The Use of Commercial Computer-Based Training Design Software

Jenelle Ouimette
Instructional Design and Development
Professional Studies Department
University of South Alabama
Mobile, Alabama
jmo303@jaguar1.usouthal.edu

Rebecca Reese
Instructional Design and Development
Professional Studies Department
University of South Alabama
Mobile, Alabama
rmr603@jaguar1.usouthal.edu

Abstract: One of the most common problems developers of instruction face is cognitive overload. Cognitive overload occurs when information is not moved from short-term to long-term memory quick enough, thus causing a bottle neck or buildup of information. Multimedia software used in computer based training (CBT) can address this issue by delivering information via audio and visual channels, and incorporating learner choice. Captivate is a multimedia program that has been successfully implemented in our department and professional development. This program can be used to present difficult concepts with aid of visual and auditory components. Animation can be added to instructional text and graphics as well as audio to individual slides or the entire project. The use of Captivate provides educators with practical tool to take an active role in the reduction of cognitive overload and thereby increasing knowledge acquisition.

Introduction

When designing instruction, delivery method is a fundamental element that must be addressed. Depending on the content to be presented instructional strategies will vary, and their effect on learning is equally dependant on the media being used (Mousavi, Low, & Sweller, 1995). When designing computer based instruction, it is important for the developer to take into consideration not only cognitive load theory, but learner choice as well. By allowing the learner to feel they have control over their own learning experience, they become more engaged and often knowledge transfer and retention is increase. Cognitive load theory suggests that since working memory is limited, learners may be inundated by information and, if the instructional materials are not properly organized, will result in cognitive overload (Sweller, 1988). According to dual-coding theory (Paivio, 1986), memory systems are separate; one functioning as verbal memory and the other as visual memory that deals with image processing. By addressing both channels the possibility of cognitive overload is reduced.

In the design and development phase, it is important to choose a background that works for your project as well as one that is not overly distracting for your audience. With Captivate, animation can be added to your text and graphics as well as audio to individual slides or your project as a whole. Another important quality of commercial computer-based training programs is their ability for the learner to work their way through them and master the necessary skills at their own pace. As a developer, this feature is designed through the use of different layers and pacing of the material to be presented. Multimedia programs, like Captivate, allow instructors to emphasize difficult concepts, narrate images or slides, or allow a guest lecturer to share their experience while reducing the learner's cognitive load. In this article, we will incorporate research theories related to the problem of cognitive overload, how it can be addressed to improve knowledge acquisition.

Problem

Cognitive overload occurs when information is not moved from short-term or working memory to long-term memory expeditiously to allow for newer information to be processed, thus causing a bottle neck or buildup of information. Cognitive Load Theory, as defined by Sweller (1988), states that optimal learning occurs in humans when the load on the short-term memory is kept to a minimum. This facilitates the transfer knowledge into long-term memory. This theory builds upon previous research, which found that the short-term memory is limited to seven units of information plus or minus two (Miller, 1956.) Cognitive load is divided into three types: intrinsic, extraneous and germane. Sweller defines intrinsic cognitive load as the mental work imposed by the complexity of the content (Clark, Nguyen, & Sweller, 2006). Extraneous cognitive load is defined by Sweller and colleagues as the load that is not inherent within the instruction; instead it is created by the design and presentation of the instruction (Chandler & Sweller, 1991). It is the developer's goal to reduce the learner's extraneous cognitive load. Finally, germane cognitive load is the free space of the working memory. A primary belief of cognitive load theory is that instructional strategies are likely to be random in their efficacy, unless they consider the underlying cognitive schema of the learner during instruction (Clark, Nguyen, & Swellller, 2006).

The dual coding theory addresses the limitation of human learning. Dual coding theory (Paivio, 1986), states that cognition consists of two subsystems which process information simultaneously. According to Paivio (1986), the verbal subsystem, sometimes referred to as the auditory channel, processes and stores linguistic

information, while the visual subsystem, also known as imaginal, processes and stores images and pictorial information. While the two subsystems can be activated independently, it is the interactivity and relationship between the two systems that allow for the dual coding of information. When accommodating the dual functionality of this learning system, recall and recognition are increased by presenting information in both visual and verbal forms (Paivio, 1986).

To reduce the likelihood of cognitive overload, we suggest the application of the modality principle. Clark and Mayer (2003) explain the modality principle as incorporating audio narration to expand on a visual presentation, there by increasing knowledge transfer and reducing the risk of cognitive overload. We refer to modality as independent sensory channels which process visual and auditory represented material (Baddeley, 1992). “People learn more deeply from multimedia lessons when the words explaining concurrent animations or graphics are presented as speech rather than as onscreen text,” (Clark & Meyer, 2003, p. 93).

Process

One valuable step is the ability to branch, which is implemented in the designing of a computer-based training module. This allows the designer to guide learners through the module while still affording them the ability to participate in their own learning via individual choice. This is done through matrixes of choices and paths developed within the program itself. When the learner makes a selection, one answer will take them to a specific section of the program while another answer would take them to an alternate section. Take for example a true/false segment of a computer-based exam. If a learner selects true, the CBT then directs them to a new selection of material while false might direct them to a review of the previously learned material.

Learner choice can easily be implemented not just with questions after or during the lesson, but also through the ordering of material so long as the material does not have to be learned in an ordered step process. This allows learners to explore the various sections of a larger module through selection thereby increasing learner involvement and interest. For example, learners must acquire the skills of addition and subtraction sections of a math module before moving into the multiplication and division sections. However, learner choice would be allowable in a math module discussing the differences between the metric and standard measurement systems. It is not important if they explored the metric and then standard or visa versa. During the development of instructional material when the designer applies the dual coding theory, they are taking an active role to increase the enhancement of recall and recognition of content presented. To reduce the risk of cognitive load in instruction, we recommend the use of the multimedia software Captivate.

To aid educators and instructional designers in implementing the modality principle, a variety of multimedia software programs are available to fit any budget or content need. In our department, we have utilized the commercial software, Captivate to construct training as well as educate faculty and staff in building computer-based training modules. This program is user-friendly and allows our instructors the hands-on guidance that is necessary when learning a new program. The Captivate software can be used to create stand-alone projects that can then be implemented into an existing learning management system or offers its own learning management system for purchase. The program is ideal for designing training as well as developing quiz and test items, and makes the development and implementation of computer-based training effortless whether it is used at the university or the corporate level.

Conclusion

Cognitive overload is a dilemma experienced by learners of all ages. A multimedia presentation that incorporates multiple visual resources, such as a mathematical diagram and the text needed to explain the diagram, could overwhelm the viewer because they must now attend to two separate images simultaneously. On the other hand, an instructional module that shows the same diagram divided into integral steps with narration to describe the process provides for an improved learning experience. This is because the visual and verbal information is not competing for space, thus reducing probability for cognitive load. The solution presented here is only one of many possibilities. The use of Captivate software provides educators with practical tool to take an active role in the reduction of cognitive overload and thereby increasing knowledge acquisition.

Recommendations

Our recommendations are based on the formerly discussed theories, and more specifically that of Clark and Mayer (2003). “According to the cognitive theory of learning…people have separate information processing channels for visual and auditory processing.” (Clark and Mayer, 2003, p. 89). With the limitations of working memory, educators and instructional designers should look to increase working memory capacity by presenting auditory and visual information in conditions where by both sources of information are necessary to understanding, while avoiding redundancy of information.

References

Baddely, A. (1992). Short-term memory. *Science*. 255, 556-559.

Chandler, P. & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*. *8*(4), 293-332.

Clark, R. C., & Mayer, R. E. (2003). Applying the modality principle. *e-Learning and the science of instruction.* (p. 83-95) San Francisco: Jossey-Bass/Pfeiffer.

Clark, R.C., Nguyen, F., and Sweller, J. (2006). *Efficiency in learning: evidence-based guidelines to manage cognitive load.* San Francisco: Pfeiffer.

Miller, G. A. (1956). The magic number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review, 63*, 81-97.

Moreno, R. & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity effects. *Journal of Educational Psychology.* 91, 358-368.

Mousavi, S. Y., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Educational Psychology, 87*(2) 319-334.

Paivio, A. (1986). *Mental Representations.* New York: Oxford University Press.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12, 257-285.