EFFECTS OF INTERACTIVE E-BOOKS IN ENHANCING MANDARIN LANGUAGE VOCABULARY ACQUISITION, STORY COMPREHENSION AND STORY RETELLING AMONG KINDERGARTEN CHILDREN IN CHINA

CHEN CHUANG

UNIVERSITI SAINS MALAYSIA

2024

EFFECTS OF INTERACTIVE E-BOOKS IN ENHANCING MANDARIN LANGUAGE VOCABULARY ACQUISITION, STORY COMPREHENSION AND STORY RETELLING AMONG KINDERGARTEN CHILDREN IN CHINA

by

CHEN CHUANG

Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

October 2024

ACKNOWLEDGEMENT

I would like to dedicate this to my beloved mother, Zhang Jinhua, a diligent Chinese woman. She passed away in August 2016 after four years of fighting against illness. I hope she's proud of me somewhere on the other world. I look forward to the day when I can make her proud of me again.

I express my sincere gratitude to my main supervisor, Dr. Nurullizam Binti Jamiat, whose academic guidance and support have left a lasting impression on me. Without her invaluable assistance, I would not have achieved such swift progress in my studies. I also extend my appreciation to my co-supervisor, Dr. Siti Nazleen Abdul Rabu, for her consistent guidance on crucial aspects of the thesis. I deeply admire her academic rigor, patience, and wealth of experience.

I would like to express my special thanks to Universiti Sains Malaysia and the Centre for Instructional Technology and Multimedia (PTPM) for providing excellent facilities for my Ph.D. studies. I would also like to thank the friends I met at Universiti Sains Malaysia (Carlos Du, Yuan Li, Yang Li, YongChun Mao, ShiFeng Song, and Jason Zhou).

Last but not least, I want to express my deepest gratitude to my wife, who has shown incredible determination. While I pursued my PhD, she was alone in China, caring for our daughter. I truly appreciate her selfless love, as it has been the cornerstone of my success. From the bottom of my heart, thank you.

I would also like to extend my thanks to my family, especially my eldest brother, and everyone who has supported me throughout this journey.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF APPENDICES

KESAN E-BUKU INTERAKTIF DALAM MENINGKATKAN PEMEROLEHAN PERBENDAHARAAN KATA BAHASA MANDARIN, PEMAHAMAN CERITA DAN PENCERITAAN SEMULA CERITA DALAM KALANGAN KANAK-KANAK TADIKA DI CHINA

ABSTRAK

Dalam era digital masa kini, di mana kanak-kanak semakin banyak meluangkan sebahagian besar aktiviti membaca mereka kepada skrin, para penyelidik semakin memberi tumpuan untuk memahami kesan penggunaan buku elektronik interaktif dalam pengalaman membaca kanak-kanak. Kajian ini menyelidik kesan tahap interaktiviti yang tinggi, rendah, dan tanpa interaktiviti buku elektronik dalam mempromosikan pemerolehan kosa kata Bahasa Mandarin, pemahaman cerita, dan penceritaan semula cerita dalam kalangan kanak-kanak tadika Cina, dengan jantina sebagai pemboleh ubah moderator. Dipandu oleh Teori Kognitif Pembelajaran Multimedia (CTML), Teori Kognitif-Afektif Pembelajaran dengan Media (CATLM), dan Teori Beban Kognitif (CLT), reka bentuk penyelidikan eksperimen, kumpulan kawalan selepas ujian sahaja telah dijalankan untuk menilai kesan format buku elektronik yang berbeza ini. Sampel terdiri daripada 90 kanak-kanak (45 lelaki dan 45 perempuan) dari sebuah tadika awam di Bandar Zhengzhou, Wilayah Henan, China. Kajian ini menggunakan analisis varians satu hala (ANOVA) dengan ujian pasca hoc untuk mengenal pasti perbezaan antara kumpulan, dan analisis varians dua hala (ANOVA) untuk meneliti kesan interaksi antara pemboleh ubah bebas dan pemboleh

ubah moderator. Keputusan ANOVA sehala menunjukkan bahawa pelajar tadika yang menggunakan buku elektronik dengan interaktiviti rendah mencapai prestasi terbaik dalam ujian pemerolehan kosa kata dan pemahaman cerita, menunjukkan bahawa tahap interaktiviti yang "cukup tepat" ini adalah ideal untuk pelajar muda ini – tidak terlalu banyak, tidak terlalu sedikit. Sebaliknya, buku elektronik dengan interaktiviti tinggi, walaupun mungkin menarik, boleh menyebabkan beban kognitif yang berlebihan, mengakibatkan prestasi terendah dalam semua tiga pembolehubah bersandar. Pelajar yang menggunakan buku elektronik tanpa interaktiviti menunjukkan prestasi yang lebih baik dalam penceritaan semula cerita, menunjukkan bahawa penyampaian yang mudah dan linear mungkin memudahkan ingatan naratif. Keputusan ANOVA dua hala menunjukkan tiada kesan interaksi yang signifikan antara tahap interaktiviti buku elektronik dan jantina, menunjukkan bahawa kesan interaktiviti adalah serupa untuk lelaki dan perempuan, walaupun terdapat beberapa perbezaan jantina dalam tahap interaktiviti tertentu. Penyelidikan ini memberikan dapatan bermanfaat untuk penggubal dasar, pereka buku elektronik, dan guru tadika. Ia menekankan keperluan untuk mempertimbangkan semula idea bahawa lebih banyak interaktiviti selalu menghasilkan pembelajaran yang lebih baik, menggalakkan pendekatan yang lebih berhati-hati dan teliti dalam reka bentuk buku elektronik yang mengambil kira beban kognitif yang dikenakan ke atas pelajar muda. Tambahan pula, kajian ini menekankan kepentingan menilai dengan teliti reka bentuk dan pelaksanaan buku elektronik interaktif, memastikan bahawa ia benar-benar menyokong

perkembangan bahasa dan kemahiran literasi, terutamanya dalam konteks pendidikan awal kanak-kanak Bahasa Mandarin.

EFFECTS OF INTERACTIVE E-BOOKS IN ENHANCING MANDARIN LANGUAGE VOCABULARY ACQUISITION, STORY COMPREHENSION AND STORY RETELLING AMONG KINDERGARTEN CHILDREN IN CHINA

ABSTRACT

In today's digital age, where children increasingly devote a significant part of their reading activities to screens, researchers are increasingly focused on understanding the effects of using interactive e-books in children's reading experiences. This study investigated the effects of high-, low-, and non-interactivity levels of e-books on promoting Mandarin vocabulary acquisition, story comprehension, and story retelling among Chinese kindergarten children, with gender as a moderator variable. Guided by the Cognitive Theory of Multimedia Learning (CTML), the Cognitive-Affective Theory of Learning with Media (CATLM), and Cognitive Load Theory (CLT), a posttest-only control group experimental research design was conducted to evaluate the effects of these different e-book formats. The sample consisted of 90 children (45 boys and 45 girls) from a public kindergarten in Zhengzhou City, Henan Province, China. This study used one-way analysis of variance (ANOVA) with post hoc testing to identify differences between groups, and two-way analysis of variance (ANOVA) to examine interaction effects between independent variables and moderator variables. One-way ANOVA results revealed that kindergarten students who used low-interactivity e-books performed best on tests

of vocabulary acquisition and story comprehension, suggesting that this "just right" amount of interactivity was ideal for these young learners – not too much, not too little. Conversely, high-interactivity e-books, while potentially engaging, may have led to cognitive overload, resulting in the lowest performance across all three dependent variables. Students who used non-interactive e-books performed better in story retelling, indicating that a simplified, linear presentation might facilitate narrative recall. Two-way ANOVA results showed no significant interaction effect between e-book interactivity level and gender, suggesting that the effects of interactivity were broadly similar for boys and girls, although some gender differences emerged within specific interactivity levels. This research provides valuable insights for policymakers, e-book designers, and kindergarten teachers. It highlights the need to reconsider the idea that more interactivity always equals better learning, encouraging a more careful and thoughtful approach to e-book design that considers the cognitive demands placed on young learners. Furthermore, the study emphasizes the importance of carefully evaluating the design and implementation of interactive e-books, ensuring that they genuinely support language development and literacy skills, particularly in the context of early childhood Mandarin education.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Encouraging children to read books can have numerous benefits. Early exposure to reading can spark an interest in books and increase motivation in preschool children (McGeown et al., 2020). Studies have shown that good early reading abilities can lead to better academic achievement and sustained interest in learning. Reading comprehension, cognitive abilities, and vocabulary acquisition can also be developed through storybook reading (Courage, 2019). In addition, reading helps children become familiar with story structures and literacy conventions necessary for text comprehension (Shahaeian et al., 2018). The positive effects of early reading extend to children's reading habits, such as improved motivation and engagement (Nevo & Vaknin-Nusbaum, 2020). Therefore, implementing preschool reading interventions is crucial for promoting children's development (Ardoin & Bowers, 2020; Messier & Wood, 2015).

At a time when paper books were the predominant reading medium, shared reading between parents and their young children became the primary method of reading to preschoolers. Studies have consistently shown that reading to young children is a critical factor in literacy development (Bus et al., 2020). In the binary parent-child reading model, reading aloud by parents has been associated with improved reading comprehension and retention (Dore et al., 2018). During reading sessions, parents often engage with their children, discussing both the pictures and the

content of the story and sometimes drawing on their own experiences to deepen their children's understanding of the story (Schwarzer et al., 2022).

Traditionally, the teacher is in control and plays a central role in the conventional reading classroom. They help students understand the story by reading aloud, explaining in detail, and guiding them through complex concepts, new vocabulary, and context (Şimşek et al., 2021). This approach aims to improve students' reading comprehension. However, current trends in education have brought about a change in reading instruction. There is now a greater emphasis on the integration of technology and digital resources, as well as a more student-centered approach. These changes are intended to foster greater student interaction, engagement, and critical thinking, ultimately creating a more interactive and enriched learning experience that overcomes the limitations of the traditional reading classroom (Shehata et al., 2023).

Reading assessment methods include three essential dimensions: vocabulary acquisition, story comprehension, and story retelling, as shown in Table 1.1. These aspects are assessed in sequential order because they represent the cognitive developmental process from basic to advanced reading skills (Cao et al., 2021). Students must first acquire the vocabulary in the story in order to comprehend the content of the story, and eventually, through vocabulary acquisition and story comprehension, they will be able to retell the story (Spencer & Petersen, 2020).

Table 1.1 Three Dimensions of Reading Evaluation Methods

	Dimensions	Define
Reading assessment	Vocabulary acquisition	Vocabulary acquisition is the process of learning and mastering a set of new words and their meanings. It involves understanding, recognizing, and incorporating words into one's linguistic repertoire (Bueno-Alastuey & Nemeth, 2022).
	Story comprehension	Story comprehension involves identifying characters, recognizing relationships between characters, monitoring, perspective taking, inference, interpreting main ideas, and using working memory skills (Dempsey & Skarakis-Doyle, 2019)
	Story retelling	Story retelling involves students orally reconstructing a story they have read or heard. It should include characters, settings, and events in the logical sequence. It is usually measured by counting words and summarizing the main ideas, focusing on the problem and solution

Previous studies have shown that gender differences in reading achievement persist on national and international assessments (Logan & Johnston, 2010). A study of primary schools in the United Kingdom found that girls outperformed boys in English at all levels (Reilly et al., 2019). Another study of 15-year-olds in 31 countries around the world found that girls outperformed boys in reading in every participating country (Thomas et al., 2022). In addition, gender differences in reading interest suggest that girls are more likely to excel in story comprehension regardless of content, while boys are more likely to outperform in comprehension when passages make sense to them (Hirnstein et al., 2023). In the study by Schleeter et al. (2019), female

English Language Learners were found to significantly outperform male English Language Learners in reading across all three grade levels. There is also evidence that boys and girls approach problem solving differently, that boys are better than girls at mentally orienting visual images, and that boys prefer visual learning methods (Johnson et al., 2022).

With the development of mobile technology and the proliferation of mobile devices, children are increasingly exposed to screen-based reading activities (Bus & Anstadt, 2021). A 2019 report by the National Literacy Trust (UK) showed a notable increase in children's ownership of electronic reading devices, rising from 20% to 30% between 2018 and 2019. This increase was primarily driven by significant increases in both tablet ownership (from 37% to 65%) and smartphone ownership (from 38% to 70%).

According to a report by the Association of American Publishers (AAP, 2021), e-book sales increased 15.2% in the first eleven months of 2020, generating $1.0 billion. Harper Collins, one of the world's largest publishers, reported a 26% year-on-year increase in e-book sales in the first quarter of 2020 (Kozlowski, 2020). The leading genre sales within the digital division were children's and general fiction e-books (Kozlowski, 2020). Based on the National Literacy Trust Research Report - Children and Young People's Reading in 2019, more than 10% of children and young people use screens to read in each of the seven different formats, especially in fiction reading, where the proportion rises to 20%. The report states that on average, children and young people aged between 9 and 18 read on-screen material at least once in their

free time, 2.17 (SD = 1.31) times. It is worth mentioning that although the reading of most material in both formats declined between 2018 and 2019, there was a small increase in the number of children and young people reading fiction, non-fiction, and comics digitally compared to the previous year ,as shown in Figure 1.1. At the same time, the number of interactive e-books for children is also increasing, thanks to advances in multimedia technologies. There is an urgent need to evaluate the effects of interactive e-books in today's dynamic multimedia learning environments (Savva et al., 2022).

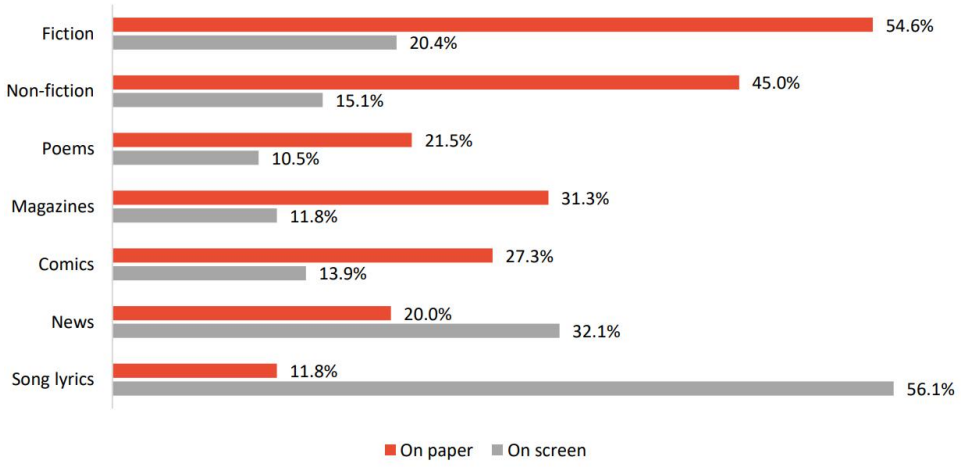

Figure 1.1 Proportion of children reading on paper and on screen
(Source: National Literacy Trust's annual literacy survey (2019), N = 56,906)

Advances in computer and multimedia technologies have greatly enhanced the content and presentation of e-books in recent years. One particularly remarkable development is the interactive e-book, which provides students with engaging reading experiences both in and out of the classroom (Xu, 2021). E-books have become the dominant source of children's reading, leading to a shift in the reading environment and subsequent effects on reading experiences and outcomes (Kucirkova, 2019). Interactive e-books incorporate multimedia elements such as written text, music,

sound, animation, and hotspots that activate various features with the click of a mouse (Shamir & Korat, 2006).

However, as interactive e-books have become increasingly popular, concerns have been raised by various stakeholders, such as schools, kindergartens, parents, and policymakers, about the effects of touch-device-based interactive e-books on children's reading outcomes (Almekhlafi, 2021; Tlili et al., 2022). Schools and kindergartens want to use interactive e-books effectively to achieve educational goals, while parents are concerned about their effects in supporting children's reading achievements and primary school readiness. Policymakers need empirical research data to develop appropriate policies that provide both theoretical and practical support. Therefore, it is essential to investigate the effects of interactive e-books in promoting reading achievements in kindergarten children (Furenes, Kucirkova, & Bus, 2021).

This chapter covers the study's background, problem statement, research objectives, questions, hypotheses, and significance. It also discusses the theoretical framework, limitations, and operational definition. Finally, the researcher will provide a summary of this chapter.

1.2 Background of the Study

In 2015, the 2030 Agenda for Sustainable Development was unanimously adopted by all United Nations members states to serve as a comprehensive framework for achieving lasting peace and prosperity for humanity and the planet, both now and in the years to come. This agenda consists of 17 Sustainable Development Goals, each of which embodies a critical dimension of sustainable development (Weiland et al.,

2021). The fourth goal emphasizes the importance of inclusive and equitable quality education for all, promoting lifelong learning opportunities and specifies that countries need to ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary school education (Bose & Khan, 2022; Weiland et al., 2021).

According to the requirements of the Learning and Development Guidelines for Children Aged 3-6 issued by the Ministry of Education of the People's Republic of China, public kindergartens emphasize the development of children's reading skills (Guidelines for Kindergarten Education, 2022). The guidelines state that children aged five to six years old should be able to concentrate on reading a book, enjoy talking about the content of a story with other people and be able to tell the main content of a story, understand the content of a story according to part of the plot of the story or clues from the picture in the book, and express their own opinions when retelling the story.

Learners in traditional teaching classrooms experienced difficulties and challenges in learning Chinese vocabulary. This is mainly because Chinese characters are hieroglyphic, with each character typically representing a word or concept rather than a single syllable (Gong et al., 2020). This requires learners to memorize a significant number of characters to express different ideas. In addition, many characters have multiple pronunciations and meanings, which further increases complexity (Chen et al., 2023). The pronunciation of Chinese characters may not directly correspond to their spelling, and the grammatical structure of Chinese differs

significantly from that of Western languages (Nel & Soezin, 2021). There is no doubt that this is an enormous challenge for kindergarten children who are not yet cognitively developed.

The Chinese government has implemented policies to improve the quality of preschool education in kindergartens. These policies focus on enhancing teaching methods and introducing innovations like educational technology. The goal is to provide higher-quality early education for children, fostering their cognitive, linguistic, social, and emotional development (Guidelines for Kindergarten Education, 2022). The use of educational technology adds interactivity and innovation to early childhood education, making learning more engaging. (Rao et al., 2021).

Multimedia is a versatile form of communication that includes various types of content, including text, sound, images, video, and animation. Children's reading environments have been influenced by the development of multimedia (Schubertová et al., 2023). Unlike traditional mass media such as print publications and audio recordings, which serve as single channels for information dissemination, multimedia provides multiple mechanisms for information dissemination (Onyejelem et al., 2024). The multimedia learning environment describes the situation in which users can perceive and navigate the information they need through multiple channels in an environment characterized by integrated media content (Bus & Takacs, 2019). The rapid and steady development of smart mobile devices and network technology has revolutionized the speed and efficiency with which users can access information via

the Internet. E-books have been integrated into various smart terminals, moving from the era of print publications to the multimedia era (Bus, Neuman, & Roskos, 2020).

Multimedia causes significant changes in children's reading environments, with hypermedia and interactive media enhancing their reading experiences. In such an environment, both verbal and visual representations are provided (Paivio 1986). Multimedia learning environments can be classified as either non-interactive or interactive. While non-interactive environments present predetermined multimedia information, interactive learning environments depend on the learner's behavior during the learning process, and interactive reading e-books are an interactive learning environment (Barut et al., 2022).

Tay (1993) stated that multimedia is a comprehensive means of communication that integrates text, graphics, sound, animation, and video. The age of interactive media begins when users can control the distribution of these elements. By providing a system of linked elements that facilitate user navigation, interactive multimedia becomes hypermedia (Tay, 1993). With the advent of streaming services, apps, and e-books, children's learning environments have undergone significant changes. Traditional educational materials are giving way to digital content that users access through electronic devices that are often mobile or handheld, making reading faster and more convenient than previously paper-based media (Bus et al., 2020).

Interactive e-books, or e-books on electronic devices, have gained popularity due to the widespread use of smartphones, tablets, and laptops. The Association of American Publishers (AAP) 2021 report found that sales of e-books on these devices

will reach $1.1 billion by December 2021, indicating significant growth. Studies show that the use of smart devices for reading has become a common practice among children, with almost all children under the age of four in the US using mobile devices for this purpose (Jeong & Gweon, 2021). This trend is also observed in other developed countries. Interactive e-books provide children with an interactive and multimodal learning environment, which is preferred over passive digital media by the National Association for the Education of Young Children (NAEYC). The NAEYC recommends the use of interactive digital media in early childhood literacy (Aladé, 2023).

The interactive e-book has demonstrated the ability to integrate seamlessly with a variety of digital components and allow children to engage with books by clicking, dragging, zooming, and pinching, resulting in an immersive reading experience (Vackova et al., 2023). In addition, the mechanisms by which interactive e-books affect children's early literacy development are not fully understood, making it difficult to assess their effectiveness (Bus et al., 2020). As the United Nations members to prioritize quality education, there is growing interest in exploring how e-books can enhance children's vocabulary acquisition, story comprehension and story retelling within multimedia learning environments. However, the results obtained from studies on interactive e-books have not been consistent (Alice Chen et al., 2023). Further research is needed to assess the effects of e-books as instructional tools in different educational settings, geographic regions, and target groups.

Finally, it is worth noting that the Chinese government has demonstrated a strong commitment to early childhood education, as evidenced by the implementation of policies such as the *Kindergarten Education Guidance Program and the National Long-Term Plan for Education Reform and Development (2010-2020)*. The Ministry of Education of the People's Republic of China recently issued the Guidelines for Kindergarten Education (2022), which explicitly advocate the use of diverse teaching methods, including e-books, to stimulate children's interest in reading, writing, and pre-literacy skills, which are critical to a child's overall development and success in future academic endeavors. Meanwhile, this guideline also requires kindergarten teachers to select different reading materials for the different learning characteristics of boys and girls in order to improve the reading skills of students of different genders (Guidelines for Kindergarten Education, 2022).

According to a survey conducted in China in January 2022 by Avery iClick (2022), an online research platform, Chinese children are increasingly adopting tablets for reading at an early age. In addition, kindergartens across the country are capitalizing on this trend by using tablets to facilitate multimedia instruction. For example, institutions such as the Little Dragon Kindergarten in Hanyang District, Wuhan, have introduced tablets as part of their reading activities, creating an interactive and intelligent reading platform.

The development of multimedia technologies and the widespread availability of smart mobile devices have led to a significant shift in children's reading formats (Korat et al., 2017). This transition is currently being explored in relation to young

children's language and early literacy development, with a focus on the potential benefits of these new technologies for learning environments (Bus et al., 2020). Educators, parents, preschool teachers, and policymakers are increasingly emphasizing the effects of interactive e-books in supporting children's reading achievement. Prior to formal reading instruction in primary school, it is important that the understanding of this issue was deepen (Furenes, Kucerkova, & Bus, 2021).

1.3 Problem Statement

The complexity of learning Mandarin for kindergarten children stems from its logographic writing system and tonal nature. Chinese characters, each representing a word or meaning rather than individual sounds, require the memorization of both form and meaning. Many characters share similar visual components, which can lead to confusion. Additionally, Mandarin's tonal system, where tones distinguish meaning, adds to the difficulty, as young learners must master not only the characters but also the correct pronunciation and tone patterns. These factors combined make learning Mandarin particularly challenging for young children.

The complexity of learning Mandarin, combined with the limited working memory of kindergarten children, often leads to cognitive overload, resulting in poor learning outcomes (Chen & Jamiat, 2023). Within traditional classroom contexts, teachers often use methods that include reading aloud and explaining meaning to students (Merga & Ledger, 2019). However, this approach may quickly exhaust students' patience and motivation, which has a negative effect on their reading

performance. Furthermore, due to the complexity of the Mandarin language and the typically limited vocabulary of young children, they may struggle to understand all the vocabulary used in a story (Sun et al., 2020). This can lead to difficulties in understanding the story and its themes.

Kindergarten children, who are in the early stages of cognitive development, often find it difficult to understand abstract concepts and follow complex storylines, especially in traditional classrooms. Their limited cognitive abilities make it difficult to comprehend complicated topics or narratives, which can easily lead to confusion and misunderstanding (Li et al., 2023). Furthermore, their relatively short attention spans pose additional challenges in maintaining focus throughout a story, causing them to miss important details and lose track of the plot (Liu et al., 2018).

In a traditional classroom environment, where children are often passive listeners, these challenges are compounded, making story comprehension even more difficult (Peras et al., 2023). Without active engagement or visual reinforcement, young learners are more likely to struggle to retain important information and fully comprehend the content of the stories they hear (G. Coogle, et al., 2022). This makes the process of story comprehension both cognitively demanding and frustrating for pre-school children.

Traditional kindergarten reading classrooms pose challenges for students in vocabulary acquisition due to the limitations of visual content in paper picture books, the inherent complexity of Chinese characters, and a lack of engagement (Korat et al., 2022). First, traditional picture books often lack rich visual content, which hinders

children's understanding of new words. While illustrations and pictures are crucial for supporting vocabulary comprehension, many traditional books offer limited visual aids (Diehm et al., 2020). Second, the complexity of Chinese characters poses challenges for kindergarten children in learning vocabulary, as recognizing and writing these characters can be difficult (Pan et al., 2021). Additionally, the absence of engaging picture books can reduce young learners' motivation and interest in reading, further impeding their vocabulary acquisition (Kaynar et al., 2020).

In traditional kindergarten reading classrooms, the common approach is for the teacher to read a story to the children and for the children to act as passive listeners. Even with the incorporation of technology, such as the use of large screens displaying e-books, the basic nature of the classroom environment remains passive (Shehata et al., 2023). Children are unable to control the rhythm of the reading or revisit the content of the story as they wish. As a result, this passive mode of participation can hinder their overall comprehension of the story they are learning. To better promote early literacy skills and deeper understanding of story content, more interactive and participatory strategies need to be considered (López-Escribano et al., 2021). These strategies should provide opportunities for children to actively participate in the reading process, encourage them to explore and read stories at their own pace, and ultimately improve their story comprehension skills (Korat et al., 2022).

Story retelling skills, a key indicator of children's vocabulary and comprehension, are particularly challenging for kindergarten children in traditional reading classrooms. In these settings, children are often passive listeners, which limits

their engagement and active participation (Altun et al., 2022). As a result, they struggle to summarize and elaborate on the main points of a story. In addition, reduced interest in reading can affect their concentration, making it more difficult for them to understand and recall the story (Kavanagh, 2019). To improve children's story retelling skills, teachers should encourage active participation, foster a love of reading through interactive activities, provide a variety of storytelling materials, encourage children to express their personal opinions and feelings, and provide ample opportunities for oral retelling (Deshmukh et al., 2019).

As educational technology is increasingly integrated into kindergarten settings, researchers have begun to investigate the effects of interactive e-books on children's vocabulary acquisition, story comprehension, and story retelling skills (Wang et al., 2019). Several empirical studies have investigated the effects of interactive e-books for kindergarten children on children's vocabulary acquisition, story comprehension, and story retelling skills. However, this research has yielded positive, negative, and neutral results regarding the effects of interactive e-books on children's reading achievement (Korat & Falk, 2019; Song et al., 2022). In order to gain a comprehensive understanding of interactive e-books in promoting children's vocabulary acquisition, story comprehension, and story retelling, researchers are encouraged to employ different research methods and reading materials to further explore this topic (Bus & Anstadt, 2021).

The meta-analysis by Egert et al. (2022) found that most of the e-books used in these studies were developed or carefully selected by the researchers and used

exclusively or primarily consistent technological features. Typically, well-known storybooks have appropriate content and age-appropriate language input and are equipped with electronic technology features. Such consistently high-quality e-books may prevent the differential effects associated with technological features, and they suggest that future research should extend to the use of commercial e-books as research material to meet current business trends that maximize entertainment (Papadakis et al., 2020). For example, Apple's App Guidelines imply that "If your App doesn't provide some form of lasting entertainment value, or is just plain creepy, it may not be accepted (Apple, 2017).

In addition, a review of various databases such as Web of Science, Scopus, and Google Scholar revealed that the majority of the studies analyzed for this study used e-books in English, Dutch, or Hebrew as study materials (Bus et al., 2020; Christ et al., 2019; Korat et al., 2019). This study also attempted to add a number of keywords such as China, Mandarin, kindergarten, reading, vocabulary acquisition, reading comprehension, and story retelling to the search and found that most studies were conducted in the Taiwan Province of China.

However, there were few studies conducted in China, and after collecting the literature, some studies were found that used interactive e-books, but they focused on other disciplines such as mathematics (Hwang & Lai, 2017) and physics (Zhao et al., 2021). There is a lack of studies that use either Chinese Mandarin interactive e-books as research materials or Chinese kindergarten children as research subjects. Further

research is needed to determine the generalizability of previous findings to Chinese Mandarin interactive e-books.

Several studies have examined children's reading with interactive e-books, but few have specifically examined the effects on participants of different genders. According to the study by Peras et al. (2023), personalized reading technology helps to reduce the gender gap in technological adaptations in education. However, their study also shows that gender differences still play a significant role in children's e-book reading. These differences can potentially create reading barriers for some children, so it is important to take them into account when using e-books for formal learning. Ihmeideh's (2014) study also states that gender differences are significant, with female children showing higher levels of initiation literacy. Loh et al. (2020) state that boys and girls are likely to read differently, prefer different genres, and have different tendencies towards print and electronic formats, and the authors also claim that girls read more online. This means that there may be a need for a more detailed understanding of reading, gender, and technology.

Based on the aforementioned problems, the purpose of this study is to investigate the effects of interactive e-books with different levels of interactivity on kindergartners' (a) vocabulary acquisition, (b) story comprehension, and (c) story retelling. Interactivity in e-books can generally be divided into low-interactivity and high-interactivity modes. Low-interactivity e-books provide limited interactivity to the user. For example, users can use page-turning buttons to adjust the reading speed or click on hotspots on the screen to create dynamic effects. Highly interactive e-books,

on the other hand, have a variety of features that respond to the reader's actions during the reading process. For example, hotspots, games, etc. A more detailed description is given in chapter 3, section 5.

Gender was also set as a moderating variable to assess whether there was a significant difference in (a) vocabulary acquisition, (b) story comprehension, and (c) story retelling between kindergarten boys and girls using the interactive e-books. After conducting a comparative analysis, one of the ten commercial e-books from the Ela Reading platform (a well-known e-book reading platform in China) and the app market (Apple and Android) was selected and will be used for the experiment. The research uses the CTML, CATLM, and CLT as the basic theories to guide the study.

1.4 Research Objectives

The purpose of this study is to investigate the effects of interactive e-books in promoting Mandarin language vocabulary acquisition, story comprehension and story retelling among Chinese kindergarten children. The objectives of the study are:

RO1: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language vocabulary acquisition among Chinese kindergarten children.

RO1a: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language vocabulary acquisition among Chinese kindergarten children.

RO1b: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language vocabulary acquisition among Chinese kindergarten boys.

RO1c: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language vocabulary acquisition among Chinese kindergarten girls.

RO1d: To investigate the effects of e-books with the same interactivity level on Mandarin vocabulary acquisition between Chinese kindergarten boys and girls.

RO1e: To investigate the interaction effects of using high-, low-, and non-interactivity level e-books on Mandarin vocabulary acquisition among Chinese kindergarten children of different genders.

RO2: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin story comprehension among Chinese kindergarten children.

RO2a: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language story comprehension among Chinese kindergarten children.

RO2b: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language story comprehension among Chinese kindergarten boys.

RO2c: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language story comprehension among Chinese kindergarten girls.

RO2d: To investigate the effects of e-books with the same interactivity level on Mandarin story comprehension between Chinese kindergarten boys and girls.

RO2e: To investigate the interaction effects of using high-, low-, and non-interactivity level e-books on Mandarin story comprehension among Chinese kindergarten children of different genders.

RO3: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin story retelling among Chinese kindergarten children.

RO3a: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language story retelling among Chinese kindergarten children.

RO3b: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language story retelling among Chinese kindergarten boys..

RO3c: To investigate the effect of high-, low-, and non-interactivity level e-books on Mandarin language story retelling among Chinese kindergarten girls.

RO3d: To investigate the effects of e-books with the same interactivity level on Mandarin story retelling between Chinese kindergarten boys and girls.

RO3e: To investigate the interaction effects of using high-, low-, and non-interactivity level e-books on Mandarin story retelling among Chinese kindergarten children of different genders.

1.5 Research Questions

This study examines the following research questions:

RQ1: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin language vocabulary acquisition among Chinese kindergarten children?

RQ1a: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin language vocabulary acquisition among Chinese kindergarten children?

RQ1b: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin vocabulary acquisition among Chinese kindergarten boys?

RQ1c: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin vocabulary acquisition among Chinese kindergarten girls?

RQ1d: What is the effect of e-books with the same interactivity level on Mandarin vocabulary acquisition between Chinese kindergarten boys and girls?

RQ1e: Is there any interaction effect between using high-, low-, and non-interactivity level e-books and different genders on children's Mandarin vocabulary acquisition?

RQ2: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin language story comprehension among Chinese kindergarten children?

RQ2a: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin language story comprehension among Chinese kindergarten children?

RQ2b: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin story comprehension among Chinese kindergarten boys?

RQ2c: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin story comprehension among Chinese kindergarten girls?

RQ2d: What is the effect of e-books with the same interactivity level on Mandarin story comprehension between Chinese kindergarten boys and girls?

RQ2e: Is there any interaction effect between using high-, low-, and non-interactivity level e-books and different genders on children's Mandarin story comprehension?

RQ3: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin language story retelling among Chinese kindergarten children?

RQ3a: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin language story retelling Chinese kindergarten children?

RQ3b: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin story retelling among Chinese kindergarten boys?

RQ3c: What is the effect of high-, low-, and non-interactivity level e-books on Mandarin story retelling among Chinese kindergarten girls?

RQ3d: What is the effect of e-books with the same interactivity level on Mandarin story retelling between Chinese kindergarten boys and girls?

RQ3e: Is there any interaction effect between using high-, low-, and non-interactivity level e-books and different genders on children's Mandarin story retelling?

1.6 Research Hypotheses

Based on the above research questions, this study employs null hypotheses, and the researcher will reject the null hypothesis if the p-value is less than 0.05 ($p < 0.05$).

Research hypotheses according to RQ1 are listed below:

$H_{01\text{-}1}$: There is no significant difference between Chinese kindergarten children in the high-, low-, and non-interactivity level e-book groups in Mandarin vocabulary acquisition.

$H_{01\text{-}2}$: There is no significant difference between Chinese kindergarten boys in the high-, low-, and non-interactivity level e-book groups in Mandarin vocabulary acquisition.

$H_{01\text{-}3}$: There is no significant difference between Chinese kindergarten girls in the high-, low-, and non-interactivity level e-book groups in Mandarin vocabulary acquisition.

$H_{01\text{-}4}$: There is no significant difference in Mandarin vocabulary acquisition between Chinese kindergarten boys and girls within the high-interactivity level e-book group.

$H_{01\text{-}5}$: There is no significant difference in Mandarin vocabulary acquisition between Chinese kindergarten boys and girls within the low-interactivity level e-book group.

$H_{01\text{-}6}$: There is no significant difference in Mandarin vocabulary acquisition between Chinese kindergarten boys and girls within the non-interactivity e-book group.

$H_{01\text{-}7}$: There is no interaction effect between using high-, low-, and non-interactivity level e-books and different genders on children's Mandarin vocabulary acquisition.

Research hypotheses according to RQ2 are listed below:

$H_{02\text{-}1}$: There is no significant difference between Chinese kindergarten children in the high-, low-, and non-interactivity level e-book groups in Mandarin story comprehension.

$H_{02\text{-}2}$: There is no significant difference between Chinese kindergarten boys in the high-, low-, and non-interactivity level e-book groups in Mandarin story comprehension.

$H_{02\text{-}3}$: There is no significant difference between Chinese kindergarten girls in the high-, low-, and non-interactivity level e-book groups in Mandarin story comprehension.

$H_{02\text{-}4}$: There is no significant difference in Mandarin story comprehension between Chinese kindergarten boys and girls within the high-interactivity level e-book group.

$H_{02\text{-}5}$: There is no significant difference in Mandarin story comprehension, between Chinese kindergarten boys and girls within the low-interactivity level e-book group.