitudes towards language learning in the proposed programme.

Personalisation was another popular feature in EBLL studies. Through the personalised EBLL, learners could have the instructional methods and contents, learning pace and interface styles tailored to their learning needs, knowledge proficiency, learning habits and preferences, and thereby obtain a higher level of learning efficiency (Gómez, Zervas, Sampson, & Fabregat, 2014). For example, Wu (2016) developed an EBLL study featured by personalisation in following one semester of English courses in a Chinese university, in which students were required to read English texts on tablet-based e-books weekly. To cater to the individual language proficiency and learning interest, EBLL was integrated with a guidance mechanism "that analyse[d] a student's learning profile and recommend[ed] articles according to article difficulty, relevance, and the learner's language ability" (p. 1938). At the end of the semester, the participants using personalised e-books performed significantly better in the post-tests of reading comprehension and vocabulary knowledge than their peers who used traditional learning methods.

### 3.3. Research issues and findings

Previous studies on EBLL were mainly of three research issues: the learning outcomes of the EBLL, learners' learning behaviours during the EBLL and learners' psychological states in the EBLL. As shown in Fig. 8, around 24 studies investigated the learning outcomes; around 10 investigated learning behaviours; around 7 investigated the psychological states. Since the three dimensions intertwined with each other tightly, the sum number was bigger than the total number of review articles, 34, because many studies researched multiple dimensions.



**Fig. 8.** Research issues

Most EBLL studies investigated the participants' learning. Studies of this research issue focused on the effect of e-books and their "enhanced features" on the acquisition of certain aspects of language knowledge, on the development of specific language skills and on language learning in general, most of which found overall positive results, especially in word learning. In the present review, we found that a vast majority of EBLL studies examined the use of e-books in enhancing vocabulary acquisition and reading comprehension. Connor et al. (2019), for example, developed an e-book-based learning system in which word knowledge and reading materials were presented through audio clips and images. The result showed that students who learnt through the proposed system significantly outperformed those learnt through printed books in the tests of vocabulary knowledge, reading comprehension and learning strategies. It was also suggested that the effectiveness of EBLL would be further enhanced when conducted in a weekly book club where learners could discuss the contents based on the e-books. Korat and Šhneor (2019) examined the learning outcomes of four modes of EBLL of vocabulary: learners' independent reading of an e-book with and without a dictionary and the joint mother-child reading of the e-book with and without a dictionary. Based on the comparison and analyses, the researchers argued that the most effective learning approach to children's word acquisition was reading an e-book with a dictionary and the maternal companion. Martin-Beltrán et al. (2017) and Korat (2010) compared the learning outcomes of EBLL in word learning and reading comprehension between

elementary students and pre-school children. They found the former learner group made more progress than the latter one. Ihmeideh (2014) investigated female and male groups in comparison and concluded that girls performed better and perceived more in e-book learning.

Learners' behaviours during e-book reading/learning were another primary research issue of EBLL studies. Researches of learners' behaviour mainly focused on the distribution and changes of learners' attention during their EBLL process, in which eye tracker, reading rate tracker and the log files recording learners' operation were the principal methods and instruments of data collection. Liang and Huang (2014), as a typical example, attempted to explore learners' reading patterns in EBLL. As the result, the researchers identified two types of e-book readers of two different reading rate patterns: the Coherent Readers whose reading rates tended to be "more consistent with the average value (ranging from 303.34 to 334.96 wpm)", and Fluctuant Reader who could "read significantly faster and produced more reading rate records" than average (p. 225). It was also revealed in the study that learners tended to have a higher level of knowledge retrieval when reading the e-books than reading the printed books. Chou (2016) identified four factors in the learners' behaviours during EBLL: reading purposes, opportunity to read screen-based texts, applications of reading strategies and second-language proficiency. The researcher also found that learners tended to be more cautious in e-book-based reading than in paper-based reading. Chou's arguments could be explained by Richter and Courage's (2017) research result that learners tended to read e-books for longer time and with a higher level of learning attention than they usually did when reading the printed books, and that the learners tended to be more engaged in peer-to-peer communications in the process of language learning with e-books than without. These behaviours during EBLL were also observed in Martin-Beltrán et al. (2017), the reason for which was postulated to be multimedia embedded in the proposed e-books for language learning.

The investigations on learners' psychological states were mainly about learner motivation, satisfaction, confidence, attitudes towards the target language and learning activities during the EBLL. Findings of the studies of this issue have yet reached any agreement of the psychological influence of EBLL. Huang (2013a), for instance, conducted interviews and questionnaires of a large scale upon a large sample size of university students in the attempt to understand their EBLL experiences and their acceptance to the innovative learning method. The researcher found that most participants held positive attitudes towards EBLL, and agreed on the positive effect of e-books on enhancing their learning efficiency, helping their cultivation of reading habits and increasing their learning motivation. Accessibility, portability and eco-friendliness were argued to be the primary reasons for students' preference of e-books to the printed ones. However, it was also mentioned that the formats of most e-books were not suitable for constant reading for a long time and was likely to cause eyestrain. In researching on university students' self-reports on their experiences of e-book-reading, Chou (2016) found that despite the effectiveness of this method on enhancing learners' reading comprehension, EBLL was not a process as pleasant as the traditional one. Future researchers may have in-depth analyses of these controversial research findings and have further investigations of this issue.

#### 4. Conclusions, implications and limitations

This study gave a panoramic view of the three significant aspects of previous studies on e-book reading as an instructional activity for language learning purpose by answering the research questions.

***RQ1:** How did the previous researchers investigate EBLL?*

The majority of previous EBLL studies were of large sample size and one-session investigations. Pre-school children and university students had received the most academic attention as the target learners of EBLL. Previous researchers mainly collected data through pre- and post-tests, questionnaires, eye-movement tracking and interviews, and processed the data through group comparison.

Future researchers in the field of EBLL were suggested to elongate the research length in order to reach the long-term influence of e-books. Primary and secondary school students also called for more scholarly attention as the target learner groups in EBLL.

***RQ2:** What devices and features of e-books were investigated?*

Computers and tablets were the most frequently used devices for EBLL because the former were more compatible with various other technologies and peripheral devices, and the latter were more accessible in real-life language classrooms. Xbox was also utilised as an innovative device for EBLL and showed great potential for future exploration in EBLL studies.

Multimedia, feedback-giving, gamification and personalisation were the four most popular features investigated in EBLL. The majority of the previous studies revealed that these four features could make EBLL effective in language learning. It was suggested that future researchers of EBLL might compare the influence of the four on enhancing EBLL and identify the most effective one.

***RQ3:** What are the research issues and findings of the previous study on EBLL?*

There were three major research dimensions in the study of e-book reading as an instructional activity for language learning: learning outcomes, learning behaviours and learners' psychological states – among the three, the studies on the possible learning outcomes occupied the majority. The overall results of the investigations of the three issues were positive. However, the studies about the influence of EBLL on learners' psychological states have yet reached any agreement.

There remain several limitations in the present study. Although the present review has found the overall positive influence of e-books on language learning, the specific aspects of language knowledge that the EBLL improved are not sufficiently discussed. Future review studies in this field may have further exploration of which aspects of language knowledge could be improved most in EBLL and reasons for such improvement. Moreover, many details of e-books have yet been reviewed, such as the used media types, the integration with other types of innovative technologies and the design of interfaces. Future researchers may conduct a more comprehensive review of the e-books used in the previous studies at the technological level and have an in-depth investigation of the connection between the design of e-books and the effectiveness of them on language learning.

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## Appendix I

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