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The Design and Impact of Interactive E-Book on Academic Language Achievement to Language Minority Students

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Abstract. Digital media technology has become an increasing part of daily life. The paper suggested on the efficient e-book design and application. The purpose of the study was to design and test interactive e-book for academic language learning on language minority (LM) students. The researcher conducted an experiment with a total of 54 third-grade LM students (age 8-9). The experimental classroom had 28 LM students who learned by using the interactive e-book. The control classroom had 26 LM students who learned by using the printed book. Testing took place over a period of 4 weeks. The interactive e-book had two primary modes including the automatic and manual mode. Each mode consisted of options and interactive features according to natural approach principles. Results of testing showed that the LM students' improvement after learning with interactive e-book. The experimental group performed significantly better in story comprehension skill than the control group. Based on the results, further study of interactive e-book enhanced language learning is also suggested and discussed.

1. Introduction

A literacy learning related to language minority (LM) students has received increasing attention in educational research theme in recent years. Variety projects were carried out to improve LM students' academic language skills [1]. LM students' limited academic language skills affect their learning achievement. Thus, the achievement gap between LM students and native students is one of the educational problems which should be solved [2]. There are claims by a number of the studies to point out educational problems that LM students in various countries encounter. For example; the study of the mathematical literacy of language minority students in Canada indicated that LM students who have limited skill in the academic language are a major problem in mathematics education [3]. The literacy among the Dongxiang ethnic minority children was problematic and considered the lowest level in China. The study results found that the students at their early age were incapable of reflecting their understanding properly from the lessons which, consequently, decreased their learning achievement and performance in school [4]. Moreover, features of academic language impact on reading comprehension of LM students in Germany [5].



The development of students' literacy and language skills in schools and at home are widely supported by technologies [6],[7]. The potential of multimedia learning environments supports students' understanding and meaningful learning [8]. Notably, using interactive multimedia in e-books could reduce the cognitive load, attract students' attention and increase their reading motivation. Moreover, the students might understand the content more easily than traditional printed books [9]. Nowadays, interactive e-books are available in various formats, including CD ROM e-books, online e-books, and e-book apps [10]. Assorted studies on using interactive e-books have positive effects on students' language skills. Shamir &Korat used the e-books to support emergent reading for kindergarten children at-risk for reading difficulties. The e-books designed to improve children' literacy that focused on vocabulary, phonological awareness, concepts about print, and story comprehension. Results showed that children improved vocabulary and phonological awareness by using e-book activities in the classrooms[7]. Evans, Nowak, Burek& Willoughby compared the different outcomes of using two types of alphabet books (printed books and interactive e-books) to support letter knowledge and phonemic awareness for young children. These results showed that children spent more time oriented to the e-books than the printed books. Nevertheless, they have motivated to learn and achieve alphabet learning skills with the e-books than the printed books[11]. Similarly, a study by Kao, Tsai, Liu, & Yang showed that the effect of e-storybook with various levels of interactive on literacy learning for fourth-grade students. In comparison with the less interactive e-book which was only limited to its interactive buttons and narration features, the high interactive e-book delivered better performances as it was packed with three additional main features: guidance, prompt and feedback. The results showed that the students who used the high interactive e-book made significant improvements in story comprehension, chromatics concepts and reading motivation than the students who used the low interactive e-book[9].

1.1. Natural approach: Theory and applications

The natural approach to second language acquisition in the classroom is comprehension-based, focuses on the understanding of language by listening rather than other language skills. This means that comprehensible input plays a vital role in acquiring a language which listening and reading are the key focus that theoretically supports the natural language learning for language beginners[12]. In natural approach, second language learning should be learned with unstressed environments. In the beginning, the teacher emphasizes students' utterance and meaning rather than their structure and grammar. Students can use their first language in conjunction with the second language [13].

Some studies that have shown the effectiveness of the natural approach on second language development. Mendoza examined the influence of using gesturing as a natural approach to English learning development of Hispanic learners (ELL). The results pointed out that there was an effect on the word production in migrant ELL students in two out of three settings[14]. Tehrani, Barati, &Youhanaee investigated the English language learning improvement of young female Iranian learners by comparing audiolingual method and natural approach. The study focused on vocabulary and communicative skills. The results showed that the participants were taught through natural approach improved significantly in their vocabulary learning and communication skills than the participants were taught through audiolingual method[15]. Goudarzi, Parham, &Mahdian showed that the effects of natural approach in English as second language learning on the university faculty members. The results concluded that natural approach was more efficient than the traditional method[16].

Of these studies, the natural approach is a language learning strategy that accepted used to support language skills. But no studies have focused on design consideration and specifically on natural approach in the creation of interactive e-book for language learning. The study reported in this paper contributes by incorporating the use of natural approach in the interactive e-book design and application for language learning. The study also aimed to investigate the impact of using the interactive e-book as a supportive learning tool in the language learning classroom for the unique needs of LM students.

Stages of language instruction through natural approach [17] are following; 1) Preproduction, 2) Early speech production, and 3) Speech emergence. Application in the interactive e-book environments are shown in Table 1

Table 1. Principle of natural approach as design guidelines for literacy e-book environments.

Principle of natural approach	Application in a classroom setting by using interactive e-book
<p>1. Preproduction stage: Listening skill developing.</p> <p>1) The natural approach is a method of language learning that focus on opportunities for comprehension experiences [12]. Listening and speaking present foundation to learn a language [13]. The shared book experience strategy is used to develop literacy concepts, specifically listening and speaking skills that are consistent with the natural approach. Shared book activities offer authentic literacy experiences to help students develop their language by independent reading [18].</p>	<p>Using shared book activities with the interactive e-book.</p> <p>1) Connecting a computer to a projector so that the teacher and students can interact and control wirelessly with the e-book on the large screen by using an air mouse.</p>
<p>2) Prior to shared book experiences, have a discussion about the title and illustration cover, stimulate children to foretell what goes on in the story, increase their interest, and specify the reading aims [19].</p>	<p>2) Introduce the e-book title page and show how to interact with the program.</p>

Table 1. Principle of natural approach as design guidelines for literacy e-book environments(Cont.).

Principle of natural approach	Application in a classroom setting by using interactive e-book
<p>3) Language should be firstly acquired and utilized wholly and distinguishing and refining it should come after. In a natural approach, students are able to identify patterns and make a prediction about such patterns by using a shared book experience [20]. Learning a second language by using listening strategies for stories is considered more effective [21].</p>	<p>Using automatic mode.</p> <p>3) First time of learning in each chapter, using automatic mode to play multimedia so students can see and predict content from the whole chapter.</p> <ul style="list-style-type: none"> - Including animation shown together with voice narration and highlighted texts were synchronized with voice narration. - Ask students take turns to control the e-book.
<p>2. Early speech production stage: Basic speaking skill developing.</p> <p>4) Expand the time for read-aloud exercises on a daily basis with demonstrating the use of the language, explaining words that</p>	<p>Using manual mode with voice narration.</p> <p>4) Use manual mode with voice narration after automatic mode activity. Read activity provided at this stage out loud.</p>

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| <p>learners never familiarize with, providing some ideas, and engaging them to read [20].</p> <ul style="list-style-type: none"> - Direct learners to the words that they read from the left to the right and show the realization that the printed words are spoken equivalently [19]. - Use native language in conjunction with the second language [13]. - Repeated reading is beneficial to enhance children's understanding [23]. | <ul style="list-style-type: none"> - Ask students to read aloud with text highlights and following the voice narration. - Click picture hotspots to learning unfamiliar words. - Make use of the translation function that allows learners to see the narration and meaning spoken by students of the native language. - Click the repeat button or on the sentence that they would like to repeat the voice narration and practice more. |
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Using manual mode without voice narration.

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| <p>5) Encourage students to be active by using activities that include talking, listening, writing, and reading [20]. Students should be given the opportunity to use and explore language in contextually meaningful and cooperative activities [22].</p> | <p>5) Use manual mode without voice narration to encourage students to read aloud with their independent.</p> <ul style="list-style-type: none"> - Encourage students to interact with the program and ask them to take turns in controlling the e-book by themselves. |
|--|---|
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3. Speech emergence stage: Challenged speaking skill developing.

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| <p>6) Provide Students with opportunities to communicate what they know, think, and feel [10], [20].</p> <ul style="list-style-type: none"> - Engage students through questions, discuss the context and retell the story to improve oral expression and deepen comprehension [10]. | <p>6) After learning with the interactive e-book activities, provide discussion activities to practice oral and comprehension story skills.</p> <ul style="list-style-type: none"> - Motivate students to discuss what happens with the characters, scenes, and situations in the story to show their views and communicate with them to see what they perceive, think, and feel. |
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1.2. The current study

This study used a quasi-experimental research design. Thai Malay students used Yala, the southern border province of Thailand as a research setting and to collect the research data used in this paper. Thai Malays is a term referred to ethnic Malays in Thailand. They have cultural differences from the Thai people. Thai Malays majority speak Patani Malay in everyday life as the dialects influenced by the Malaysian language [24]. However, the academic language used in schools is still Thai. Accordingly, these LM students have learning obstacles in schools because of their lack of skills in using Thai language [25]. The researcher reasoned that these LM students were disadvantaged students, who should improve their academic language through the proper learning environments and approach.

The specific research questions were as follows: 1) how can an interactive e-book based on a natural approach to support academic language learning of LM students be designed? 2) Does the use of an interactive e-book improve LM students' academic language skills? 3) What is the difference in academic language learning outcomes between LM students who study with an interactive e-book and students who study with a printed book?

1.3. Study purposes

The purposes of the study were as follows: 1) Design an interactive e-book based on a natural approach to support academic language learning of LM students. 2) Test the LM students' improvement in academic language skills after studying with an interactive e-book. 3) Test the difference in academic

language learning outcomes between LM students group who study with interactive e-book and the group who study with a printed book.

The empirical evidence will back up findings of the study together with the natural approach to understand interactive e-book design environments that could affect language learning.

2. Method

The study was a quasi-experimental design and conducted in three phases as illustrated in Figure 1. The primary phase was design and creation of the interactive e-book. The secondary phase was testing the interactive e-book. The final phase was a publication to make the completed e-book available to the public.

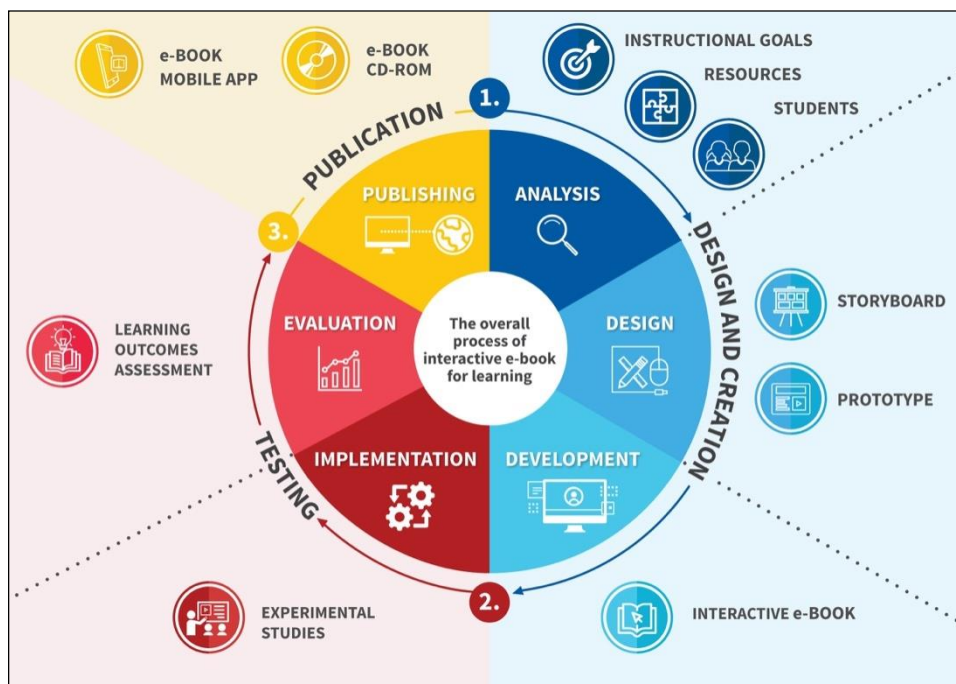


Figure 1. The overall process of the study.

2.1. Participants

The participants of the testing consisted of 54 LM students who used the Patani Malay language as a native and used the Thai language, the language of instruction in the school, as a second language. Participants studied in grade three (8-9 years old) from two classrooms. The experimental classroom had 28 LM students (13 boys, 15 girls) who studied with a teacher using the interactive e-book. The control classroom had 26 LM students (10 boys, 16 girls) who studied with a teacher using the traditional printed book.

2.2. Procedures

The 4-week intervention period, using a pretest-posttest design on word recognition and tone rules and only posttest design on story comprehension. Two elementary classrooms were selected for the study. These LM students were given a pre-test in the first step. The learning experience (50 minutes a day) aimed to support academic language skills using a natural approach. LM students assigned to an experimental group with the opportunity to learn with interactive e-book environments. The interactive e-book was used as a supportive learning tool in the classroom. The teacher and their LM students could project the e-book onto a projector screen. They could interact with the e-book wirelessly from a distance through an air mouse. The control group was provided to learn with a paper version of the e-book in a traditional classroom. Both groups were given a post-test as the last step of

the intervention. The determination to compare the results of the groups are made in order to explore whether there is a significant relationship between the language skill rates.

2.3. The pre and posttest administration

The pre and post tests were measured in both the experimental and the control group. The validity of the pre and post tests were evaluated by three content experts, who specialize in Thai language teaching. For finding the degree of the congruence over each question with learning aims, the index of item-objective congruence (IOC) was applied [26]. The validity was determined to be at an average of 0.90 (SD = 0.1), demonstrating strong content validity for the test. Moreover, The Cronbach's alpha reliability of the test was 0.83 which shows that the test was reliably accepted.

2.4. Data Analysis

A paired sample t-test was used for the statistical analysis to show the comparison of words recognition and tone rule that LM students used for their pretest and posttest. Furthermore, an independent sample t-test was employed to compare all three language skills outcomes (word recognition, tone rules, and story comprehension) between the two groups.

3. Description of the interactive e-book

The interactive e-book used the content “Mana and Manee” and has been copyrighted by the Ministry of Education of Thailand. Natural approach principles developed the guidelines of e-book features. The e-book had six chapters. Each chapter had two primary modes including the automatic mode and the manual mode. 1) The automatic mode: The chapter enabled the user to play from the first to the last page automatically. The user could control only using “stop,” “play” and “home” buttons. Each page included highlighted texts shown together with animation and was synchronized with voice narration. The teacher and students could replay this mode as often as needed. 2) The manual mode: This mode had two options which the user can choose to study as follows; 2.1) content with voice narration. In this option, the users could click the repeat button or the sentence that they would like to learn more. The translate button was optional that the users could click to support their story understanding from both the narration in an academic language and their native language. 2.2) Content without voice narration. The repeat button and translate button were disabled in this option view. Students should read the content by themselves. The text was highlighted when the user clicked the sentence while they are reading.

Also, this mode included activated hotspots that the users could click on to understand the story, and each chapter had a practice mode for reviewing and practicing word recognition, tone rules, and story comprehension. The example of the e-book is illustrated in Figure 2.

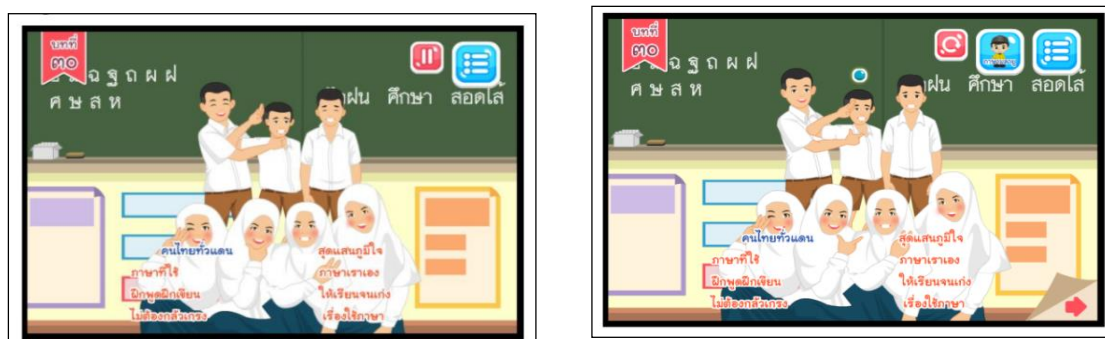


Figure 2. Automatic mode (left), Manual mode (right).

4. Result

Table 2. reported the LM students' improvement after studying with the interactive e-book. A paired-sample t test was conducted to compare the pretest and posttest on word recognition and tone rules skills. A statistically significant difference in word recognition skill conditions; $t(27) = -11.21$, $p = .000$ and tone rules skill conditions; $t(27) = -10.19$, $p = .000$.

Table 2. Pre- and posttest scores of experimental students on word recognition and tone rules skills.

Academic language skills	Score of experimental students		T
	Pretest	Posttest	
	M (SD)	M (SD)	
Word recognition	3.07 (2.07)	7.29 (2.12)	-11.21**
Tone rules	2.96 (1.31)	6.50 (2.02)	-10.19**

** $p < .01$.

To examine learning outcomes (word recognition, tone rules, and story comprehension) between students studying with the interactive e-book versus the traditional printed book. An independent sample t-test was conducted to compare learning outcomes between the two groups.

There was no significant difference in two language skills: The word recognition conditions; $t(52) = 1.11$, $p = .269$, and the tone rules conditions; $t(52) = 0.79$, $p = .066$. There was a significant difference in story comprehension conditions; $t(32) = 4.52$, $p = .000$. The findings are showed in Table 3.

Table 3. Differences posttest scores between experimental and control students

Academic language skills	Score of experimental group	Score of control group	t
	M (SD)	M (SD)	
Word recognition	7.29 (2.12)	6.54 (2.77)	1.11
Tone rules	6.50 (2.02)	6.00 (2.59)	0.79
Story comprehension	7.50 (1.03)	5.08 (2.54)	4.52**

** $p < .01$.

5. Discussion and conclusion

This research complemented existing study on interactive e-book design and testing for language learning by specifically examining on academic language achievement for LM students. The first research question dealt with the interactive e-book design based on a natural approach to support academic language learning of LM students. The findings revealed principles and stages of language instruction through the natural approach as design guidelines for the interactive e-book. Starting from these guidelines, the researcher can design effective and more engaging e-book for language experience in the classroom. A natural approach is well known and popular used in language learning especially in second language learning [13]. However, very few studies have been performed so far to assess the effectiveness in line with the language learning e-book design. This paper contributed to this research area.

The second research question was concerned with the students' improvement after studying through the interactive e-book. The testing results showed that the improvement from pre- to post-intervention in academic language learning with the interactive e-book. There was a statistically significant difference both for word recognition and tone rules tests. The results are in line with other intervention research conducted for similar purposes [7], [27], [28].

The third research question was concerned with the difference in academic language learning outcomes (word recognition, tone rules, and story comprehension) between the experimental and control group. The results showed that only the story comprehension test resulted in differences in the learning improvement of the experimental group versus the control group. It is interesting to note that, the content delivery structure based on the natural approach that the researcher designed was useful for story comprehension skill. These results confirm Kao, Tsai, Liu, & Yang' suggestion that interactive features should be designed appropriately to better benefit students' reading comprehension[9]. Based on the findings, the experimental students' improvement in tone rules was lowest score level. There are some other considerations in the research; for example, tone rules are one of the significant problems of Thai language learning.

Digital media technology has become an increasing part of daily life. More recent studies showed that digital media could have negative or positive effects [29], [30]. Therefore, it is essential to examine how an e-book can play a significant role in fostering language learning for students especially who have difficulty language learning. The findings of the studies suggested on the efficient e-book design and application. Educators should be concerned with application of the e-books that contain interactive features and compelling multimedia that are aligned with the content and based on instructional design principles [9]. As future work, it would be interesting to investigate the e-books with different options and different graphical style. Also, observational data for analysis on the engagement behaviors of students or how students interact with the e-books.

In summary, the findings of the study suggested the design and application of interactive e-book support academic language learning for LM students. The natural approach was considered as instructional design. This paper not only presented new guidelines for the design but showed the effectiveness of an interactive e-book in the classroom setting, which improves language learning, particularly in comprehension skill. To make the well-designed e-books, both interactive features issues and instructional design must be considered. More importantly, incorporating multimedia in the classroom, the interactive e-book potential could empower instruction through using appropriate multimedia tools and enhance learning achievement with the enjoyment.

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