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Conceptual Paper

Review: Relationship between Cognitive Theory and Multimedia Instructional Design

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Context/Background of the Learning Resource

The online learning resource selected is a short animation of normal labor and vaginal birth. This learning resource is intended for third-year medical students in Obstetrics and Gynecology class. The rationale of the learning resource understands the process of normal labor and delivery allows optimal care and reassurance for the parturient and timely recognition of abnormal events. Learning objectives of this lesson are first, to identify the different stages of labor and second, to recognize physical findings indicative of maternal progress during labor. The learning resource chosen had 469,543 views and was published May 2013. It was developed by 7 activestudio who won the Best Educational Content Creator Award last 2012 and the best choice of 3d animation studio for medical sciences with 140,769 subscribers.

Cognitivist Concepts and Principles

The learning resource is a cognitivist instructional design because this material can enhance learning by directing cognitive load in working memory, stimulating encoding into long-term memory, and reinforce learning transfer. A series of dynamic, graphical components that represent real-world phenomena, display a complex concept in an effective manner by substituting long printed descriptions with images in motion is

called ***animation*** [1]. Hasler (2007) also added that animations examine processes and movements, use of symbols to simplify complexities, using color or highlights to emphasize pertinent information. Therefore, learners experience both instructive and engaging in animations [2].

In animation I presented, medical students learn from words and pictures. According to Mayer (2008) [3], words enter the cognitive system through the ears (if the words are spoken), and pictures enter through eyes. To start with, the ears and eyes are not permanently stored in auditory and visual ***sensory memory,*** and afterward they move into ***short term memory. Working memory*** is a restricted limit processor that incorporates separate storage for auditory and visual information. Working memory, while limited in capacity, is the fundamental processor for thinking and learning. In order the learning takes place, new sensory data from auditory and visual systems should be incorporated into working memory to shape a coherent idea. After that, ideas should be rehearsed in working memory so that it will incorporates new ideas into memories that are existing called ***schema*** in ***long-term memory.*** When the new data is integrated into existing schemas this known as ***encoding.*** Long-term memory has a huge storage capacity. Nonetheless, encoding into long-term memory is insufficient. Due to the fact that all processing occurs in working memory, the new skills and knowledge encoded into long-term memory should be retrieved into working memory when needed to execute a task. The last phase is the cognitive basis for the transmission of learning.

The fundamental guidelines for animations are based in the ***Cognitive Theory Multimedia Learning (CTML)***. CTML supports and builds on established theories such as dual coding theory [4] and cognitive load theory [5]. According to Paivio, 1986, in ***dual coding theory,*** the images and words in are processed in separate, limited-capacity channel of working memory before incorporated into a single, coherent mental model, which is formulated conceptual framework of the subject matter at hand [4].

CTML also link to ***cognitive load theory*** which integrates learners' cognitive capacity for forming mental models into the designing of instructional materials, such as the animation. Sweller, 1998 emphasizes that an effective animation contains sequences of motion frames and presents the main characteristics of a concept in a manner that facilitates learning. Animations that achieve this goal are constructed with the student's cognitive capacity in mind and aim to enhance the balance among three types of cognitive demand: essential processing; extraneous processing, and generative processing. ***Essential processing,*** which sets an intrinsic load, is the cognitive processing innately required by the nature of the task to mentally represent the content of the lesson. ***Extraneous processing,*** which imposes an extraneous load, includes inefficient mental activities in which students engage when faced with not relevant learning situations like sound effects that are distracting and images that are separated from their verbal descriptions. ***Generative processing,*** which imposes a germane load, occurs when the student builds a coherent mental model of the subject at hand. This type of processing is extremely important for the student to comprehend the topic as well as the comprehensive domain of learning.

Strengths and Weaknesses of the Learning Resource

Managing Essential Processing

Pre-training Principle

Key terms in the selected learning resource were not described before the main content of the lesson. I believe that administering key terms prior the main lesson, learners experience less intrinsic load during the lesson because they are concentrating only on the content of the lesson rather than on content and vocabulary. Subsequently, learners have an increased capacity to efficiently develop schemas and mental models amid that time [1].

Modality Principle

The learning resource met the criteria of modality principle. The words were presented aurally instead of visually to make the most efficient use of both verbal and visual processing channels [4]. The significance for this principle rests in dual coding theory: when learning, learners can process data in both visual and verbal channels at the same time. If the learner uses his or her visual channel to process any pictures or animations, exhibiting on-screen text to pass verbal data merely divides the learner's visual attention and decreases the adequacy of the lesson [1].

Segmenting Principle

Medical students can learn better if the learning resource presented is a user-paced segments rather than as a continuous unit [1].

Minimizing Extraneous Processing

Coherence Principle

The learning resource had no unnecessary verbal or visual information that disrupts schema formation, thus, learners can focus on the relevant information.

Redundancy Principle

The learning resource presented same verbal information simultaneously in both aural and visual modalities overloads learners' cognitive capacity. There is no added on-screen text to narrated animation that compete with the animation for cognitive resources in the visual-pictorial channel, leading to split-attention effect [5].

Signaling Principle

The learning resource outlined the different stages of labor (Stage 1, Stage 2 and Stage 3) with descriptive title header. Using such organizational signals in an animation will help learners focus on the essential information and understand how each stepfitinto the overall process.

Temporal Contiguity Principle

The narration and pictures were presented at the same time, thereby enabling the learner to construct mental connections between them.

Spatial Contiguity Principle

The labels appeared next to the corresponding graphics. Adherence to these principles helps learners to reduce the unnecessary mental processing involved in trying to match segments of information that are far apart in time or space, and thus leaves more cognitive resources available for generative processing [6].

Facilitating Generative Processing

Interactive Principle

Learner control was generally limited in this learning resource. I would recommend that learning resource must have select button to reveal a label or definition of a given area of the image. Interactive features can minimize passive learning, able engage with the material and generate coherent mental models to facilitate understanding [2].

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