The effects of high/low interactive electronic storybooks on elementary school students' reading motivation, story comprehension and chromatics concepts

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ARTICLE INFO

ABSTRACT

Providing e-books does not automatically increase readers' comprehension. E-books must be designed to facilitate students' learning effects. We designed two versions (high/low interactive) of the electronic picture book titled "Color Monster's Adventure," which has a fantasy storyline and appealing art design, and embedded basic concepts of chromatology and color psychology. The low interactive e-book version contains only simple interactive buttons with narration, and the high interactive e-book version features the following three advanced functions: guidance, prompt and feedback. We conducted an experiment in a northern Taiwan elementary school with a total of 40 fourth-grade students. The results showed that the students in the high interaction group performed significantly better in reading motivation, story comprehension and chromatics concepts than their low interaction counterparts. We concluded by proposing a high interactive e-book model and providing suggestions regarding integrating proper scaffolding into designing the e-book content to improve students' reading performance.

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1. Introduction

Reading is a unique cognitive activity through which we comprehend various concepts and gain different knowledge and messages (Franceschini, Gori, Ruffino, Pedrolli, & Facoetti, 2012). Reading is viewed as the key to learning (Boekhorst, 2003; Gabrieli & Norton, 2012) and has a considerable impact on children's academic success and future cognitive development (Snow, Burns, & Griffin, 1998). Boekhorst (2003) indicated that an individual's knowledge could be expanded through reading; one's mind could be enriched and skills in different fields could be developed. Additionally, problem solving skills and critical thinking could be cultivated through reading (Ediger, 2002; Volentine & Tenopir, 2013).

However, for elementary school students, a large number of unfamiliar words could present a barrier to reading comprehension and lead to a lack of interest in the reading activity. To eliminate these learning barriers, many elementary school teachers have been using story books and incorporating reading strategies to enhance reading comprehension and reading motivation (Grimshaw, Dungworth, McKnight, & Morris, 2007; Lewin, 2000; Shamir, Korat, & Barbi, 2008). In the

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children's world, story and picture books play an important role. Many scholars have indicated that the story can not only cultivate creative thinking but also improve reading pleasure and interest (de Jong & Bus, 2003; Korat, 2010). Therefore, teachers could navigate students through the world of reading by integrating the children's favorite stories and pictures into learning materials, providing new learning strategies and applying various media in their classroom activities.

In today's digital world, spreading knowledge is no longer limited to the medium of paper. Increases in digital content and electronic books have initiated a wave of reading revolution, overturning the traditional reading experience. Take electronic storybooks, for example; the multimedia effects of electronic storybooks could effectively attract children's attention and reduce the heavy cognitive load of the large amount of printed text for children. The students might understand the content of the storybook easier and their reading motivation might be increased (de Jong & Bus, 2004; Doty, Popplewell, & Byers, 2001; Grimshaw et al., 2007; Lefever-Davis & Pearman, 2005; Pearman, 2008; Underwood & Underwood, 1998). To effectively enhance the effects of reading electronic storybooks for children, Graesser, Jeon, and Dufty (2008) and Mayer (2005) indicated that instruction designers should provide more assistance and guidance for young learners. Moreno and Mayer (2005) also indicated that multimedia-assisted teaching should include the following four interactive functions: reflection, guidance, feedback and interactivity. These techniques help to decrease the young learners' feelings of disorientation and frustration in learning and lead to improvement in reading performance.

Thus, if we could design a high interactive electronic storybook that guides students to observe details through related cues, provides appropriate questions for students to reflect on, and initiates instant explanatory feedback after the students have made their choices, these assisted functions should help the learners grasp the primary ideas and improve their reading performance. Therefore, we developed an interactive electronic storybook, "Color Monster's Adventure," which has a fantasy storyline and appealing art design, to introduce chromatics-related concepts to the students. The main plot tells a story about a mysteriously colored forest at the other end of the rainbow. The forest is the origin of colors, and color monsters that control various colors live in the forest. Different color monsters have their own powers and tasks. We aimed to learn (1) whether our electronic storybook could support students' reading motivation, story comprehension and chromatics concepts of learning and (2) whether this support differs for students with high or low interactive functions. The findings of the present study would provide empirical evidence to understand how different interactive designs of electronic storybooks might impact reading motivation and performance.

2. Review of the literature

2.1. Electronic storybooks

Electronic storybooks assist learners to construct messages and connect information by presenting a reading environment and process that extend beyond what is offered in traditional storybooks (Ertem, 2010). In particular, electronic storybooks provide a customized learning environment for the learners to explore at their own pace (Adam & Wild, 1997; Verhallen, Bus, & de Jong, 2006). With the development of technology and the popularity of multimedia, electronic storybooks provide animation and sound effects beyond that which is available in traditional storybooks and may support better reading motivation (Chen, Ferdig, & Wood, 2003; Ciampa, 2012b; Grimshaw et al., 2007; Korat, 2010; Morgan, 2013). Moreover, electronic storybooks that incorporate oral reading, sound effects, dynamic images, highlighted text, and interactions can improve an individual's reading comprehension by decreasing cognitive overload, burden of decoding words or grammar, and usage of working memory (Ciampa, 2014; de Jong & Bus, 2003; Pearman & Chang, 2010; Ricci & Beal, 2002; Schugar, Smith, & Schugar, 2013; Takacs, Swart, & Bus, 2015). It is urgent to develop appropriate learning aids for children to improve their reading comprehension and reading motivation by using this type of media.

Various issues related to electronic storybooks were studied in the past, such as reading comprehension (Grimshaw et al., 2007), reading proficiency (Evans & Gibbons, 2007; Moreno & Mayer, 2005, 2007), reading motivation (Ciampa, 2012a; Miranda, Johnson, & Rossi-Williams, 2012), reading literacy (Shamir et al., 2008), and word recognition (Lewin, 2000); the evidence suggested the positive effects of electronic storybooks. However, learners might feel disoriented and distracted by the abundant multimedia effects in electronic storybooks. The overuse of supplemental features, such as automatic reading of text, sound effects with graphic animations, and hotspots, might not only permit the children to ignore their learning goals but also decrease their reading comprehension (Ciampa, 2014; Pearman & Chang, 2010; Ricci & Beal, 2002; Schugar et al., 2013). Thus, educators should be cautious in incorporating reading skills/strategies in their instruction and interactivity into electronic storybooks to moderate over-reliance on these features to avoid cognitive overload and boost reading performance.

2.2. Interactivity

The interactivity features in multimedia learning environments are responsive to the users' actions and behaviors during reading (Moreno & Mayer, 2007). Several researchers have suggested that interactive elements, such as games and hotspots, were not beneficial to understanding the story content because the visual information would distract students from the verbal texts (de Jong & Bus, 2002, 2003; Rolandelli, 1989; Schugar et al., 2013; Takacs et al., 2015). However, several empirical studies have emphasized that the congruence between the interactive elements and the story line can simultaneously facilitate the processing of visual and verbal information and thus promote the