

Dr. Mohamed Ibrahim  
Arkansas Tech University  
Curriculum and Instruction  
College of Education

Re.: Final Report for the research paper presentation at the AERA 2012 Annual Meeting, Vancouver, Canada (Friday, April 13 - Tuesday, April 17, 2012)

**A.** Paper entitled “*The Relationship between Students’ Perceived Difficulty of Learning Materials and Knowledge Acquisitions in the Context of Instructional Video Designed Based on CTML*”

**B. Research problem:**

This study examined the relationship between students’ perceived difficulty of learning materials and their test scores after learning from the instructional video that is designed based on the cognitive theory of multimedia learning (CTML). The design principles employed include three multimedia design principles: divide learning materials into short units (referred to as segments), adding outlines and headings indicate the main ideas and structure of the video (referred to as signals), and finally by removing the extraneous materials that is not related to the learning goals (referred to as weeding) (SSW). The study employed two intact sections of an undergraduate entomology course (n=226, non-science majors) as the treatment and control group. The results indicated that there is relationship between students’ perceived difficulty and their knowledge acquisitions in the context of instructional video and that students’ learning outcomes are related to their mental effort reported by their perceived difficulty. Therefore applying SSW design principles decreases students’ mental effort and resulted in better achieving the learning goals.

**C. Research procedure**

This study used a quasi-experimental; between-subjects design to assess the relationship between students reported learning difficulty of the instructional video that was designed based on the SSW model (independent variable) and their learning outcomes represented by four dependent variables: 1) the perceived difficulty of the learning material, 2) conceptual knowledge acquisition, 3) structural knowledge acquisition, and 4) transfer of knowledge.

Participants were 226 undergraduate students enrolled in an introductory entomology course. There were 110 students in the SSW model group and 116 students in the no-SSW group. Males totaled 132 (58.4 percent) and females 94 (41.6 percent). Average age was 20 years old (SD = 3.08), with mean years in college of 2.3 (SD = 1.07). The video used is a professionally produced about insects, as well as another version of the same video designed by applying SSW

model: breaking the video up into 5 segments (i.e., segmenting), creating introduction and summary for each segment (i.e., signaling), and removing video fragments that were interesting but non-essential for students to understand the learning materials (i.e. weeding).

The paper-based materials consisted of a pre-test and post-test typed on 8.5 X 11 inch sheets of paper. The post-test included a one-question self-report of perceived video difficulty (cognitive load measure, a 20-question multiple-choice test covering all major concepts (conceptual knowledge measure), a 5-question multiple-choice test (knowledge transfer measure), and a 20-item sorting task to arrange the main concepts in distinct categories (structural knowledge measure).

#### **D. Summary of findings**

This paper investigated the relationship between students' perceived difficulty and their knowledge acquisitions in the context of instructional video and found that students' learning outcomes are related to their mental effort reported by their perceived difficulty of the learning materials (Salomon, 1984). While students in non-SSW video invested more mental effort to process the video and to accommodate the task demands of unorganized video, the design intervention in the SSW video condition assisted students in their cognitive processes and freed cognitive resources to process the learning content more efficiently. These results also indicate that perceived difficulty is primarily a function of cognitive load (if other cognitive processes are equal) and there is a positive and linear relationship between mental effort and the SSW design manipulation. Therefore the less we consciously design instructional video based on research based design principles, such as CTML design principles, the more mental effort that must be invested to achieve learning goals. This result could be explained by the increase number of items that students must process in working memory, the increase of the mental effort to successfully achieve meaningful learning and the less cognitive resources available to process all learning goals. Furthermore, this study found that video modification accounts for improvement in the higher order of learning (transfer test scores) over and above students' pretest scores and perceived difficulty.

#### **E. Conclusions and recommendations**

The results also support the underlying assumption that working memory has a limited capacity and that human mind can only process small portions of large amounts of visual and auditory stimuli at one time. In this study, the investigators used SSW principles to assist learners managing their cognitive processes and decrease their mental effort by focusing their attention on important aspects of the learning material, providing concise cues about relevant information, and guiding them to engage in organizing and integrating only the essential information. More specifically, SSW assist students to learn from the complex learning materials, such as instructional video, without imposing a heavy working memory load.