CHAPTER 2: LITERATURE REVIEW

2.0 Chapter Overview

In this chapter, a theoretical overview is provided. As the study aims to investigate the effectiveness of interactive animated e-books compared to traditional paper-based books, this chapter will cover interactivity of e-books, multimedia features and possibility of interactive e-books’ being a supplementary tool.

2.1 Reading Comprehension

Reading comprehension is the process of understanding a text. Tomkins (2006) refers to comprehension as a meaning constructing process by using both the reader factor and the text factor. The reader factor include background knowledge, purpose, fluency, comprehension strategies, making inferences, and motivation. The text factor means structure, genre, content and vocabulary. Tompkins (2006) stated that these factors heavily influence students’ understanding. For example, if students have no purpose for reading, students may not read text fluently or have no interest in it. If students use comprehension strategies like predicting or visualizing properly, they may understand the text more efficiently. Also, if students have knowledge on or are familiar with different kinds of genres, vocabulary, and how authors organize and present their ideas, they can comprehend text much more easily.

2.2 Multimedia Effects and Reading Comprehension

When students read, they use linguistic and contextual knowledge to decode a certain text, which can be supported through the use of various kinds of multimedia such as texts, graphics, video clips and audio resources (Li, 2017). The author stated that the positive effects of multimedia on reading is based on dual-coding theory, which describes human memory as consisting of two separate subsystems: nonverbal systems (dealing with nonverbal objects and events including images) and the verbal system (dealing with language including words) (Pavio, 1986). The two systems are structurally and functionally different but, they are also interconnected, this means that an activity in one system can activate the other system.

Mayer (2003) suggested that pictures and words need to be presented together to promote meaningful learning - words refer to printed and spoken texts and pictures to static graphics (graphs, charts) and dynamic graphics (video and animation). Also, it is a prerequisite of multimedia learning situation that the representation of matching image and word is held in working memory simultaneously. The author recommended four methods to promote active cognitive processing within the constraints of the human information processing system: adding pictures to words, eliminating extraneous words and pictures, placing words near corresponding pictures, and using conversational style for words” (Mayer, 2003, p. 137).

Clark and Mayer (2016) also stated that learning through multimedia, which means static and dynamic graphics used with texts, helps students learn actively and make connections between visual systems and verbal systems. If we provide texts only without visual presentation, learners, especially inexperienced learners, may only engage in shallow learning. The authors, however, warned that not all visual aids are helpful in reading, suggesting that you need to minimize the use of graphics such as decorative graphics or representational graphic which simply demonstrate a single object whereas should include graphics such as transformational and interpretive graphics, which enable students to comprehend the material, as well as organizational graphics, which help organize the material. In addition, the authors stated that an animation or a video is not always superior to a static image. According to them, static images should be used except the case in which animations are known to be more beneficial: to illustrate procedures like showing how to make a paper flower and hat. Especially, when explanative illustration is covered during the class, incorporating static images seems to be more desirable because animations can cause unnecessary cognitive load, and put students in a passive learning process, which is caused by not being able to control the pace of an animation and depriving students of an opportunity to mentally picture the scenes presented.

Combined with visual aids, audio features can play positive roles in language learning. Tsous and her colleagues (2006) stated auditory stimuli like sound effects help students recall the story they read. A similar result was reported in the meta-analysis by Takacs and her colleagues (2015) in which multimedia feature such as music, sound, and pictures were beneficial in students’ language learning. On the other hand, there are times when sound effects cause negative effects on students. For example, Smeets and her colleagues (2012) found that the background music and sound negatively influences vocabulary learning of children suffering from severe language impairments. In addition, there are cases when audio representations should be valued over written words in e-learning programs. Sometimes using audio rather than words has psychological benefits because when human brain accept information, it is divided into two distinguished channels: auditory channels and visual channels (Clark & Mayer, 2016). As a result, if we present audio information instead of words, we could reduce the burden imposed in the visual channel where the information of words and pictures are processed. However, the preference of audio over words should be limited only to when graphics are complex or fast-paced and when spoken words are relatively easy and short to learners. If verbal material includes technical, lengthy or require for reference in the future, written words should be used rather than audio.

2.2.1 The Empirical Research about Multimedia

Positive relations between reading comprehension and multimedia effects were shown in multiple research papers. Children’s reading comprehension could be enhanced with multimedia content added to e-books (Smeets & Bus, 2013; Chamber, et al., 2006). That was possibly because children could relate details of illustration to story. Especially, camera effects of zooming in appeared to help children to find relevant detail and understand the story (Smeets & Bus, 2013). Takacs and Bus (2016) showed the important role of animated pictures in students’ comprehension. If animated pictures are congruent with story, children can benefit from animated illustration. In addition, motion pictures could engage four to six-year-old children’s attention. That is, children appeared to pay longer attention to animated condition compared to static one, which helped children enhance their comprehension of the story they read. The reason why their research is meaningful is that the result indicates that motion pictures are integral and should be included in interactive animated e-books. The finding supports de Jong and Bus’s findings (2004), who stated that animated pictures may not interfere with the process of children’s reading and understanding a story even when animation is incongruent with a story. They specified that although animation attracted children’s attention, it did not harm students’ reading comprehension. Children who read animated e-books could recall 50% of the story with using 8.5% of words used in e-books. The findings of the meta-analysis conducted by Takacs and her colleagues (2015) are in line with the other authors’ findings. From forty-three researches including 2147 subjects, they concluded that multimedia effects positively influence understanding of a story and vocabulary growth. That is, e-books with multimedia features helped enhance students’ reading performance much more than conventional books with static features.

Korat (2010) investigated the effectiveness of an e-book in Israeli children’s language and literacy, where forty kindergarteners and fifty first graders participated. In the research, twenty kindergartners and twenty five first graders were randomly assigned into an experimental group and a control group. The experimental group engaged in five e-book reading sessions and the control group only received regular kindergarten/ first grade program. The author found that children in the experimental group made greater progress in word meaning and word reading than those in the control group. Also, both age groups from the experimental group benefited from e-book reading when it comes to reading comprehension. Children studying with e-books could retell the story similar to that of the original story book. The research suggest that reading and listening books with attractive and amusing multimedia features can enrich young learners’ early literacy.

Tsou and her colleagues (2006) investigated how web-based technology affects teaching and learning in English as a Foreign Language (EFL) situation. 70 students from one elementary school in southern Taiwan were divided into two groups: an experimental group which engaged in an English class of storytelling and story recall aided by the Storytelling Website and the control group which received same storytelling class except the assist of the Storytelling Website. Students in multimedia computer assisted process appeared to retain more words, phrased and sentences. As a result the students in the experimental group could more fluently recall the story than the control group did. The authors believed that multimedia environment enables students easily recall the story with the help of visual and auditory stimulus. In a survey, students belonging to the experimental group more confidently expressed that they improved their language than those in the control group. The positive benefits of the website were also observed in the instructor in the research, reporting that when teaching students in the control group she feels nervous. On the other hand, she was more confidents when teaching students in the experimental group, and they appeared to concentrate more on the storytelling process by the colorful visual aids.

Many teachers agree that visual aids, which is a key feature of e-books, are helpful because they can help students concentrate and understand texts (Yunus, Salehi, & John, 2013). To be specific, in the research, 96.2% of the teachers out of 52 English teachers in Malaysia believes that the use of visual aids makes learning literature more exciting due to the effects of visual aids with sound, light and color. Al-awidi and Ismail (2015) found similar results in which the primary reason why teachers use CALL including multimedia features is to motivate students to read and to actively engage in reading process. Students may be more encouraged to read and learn with the help of pleasant and exciting features of e-books with multimedia functions.

2.3 Interactive Animated E-books

These days, most e-books include interactivity as a way to provide exciting learning experience and help improve students’ reading performance. These have become known popularly as interactive animated e-books. Interactivity and convenience of e-books can change the way our students read books (Schugar, et al., 2013) as the features are responsive to them as they engage with the text (Moreno & Mayer, 2007). Common interactive features are hidden hotspots, multimedia glossary, text-to-speech or games. Hidden hotspots refer to a function which is activated when users click pictures, words or sentences (Korat & Shamir, 2007). Once the hotspot of a picture is performed, it demonstrates the text in more detailed way. Thus, as readers get more visual information which was not accessible in an original text, they may be able to understand the story better. In addition, if a reader clicks a glowing word in a text, students are given the explanation of the word, which also assists reading comprehension because students can easily comprehend the meaning of a sentence with the aid of the definition provided.

Multimedia glosses is the function that allows readers to know the unknown word through a pop-up window (Marzban, 2011b). By clicking the word or a hyper link, students can get the meaning of the word in a certain type of gloss. He stated that there are four types of glosses: text gloss which provides written definition or meaning of a word, picture gloss which shows a static picture describing the word, audio gloss where a speaker reads the definition of the word, and video gloss which plays a video clip explaining the word. The biggest advantage of multimedia gloss is that students can avoid wrong guessing of a difficult word, and that children focus on unfamiliar words, which naturally promote word learning (Smeets & Bus, 2015).

Biancarosa and Griffiths (2012) described text-to-speech as a digital text read aloud by human or a computer-generated voice, which can be a tool to help people with visual disabilities or other language related disorder read a digital book and help develop early reading skills of young learners who cannot read by themselves. This function is also called a “Karaoke-bar” as words in a text are emphasized in synchrony with the voice (Smeets & Bus, 2013). The whole text as well as an individual words can be read aloud and highlighted when children click a sentence or a word. As a result, children can match sound with a word and a sentence, which helps increase the awareness of students on the letters and how they are pronounced. Furthermore, text-to-speech and read-aloud technologies can improve reading comprehension of students with reading difficulties although how the technologies works is unknown, signaling the necessity of more studies on this subject (Wood, et al., 2017).

Games are widely developed and used in an interactive e-books as a way to promote learning (Li, 2017). Interactive games allow learners to have an opportunity to practice a language while having fun. Thanks to reward and immediate feedback, learners can be easily motivated. But there are concerns over games because those engagement can distract students from paying attention to the story (Sargeant, 2015). Moreno and Mayer (2007) claimed that when developing games, the work should “be consistent with research-based principles of multimedia design and grounded in a research-based theory of how people learn (p. 321).

2.3.1 Effects of Interactivity

Students’ reading performance can be enhanced if interactive features are congruent with the story that students read (Korat, 2010; Takacs et al., 2015; Takacs & Bus, 2016). Kao and her colleagues (2016) investigated how two different levels of interactivity in e-books, high and low interactive electronic storybooks, affected students’ story comprehension, reading motivation, and chromatics concept. The result showed that students taught by high interactive electronic story books including features of guidance, prompt, and feedback performed better in all three areas than students using low interactive story books whose features only include simple interactive buttons with narration. More specifically, when it comes to reading comprehension, students using e-books performed better in literal and critical questions but not in inferential questions. The authors explained that the functions of guidance, prompt and feedback might have led to better story comprehension because those functions may have helped leaners connect newly learned knowledge with their life experience, because the functions might have made story easier to understand, and because high interactive designs might have made pleasant reading environment. Thus, we might believe that well-designed animated e-books with interactivity can play an important role in the classroom (Schugar, et al., 2013). Also, the relationship between students’ vocabulary growth and interactive features was reported in several research papers.

Smeets and Bus (2015) found that the functions of hotspots, which provide definition of words automatically when users click on or touch (hot) spots on animated pictures, efficiently had students pay attention to unfamiliar or difficult words. Combined with multimedia effects, hotspots positively contributed to students’ vocabulary learning. Specifically, when students read interactive animated e-books with multimedia features including pictures, sound, and background music, students exhibited 6% increase in word acquisition while student who read traditional static books learned 2% of the words. This growth was boosted by another 8% when hotspots were employed in animated e-books. Similar results were reported in the research by Marzban (2011a) undertook research to find out whether Iranian students’ reading comprehension can benefit from a CALL reading program which includes multimedia features. Sixty-female students aged from 18 to 25 voluntarily participated and those students whose proficiency level is intermediate were randomly assigned into four groups of fifteen, two experimental and two control groups. The experimental groups were taught by CALL instructional techniques whereas the control groups were taught reading by a traditional teacher centered method of reading where translation, structural analysis, and vocabulary memorization occupied. The result showed that there was a statistically significant difference between the experimental groups and the control groups, concluding that employing CALL in an English class can improve students reading comprehension. The author stated that as students do not need to suffer from peer pressure and anxiety while using CALL, students may learn English easily by taking an active role in language learning process.

Marzban (2011b), who investigated the effect of a multimedia annotation by comparing it with that of traditional paper text and dictionary. Students were able to access video or audio annotations while reading or answering questions. The results showed that by figuring out the meaning of unknown word with multimedia gloss, students’ reading comprehension skill could be enhanced. That was because students did not have to make a wrong guess when encountering difficult words. In addition, the function of gloss itself helped students pay attention to target words. With the finding, the author argued that CALL material designers, language teachers and administrators should consider what the right combination of modalities can be. Constantinescu (2007) also recommended that teachers who teach English to speakers of other languages should incorporate multimedia glossing into their reading classes so as to promote students’ vocabulary acquisition. He argued that as vocabulary and reading comprehension is closely related, multimedia glossing elicit better reading comprehension.

However, there are some researchers who think interactivity in e-books harm students reading comprehension. Sargeant (2015) emphasized that as engaging interactive features can distract students, interactive designers should ponder whether interactive features are helpful to students understanding. Schugar and her colleagues (2013) suggested less interaction time and less frequency of interactive features could mean better reading comprehension. In other words, if multimedia glosses take too much time or take students’ attention frequently away from the text, they could interfere with comprehension of stories. The meta-analysis by Takacs and her colleagues (2015) also showed some unexpected results about interactive features. When e-books with multimedia features were added with interactive features, or even when e-books only included interactive features without multimedia features, the interactivity in e-books prevented students from comprehending stories of e-books. That was possibly because interactive functions in e-books may prevent students from following the story and negatively influence children’s comprehension process.

2.3.2 Ideal Interactivity Design in E-books

Researchers agree that the design of multimedia learning is critical (Chambers et al., 2006; Constantinescu, 2007; Mayer, 2003; Moreno & Mayer, 2007; Korat, 2009; Sargeant, 2015). Mayer (2003) argued that how human brain works during learning process should be understood and considered when designing multimedia learning. The author (2007) proposed the following five principles of instructional design:

* Guided activity, which allows students to interact a pedagogical agent who helps guide their cognitive processing
* Reflection, which asks student to reflect upon correct answers during the process of meaning making
* Feedback, which provides explanatory feedback rather than corrective feedback alone
* Pacing, which allows students to control the pace of presentation of the instructional materials
* Pertaining, which allows students to receive focused pertaining that provides or activates relevant prior knowledge. (p. 316)

2.4 Potential of Interactive Animated E-books to Supplement Lack of Language Exposure

Interactive animated e-books have potential to be used as a supplementary tool for reading practice although they cannot deputize a real teacher (Schugar, et al., 2013; Biancarosa & Griffiths, 2012). First of all, interactive animated e-books can motivate students to engage language learning process with appealing multimedia and interactive features (Al-awidi & Ismail, 2015; de Jong & Bus, 2004; Korat, 2010; Takacs & Bus, 2016; Yunus, et al., 2013). This motivational advantage is especially important because there is nothing better than enjoying and having fun in the learning process in order to have student study a new language especially independently after school. When it is exciting and fun, students can naturally read books more than once, and enhance their language skills. For example, Korat (2009) investigated the effectiveness of repeated reading and how the age factor influence children’s early literacy such as vocabulary, phonological awareness, word recognition and story comprehension. Five pre-kindergarten classes of 108 and five kindergarten classes consisting of 106 participated in the research. Children of ten classes were randomly assigned to three groups: an intervention group of reading CD-ROM storybooks three times, another group of reading those books five times, and a control group in which children took the regular kindergarten program. The results showed that pre-kindergartners benefited as much as kindergartners. Especially, 4-5 years old children showed comparable comprehension level with kindergartners of 5-6years old children, which indicates as young as 4 years old children can understand and learn from the story. More importantly, the study suggested the importance of repeated reading. Children who read books five times seemed to learn more words and exhibited much more improvement in relation to word reading or phonological awareness than children belonging to the other groups.

Also, CALL including e-books might allow learners to take the initiative and be actively involved in learning process due to unique environments which CALL establishes (Marzban, 2011a). Shamir, Korat and Barbi (2008) stated that one benefits of interactive e-books is that learners can decide their speed of studying as most e-books provide buttons to go to the next or to the previous page. In other words, “self-pace tutorials lead to gains in self-questioning, error detection, inference, summarization, and concept-mapping skills and strategies to enhance reader’s use of reading strategies and comprehension of texts” (Biancarosa & Griffiths, 2012, p145).

Last but not least, e-book reading may benefit all levels of students from students with advance reading skills to even second language learners (Biancarosa & Griffiths, 2012). For example, Chen and her colleagues (2013) found positive effects of extensive e-book reading on university students’ reading attitude, reading comprehension and vocabulary growth. Forty six students in the experimental group were encouraged to read e-books of their interest based on their reading level freely for at least two hours a week during ten weeks of the experiment while the other forty three students in the control group did not engage in extensive e-book reading. The result showed that the extensive reading with e-books could positively