The Impact of Multimedia Learning on E-Learning

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October 13, 2013

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Introduction

Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2001) has potentially impacted how people learn for many generations. A variety of multimedia forms have been utilized in and integrated into instructional design systems. The scope of multimedia that has been used includes words, spoken words, text on pictures, photos, illustrations, animation, video, audio, narration and captions. They are transformed into instructional contents through a variety of formats, such as lectures, printed instructions, textbooks, handouts, web-based content, interactive simulation games, animation or videos.

The purpose of this paper is to investigate how multimedia impacts learners in e-learning environment based on CTML Mayer's multimedia learning theory (Mayer, 2009). First, I will introduce the concept of CTML and define the background and development of e-learning. Second, I will share analysis on how human mind interprets multimedia content in its learning process by comparing the concept of multimedia learning theory and the first principles of instruction (Merrill, 2012) and showing how they can work together to effectively impact e-Learning (Clark & Mayer, 2011).

Literature Review

This section of this paper introduces the concept of multimedia learning (Mayer, 2009). It also covers the fundamentals of e-learning including the background and the educational commonly used in current time.

Background of "Cognitive Theory of Multimedia Learning"

Humans and learning are never really separated from each other. There are several methods and theories that make an impact on humans learning and one of them is cognitive theory of multimedia learning (Mayer, 2009). In this learning theory, Richard

Mayer analyzes CTML and hypothesize that "people learn better from words and pictures than words alone" (see Mayer 2009 quote in paragraph 1 on page 1).

Mayer identifies that learning changes the experience and ability of the learner (Mayer, 2008). His work emphasizes three major learning assumptions of (1) dual-channel, (2) limited-capacity, and (3) active-processing assumption (Mayer 2001). Each assumption is based on how humans learn by integrating multimedia messages into their cognitive process.

One of Mayer's experiments was a lesson on how lightning storms develop (Mayer, 2009). He gave three different formats of instructions based on the measurement of retention and transfer— First, a 500-word long passage from encyclopedia in paragraph format; second, the "annotated illustration" (see Mayer 2009 quote in paragraph 3 on page 33) with words depicting the steps of lightning formation in a book-based format (Levin & Mayer, 1993); and third, the same messages presented as computer-based multimedia with narration lesson (Mayer, 2009). As a result, he concludes that the printed word format doesn't seem to work well. Students are unable to remember and transfer what they learn from a long explanation with time limitation.

When creating multimedia for instruction, it's important that the visual explanation be concise, coherent and coordinated (Mayer, Bove, Bryman, Mars, & Tapangco, 1996).

Definition and Types of E-Learning

E-learning is a broadly used term that includes all forms of educational technology that utilized in learning and teaching. There are two types of e-learning: Asynchronous targets self-study learners who access the courses at their own pace.

Synchronous e-learning targets learners that need an instructor to lead their learning as an online class in real time.

Background and Development of E-Learning

E-learning initiated in 1960 by University of Illinois on computer terminal where students could access the recorded course content remotely. Computer-based learning began rising in the early years of e-learning development. By 1994, CAL Campus presented its first online curriculum. As Internet grew through major telecommunication networks, the concepts of online-based school began.

The development of online education has rapidly been increasing (Clark & Mayer, 2011). In 2001, ASTD reported that approximately 11percent of training delivered via computer including internet, intranets and CD ROM, increased to 29 percent in 2006 and to36.5 percent in 2009 (ASTD State of Industry Report, 2010). The effectiveness of online instruction is considered equal to face-to-face classes, but not as effective as the combination of face-to-face and online methods. However, driven by economic conditions, people are concerned more about the cost of education than ever. With the evolution of computer and network technology, some organizations are switching from traditional face-to-face to e-learning because it eliminates the cost of a physical location and the time and cost commuting. However the quality of instruction remains a major concern.

The technology of e-learning has been continually growing in various formats including software and hardware both computer-based and web-based technology. There are a variety of technologies that have been used in both formal and informal learning, such as example, LMS, interactive simulation, virtual classrooms, blogs, social media,

social networks, webcams, tablets and mobile devices, whiteboards, screencast, and collaborative software. The development of educational technology has changed the learning environment and it affected how people learn over time.

The Impact of Multimedia Learning on E-Learning

By Means of Humans Learning and Interpreting Multimedia Content

The decision of how to design multimedia messages should reflect the underlying concept of how the humans mind interprets information. Humans change, when they apply their knowledge to their experience (Mayer, 2008). It is important to understand then how the human mind and brain works and how it processes information. According to significant brain research, effective learning can be maximized by how humans are taught. The brain consists of the left and right hemispheres, and they should be taught separately. On average, people use only 20 percent of their brain's ability, when it could be used more. Neuroscience finds that there are "silent areas" in the cerebral cortex that are not turned on by sensory or motor activity. Importantly, these silent areas are able to store high cognitive functions. (Bransford, Brown, Cocking, & National Research Council (U.S.)., 2004). This section will describe how learning works and explore the process of how people interpret multimedia messages.

Based on CTML, human perceives information and store it in sensory memory, working memory and long-term memory (Mayer, 2009). When human perceives the presentation of pictures through eyes and spoken words through ears, these presentation elements are held in a very short time in sensory memory. Because of the limited capacity of the human memory, human selects words and pictures that make sense to them and store them in working memory. The information becomes knowledge that the person can

apply to prior experience. When the knowledge have been applied and practiced

repeatedly, it will move to the long-time memory. The integration of information from

long-term memory to working memory happens when people see things that relate to

their prior experience. That's why multimedia has the potential to make a major impact

on learning.

So what happens if learners have too much information presented in words and

pictures? When a learning task requires more than a person's processing capacity, it is

called "cognitive overload" (see Mayer & Moreno 2003 in paragraph 2 on page 45).

Mayer and Moreno describes the three different types of cognitive demands: (1) essential

processing, (2) incidental processing, and (3) Representational holding (Mayer &

Moreno, 2003). These processing demands affect human learning. The problem with

multimedia learning may come from split-source information (Chandler & Sweller, 1991)

as it is called split-attention effect (Sweller, 1999) which creates a severe cognitive load.

In summary, understanding the process of how humans learn combining with the

concept of multimedia cognitive theory are definitely essential when designing

instructional multimedia messages. People can learn meaningfully and effectively.

The Comparison of Multimedia Learning to the First Principles of Instruction

There are many instructional design principles that have been implemented over

several years. Many current instructional theories and models suggest that the most

productive environments are those that are problem-centered and involve learners in four

phases of learning principles (Merrill, 2012). The activation learning principle is affected

when learners can activate their prior knowledge and skills to use as a base to create new

skills. The demonstration learning principle is affected when learners can demonstrate the

skills that they learn. The application learning principle is affected when learners can apply the new learning skills to solve problems. And, the integration learning principle is effective when learners can integrate the skills they learn into real-world activities.

How does multimedia learning affect the first principles of instruction? According to the level-one demonstration of instructional strategy, Merrill states "Learning is promoted when multimedia implements prescribed instructional events and functions" (see Merrill 2012 quote in paragraph 4 on page 24). He also suggests that multimedia in instructional products too often fail to enhance learning. It interferes with learning. Too often graphics have little relevance to the learning content or video and animation are used to make the instruction more attractive, and as a result it is most likely distracting learning. Multimedia format, navigation and interaction control make learning easier but they don't necessary promote learning. To enable effective and efficient learning, the appropriate implementation of multimedia is required.

The integration of CTML to the first principles of instruction creates effective learning by simplifying and shortening the learning process (Mayer, 2009).

The Impact of "Cognitive Theory of Multimedia Learning" on E-Learning (Mayer, 2001)

There are various types of e-learning environments such as synchronous and asynchronous, collaborative learning and linear learning that can utilize multimedia. Social media like YouTube and other repository media management sites affect and change how people teach and learn. Teachers can produce their own instructional videos and upload to YouTube in a day or create slideshows using PowerPoint, upload to their courses and have it available within a day.

The integration of multimedia in learning can affect learners in multiple ways. Merrill argues that multimedia instruction can interfere with the learning process if there are too many graphics (Merrill, 2012) or if there are not enough graphics it can be boring. These days, teachers use multimedia commonly as parts of their course instruction because it helps learners understand better than text alone (Mayer, 2001). Numerous web-based resources are increasingly available including video, virtual simulation, e-books, and open-source training such as Khan Academy, YouTube Education, and Google Course Builder. The combination of technology and numerous online resources can make teaching and learning easier. However, it could affect the learning quality.

Learning quality is affected by different factors; for example, the potential for cognitive overload (Sweller, 1999), extraneous material (Mayer, 2009), or decorative purpose rather than to promote learning (Merrill, 2012). On the bright side, the impact of multimedia learning on e-learning will continually grow, and learners will gain knowledge and skills at their own pace.

Conclusions

This paper includes three major components that answer how CTML creates an impact on e-learning. First, it describes the background and concept of CTML. Second, it explores the history, the background and the development of e-learning. Third, it examines how human learn and how that relates to CTML including the major aspects, learning goals and outcomes. Fourth, it identifies the differences between the first principles of instruction and CTML strategies. Finally, it discusses the impact of integration multimedia learning to e-learning in this generation.

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