MULTIMEDIA AND ADHD LEARNERS: ARE SUBTITLES BENEFICIAL OR DETRIMENTAL?

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Abstract

This paper will present the preliminary findings of a pilot study. Participants were randomly assigned into one of two groups, those receiving instruction 1) with subtitles (redundant text); & 2) instruction without subtitles. A diagnostic test was used to categorize learners as 1) having symptoms consistent with attention deficit hyperactivity disorder (ADHD); or 2) non-ADHD learners. Two performance variables were considered (retention & transfer). Finally, learner cognitive load was also measured.

Introduction

Mayer (2009) describes multimedia instruction as including a combination of audio, words and pictures, which may be presented to the learner as animation, narration, visuals, and text. The use of these various forms of media spawned an intense debate in the 1990s (Clark, 1983; Clark 1994; Kozma, 1991; Kozma, 1994). Rather than considering a media-centric approach, Mayer proposed we should turn our attention to the learner and learning (Mayer, 1997; Moreno & Mayer, 2000). This learner-centered approach has led to the development of a wide variety of instructional principles for the design, and development of multimedia (Mayer, 2009; Moreno & Mayer, 2000; Moreno, 2006).

Several studies have found learners perform better given multimedia that includes narration and animation, as opposed to animation and text (Mayer, 2009; Moreno & Mayer, 2000). This was described as the modality effect (Penney, 1989), or the modality principle (Mayer, 2001). Much of this work revolves around the idea that a reduction of on-screen text during animated multimedia, helps learners to process their instructional materials (Mayer & Moreno, 1998).

However, a conflicting body of research has shown that bimodal presentation (or redundant text) during instruction can aid verbal recall, especially in those with learning disabilities (poor reading skills) (Montali, & Lewandowski, 1996). Evidence supporting these bimodal presentation techniques dates back to the 1970s (Halpern & Lanz, 1974; Kinchla, 1974). It should be noted that these studies only describe the presentation of text with redundant narration. This body of research was prior to the development of modern multimedia, which often includes concurrent animation, or the concurrent presentation of additional visual elements. Therefore, redundant visual elements like text (e.g. subtitles) during an animation sequence would likely cause a learner to split their attention between the animated visual elements, and the redundant text (subtitles). This is known as the split attention effect (Chandler & Sweller, 1992).

According to cognitive load theory, redundant visual elements (e.g. subtitles) may impede learning if those additional elements could be understood in isolation (Chandler & Sweller, 1991). According to Mayer's "cognitive theory of multimedia learning" (Mayer, 1997; Mayer, 2009; Mayer & Moreno, 1998) learners must integrate the verbal and visual information that they receive. Given narration and redundant text within multimedia, a learner may find this amount of information overwhelming.

Some learners tend to have increased difficulty with multimedia, especially if it is visually demanding. For instance, individuals with ADHD have a decreased ability to process visuospatial information (Alderson, Rapport, Hudec, Sarver, & Kolfler, 2010; Sowerby, Seal, & Tripp, 2011). Individuals with attention deficit or hyperactivity disorders experience a disruption in the processing of information in the visual and auditory information, affecting their ability to accomplish instructional objectives (Brown, 2009). Prior research has shown learners with ADHD tend to be inattentive while using longer non-narrated video segments or long text documents (Solomonidou et al., 2009). However little research has documented how well these learners are able to retain and transfer what they have learned, given complex multimedia.

Method

The sample included undergraduate (pre-service teachers) and graduate students from two large southeastern universities. After agreeing to participate in the study, learners were randomly assigned into one of two groups by a JavaScript. These groups will be presented multimedia that either includes 1) animation and narration (AN); or 2) animation, narration, and redundant text (subtitles)(ANT).

The subject matter of the multimedia was hurricane formation (Lewis, 2012). Following the instruction, all participants were administered a questionnaire (Likert scale, multiple choice questions, and open ended questions) collected via a web-based form. This questionnaire includes questions about content presented, the perceived difficulty of the lesson, difficulty of the instruction, their ability to attend to the lesson, perception of what they remembered, and demographic questions. Once learners have finished the questionnaire they were thanked for their participation.

Data Analysis

A subscale of 18 questions was embedded within a larger questionnaire. These questions were taken from a diagnostic tool, the ADHD Current Symptoms Scale Self Report Form (Barkley & Murphy, 1998). These questions are often used as a diagnostic tool to document ADHD symptoms. This study intends used this tool as a means of categorizing learners as either having symptoms consistent with ADHD, or as non-ADHD learners. We considered two sub-categories of ADHD (“impulsivity” or “inattentive/hyperactivity”). If a learner scored a 2 or 3, on 6 of the 9 items (within a category) indicates that individual experiences symptoms of impulsivity or inattentive/hyperactivity severe enough to impact their daily life.

In addition the questionnaire included a series of questions based upon the multimedia presentation. Nine multiple choice questions were used as means of measuring retention. Responses to three opened were scored to measure transfer.

Results

The results provided in this paper are those of a pilot study. The number of participants for this preliminary study was low (n=7) of which 2 individuals scored high enough on “the ADHD Current Symptoms Scale” to be placed in the ADHD group. One individual who met the criteria for impulsivity, was randomly assigned into the without subtitle group. The other ADHD individual met the criteria for inattentive/hyperactivity and was randomly assigned within the group with subtitles. The remaining participants did not score high enough for placement within the ADHD group. Two non ADHD learners were randomly assigned to the non subtitle group and three to the subtitle group.

Although the participant groups were small, trends as related to the research question can be identified. On the recall questions, the non ADHD participates on average scored identically the same with both groups scoring a 9.0. However, differences were noted between the two ADHD individuals with the with subtitles scoring better .6 average of correct answers as compared to the one who participated in the presentation without subtitles at .5 average of correct answers (See Figure 1). If this trend with ADHD were to be evident in a large sample, this finding would not be consistent with the well-documented “spilt attention effect” (Chandler & Sweller, 1992). As other

researchers have shown subtitles may assist individuals with ADHD, as they could be compensating for the slower visuospatial information processing.

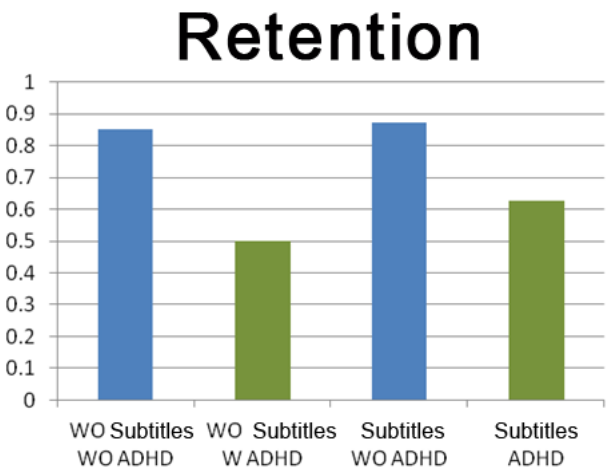

Figure 1. Average of Correct Answers of Recall Questions

The split-attention effect was evident in the transfer questions for the non ADHD group with average score of .5 as compared with the subtitle group score of 1.0. Both of the non-ADHD groups scored better than the ADHD individuals (See Chart 2). Neither of the ADHD individuals attempted to answer the transfer questions. One left them blank and the other wrote why they were unable to answer indicating they were unable to listen long enough to finish the 7.5 minute instructional presentation.

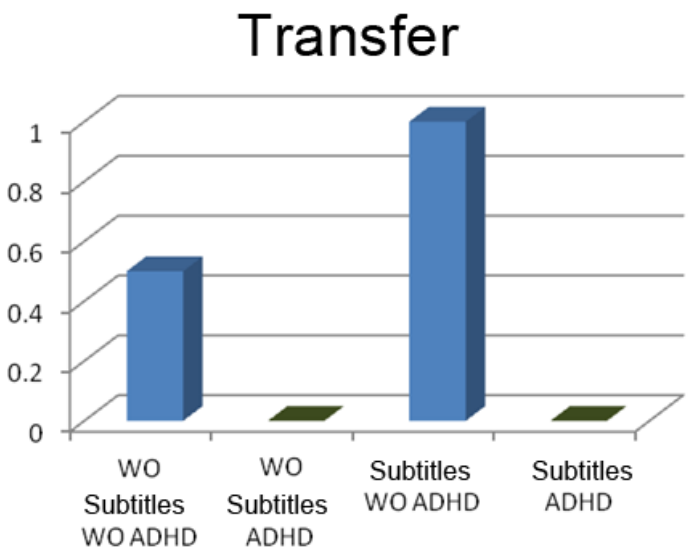

Figure 2. Average of Correct Answers of Transfer Questions

Discussion

The subtitles appear to cause non-ADHD learners to experience a cognitive overload as they process animation and text which splits the attention. Although no significant differences were noted given the retention questions, difference did emerge in the transfer questions. This is consistent with Mayer's "Cognitive theory of multimedia

learning" (Mayer, 2009). The opposite was noted with the ADHD participants. Perhaps the use of subtitles gave additional support to these learners resulting in a higher score.

The generalizability of this study is limited, due to the low number of participants. As more participants are considered, it will be interesting to observe if these findings continue to be evident. The inability of the ADHD participants to answer the transfer questions should also be explored. Would a different combination of audio and visual support improve their performance? For example, would an audio-only presentation be helpful for those with the slower visuopatial processing?

Conclusions

Several studies have shown that removing redundant material can improve learner performance as it reduces the load impacting learners as they attempt to learn new material (Kalyuga, Chandler, & Sweller, 1998, Kalyuga, Chandler, & Sweller, 1999). Mayer and Moreno (2002) found learners from the general population (without ADHD) who used redundant visuals during animated multimedia, performed poorer than those who did not have redundant visual elements. Therefore it is expected that ADHD learners will perceive redundant visual instruction (e.g. subtitles) as more difficult, because it is visually more demanding. However, based on this preliminary data collected, the individual with redundant subtitles were able to retain more information from the presentation than the individual without the redundancy. ADHD Individuals were presented materials both with, and without redundant text (subtitles) but did not answer the transfer questions. The information collected to date indicates these ADHD individuals performed better with redundant visual information. It is hoped that continued research (with a larger sample) will provide guidelines for those developing multimedia for learners with and without ADHD.

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