Applying Instructional Design Theories to Improve Efficacy of Technology - Assisted Presentations

Sunil Hazari

Abstract

Technology-assisted presentations (such as PowerPoint) are widely used in business and education. While presentations of this type provide an opportunity to easily create and integrate media-rich elements such as video and audio, a deeper understanding of instructional design principles that also incorporate learning theories is needed to develop pedagogically sound presentations that address different learning styles of an audience, or to effectively meet learner goals and outcomes. Using the context of an Information Security course, this article explores application of instructional design theories for the purpose of developing effective technology-assisted presentations.

Keywords: Presentation software, Instructional Design, Interactivity, Teaching Effectiveness

Introduction

Delivering information by using technology-assisted presentations has become very common in business and education. Technology-assisted presentations make it possible to deliver information using a "richer" format such as multimedia elements that include animated graphics, audio, and video. When delivering presentations, there is usually an element of teaching and/or learning for which the presentation is created. This article examines how existing instructional design can be used to improve efficacy of technology-assisted presentations. For the purpose of this article, efficacy is considered to be the ability to communicate/share meaning, interpretation, or message. Since coverage of all instructional design theories and models would be beyond the scope of this article, only the ones that are best fit for use in technology-assisted presentations are covered. Technology-assisted presentations in this article are defined to be those created using presentation software such as Microsoft PowerPoint. The purpose of this paper is to look at instructional design within the context of presentation software, and recommend how effective presentations can be developed to address constructs such as motivation, constructivism, multimedia learning, and information processing. The theories and models of instructional design presented below are further explained in the context of an Information Security course taught by the author in two different environments: a face-to-face lecture/discussion format, and an online distance learning environment that used synchronous (e.g. online chat) and asynchronous (e.g. e-mail, discussion forums) modes of communication.

Elements of Technology-Assisted Presentations

Technology-assisted presentations can offer the flexibility of creating instructor-controlled or group-centered approaches in delivering instruction. The general types of presentations that are used in education/training can be categorized into five main types:

- Level 1: Informational presentation by live presenter. No interaction from the audience.

Level 2: Supplementary presentation for the purpose of highlighting issues. Audience has access to previously distributed notes or handouts and can refer to them when the presentation is being delivered.

- Level 3: Presentation with audience interaction. Presentation elements include creating knowledge by using the concept of Bruner's (1990) discovery learning.
- Level 4: Presentation combined with evaluation/assessment. Using integrated tools, these presentations incorporate quizzes, flash cards, multiple-choice items, etc.
- Level 5: Self-paced presentation, no live presenter. These presentations incorporate video of instructor, audio, graphics, and other interactive elements used to inform, instruct, and assess mastery of learning.

In business and education, technology-assisted presentation software has had a dramatic effect on the communication process. When used effectively, programs such as PowerPoint can create presentations that are economical, flexible, and easy to prepare (Ober, 2003). Technology-assisted presentations offer to the audience an appealing and simple way to process the information being presented. In most cases, when making a presentation, information about subject content is disseminated to a group of learners. Presentations are usually delivered to a group with the presenter either being physically present in front of a class, or delivering the lesson to virtual sites using video conferencing in distance learning environments. The presenter may use technology-assisted presentations to simply deliver information, demonstrate a concept, brainstorm an idea, get feedback from the audience, show a video clip, or use the presentation as a interactive whiteboard.

Advantages of this type of presentation mode are that it is a widely accepted form of delivery; information can be delivered to a large group simultaneously, it can be modified quickly; and the software makes it easy to design and develop presentations. An interactive presentation also provides opportunities for the audience to ask questions based on information presented, interact with the presenter, other members of the audience, or the subject matter content. Some disadvantages associated with presentations are the fact that they use a one-way delivery method where the instructor has most of the control associated with the pace and delivery of learning. Since the presentation may have been designed to address one type of learner style, students cannot participate individually and control the sequence of instruction; retention of learning cannot be guaranteed since there may not be an opportunity to conduct assessment when the subject matter is delivered. Despite these disadvantages, presentations remain the most conventional format for presenting information.

With computer technology being widely available, presentations today are enhanced by using software that is user-friendly and does not have a steep learning curve. Use of presentation software provides opportunities for the presenter to easily incorporate a variety of design styles, text, graphics, and multimedia elements, and edit content based on specific needs. Presentation software also helps users create aesthetically pleasing, on-screen representations of important information to be shared with a group. Traditionally, presentation software was used to present information in the form of slides that follow a linear order. New versions of software now allow users to create a branching effect within a presentation using hyperlinks similar to Web browsing. Microsoft PowerPoint is one common example of software that is sold as part of the MS-Office suite of productivity software. Some other vendors and products of presentation software are Lotus Smartsuite, WordPerfect Office, and Star Office Suite. Today's presentation software can also integrate spreadsheets, databases, and web services as integral part of the learning unit. Using Internet (or Intranets), presentation software also makes it possible to create various types of presentations for local or online delivery. Most software also includes standard templates that are pre-designed to help create presentations for various occasions and purposes, such as selling a product or service, introducing a speaker, brainstorming, facilitating a meeting, motivating a team, presenting a business plan, developing a technical report, or creating an instructional video. As can be seen from these examples, the broad nature of presentation software can serve various purposes such as to aid instruction, share information, or demonstrate a concept. In all these examples, there is an element of learning. For the purpose of this article, "learning" is defined as a construct that causes change in the cognitive domain.

Instructional Design

Presentations should be tailored to learner goals and outcomes. Design of instruction needs to be structured within the context of elements available for use in the presentation software. This can be achieved by using principles of instructional design. Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the process of analysis of learning needs and goals, and the development of a delivery system to meet those needs. According to Berger & Kam (1996), it also includes development of instructional materials and activities, and tryout and evaluation of all instruction and learner activities. Using instructional design principles, technology-assisted presentations can be designed to encompass a range of formats that can vary from simple drill and practice exercise type presentations for individual or group learners, to creating scenarios using text, graphics, audio, video, presenting this to learner(s), and discussing together problem-based activities (to reflect the constructivist environment). Instructional Design also establishes a structured framework for designing lessons. Kemp (1985) states that proper sequencing of instruction is important to learning. Kolb (1984) has shown that students prefer to learn in an environment that reflects the cognitive style in which they are most comfortable and also when the instructional method used for teaching matches the student's learning style (Gordon, 1995). Sequencing of information (that is also important in developing presentations) is attributed to theories of Bloom and Gagné. Gagné (1977) describes a cog-

nitive sequence of facts, concepts, principles, and problem solving in which each level of the sequence depends on mastery of the preceding level. Gagné's sequence of instruction is based on the cognitive information processing learning theory (that states it is important to present all necessary lower level facts before proceeding to teach at higher levels of the knowledge hierarchy). The theory outlines nine instructional events and corresponding cognitive processes: (1) gaining attention (reception); (2) informing learners of the objectives (expectancy); (3) stimulating recall of prior learning (retrieval); (4) presenting the stimulus (selective perception); (5) providing learning guidance (semantic encoding); (6) eliciting performance (responding); (7) providing feedback (reinforcement); (8) assessing performance (retrieval); (9) enhancing retention and transfer (generalization). These events provide the necessary conditions of learning and serve as the basis of designing instruction.

Using the context of the Information Security course, presentation software slides were designed (see Figure 1) to gain attention by using multimedia clips of how an organization's bottom line can be improved by performing Risk Assessment. This presentation was used in the face-to-face course, as well as the online course in which there was no instructor intervention at the time the student was watching the video clip. Textual information on the slide made learners aware of lesson objectives that also included a unit on Information Systems Auditing, Vulnerabilities, Threats and Countermeasures that organizations should be aware of to maintain enterprise security. Supporting information using external web sites that had information about information security products could be explored for learning guidance, and quizzes on material presented can be used to give immediate feedback of mastery of learning. In the face-to-face course, the instructor showed a video clip in which the industry expert conveyed information about auditing and assessment, as well as differences between them. The expert noted that assessment goes beyond auditing because it looks past a checklist of item to examine extent of vulnerabilities and how to secure these by using countermeasures to minimize threats from external sources. Following the video clip, instructor led discussion centered on the importance of Risk Assessment to protect corporate assets. For the online course, students were able to view the presentation on their own by accessing the slides remotely. There was no instructor intervention when a student was watching the videoclip, but the online student was able to take a quiz that addressed topics covered in the video clip and get feedback on learning. Using the information presented above, Gagné's principles were incorporated in the presentation by using the video clip as stimulus for learning, providing guidance for learning, asking students to respond as well as discuss content presented in the video clip, taking a quiz (as an individual or as a group), and assessing performance.

Presentation levels 3, 4, 5 (as defined earlier) can be accommodated in this type of presentation.

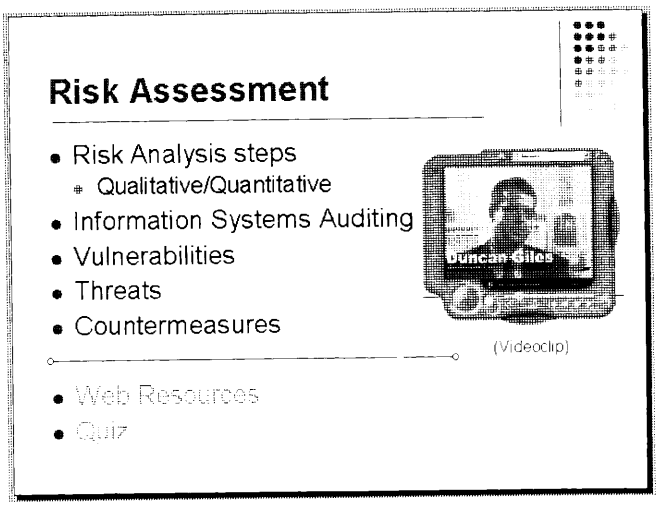

Figure 1: Use of text, multimedia, external resources, and assessment

Bloom's (1984) taxonomy of cognitive domain lists six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. When developing presentations, sequencing of content can be controlled by the presenter. This can be done using appropriate "builds" that allow certain information to be shown at a specific time or condition depending on feedback from students, as well as an opportunity to ask questions by splitting the content into logical and manageable units (benefits of this explained later under Ausebel and Reigeluth's theories). For example, presenting a unit on Firewalls in the area of Information Security, the following presentation can be developed using Bloom's taxonomy of learning.

Knowledge: Define the term firewall to the audience as it relates to Information Security.

Comprehension: Explain to the audience how firewalls work at the Applications Layer of the 7-Layer OSI (Open Systems Interconnect) model.

Application: Illustrate, through examples, the benefit of having a firewall outside versus inside the network perimeter.

Analysis: Compare and contrast features of two firewalls manufactured by different vendors.

Synthesis: Propose a firewall setup for an online bank.

Evaluation: Compare results of hacking attempts between pre and post firewall implementation periods.

Kemp (1985) has also identified other factors such as individual differences in learners (learning styles), clearly stating learning objectives, mo-

tivating learners, systematically integrating external resources and multimedia, providing feedback and reinforcement that establish a foundation for satisfactory learning. For presentations that are used in teaching, the subject content must be structured according to logical sequence as stated by Gagné (1977). In text format, this can be arranged in an outline format showing sequential, chronological, procedural, or factual relationship. To demonstrate this relationship better, presentation software lends itself well (especially for visual learners), by allowing a map of the content structure to be created which allows the audience to easily see the relationship between elements of content. Standard flowcharting tools (beginning/end, information function, action, decision point, connector etc.) are available in most presentation software to develop visual aids. Also, by presenting information in a preview format (such as by using bullet points of lesson content on the first slide), information can be made meaningful to the audience by helping the learner make connections to new knowledge within the existing schema of the learner. To avert undesirable side effects of using technology which may make presentations appear as canned or without student interaction, many experienced presenters insert 'Question Slides' throughout their presentations. This serves to moderate the presenter's pace and encourage students to become more active learners. The use of Advanced Organizers was first proposed by Ausubel (1960). Advanced organizers provide a preview of upcoming material by visually depicting themes or broad concepts to students. Presentations developed by using Advanced Organizers can make new material familiar to students, help provide a structure for integrating new knowledge within the existing knowledge base, thereby making the content more meaningful, and helping students better retrieve and retain materials at a later stage. Advanced organizers can also be enhanced by use of "progressive build effects" that gradually reveal textual and graphic elements within a slide at a particular time giving the presenter an opportunity to synchronize the appearance of informational elements with verbal commentary. This technique has been shown to reduce cognitive load for learners as well as focus attention on critical information resulting in improved learning. The example shown in Figure 2 shows the use of Advanced Organizers and progressive build in the Information Security course to set the tone of a presentation by listing topics that are to be covered in detail during the presentation. The topic in this case deals with how Return on Security Investment (ROSI/ROI) is calculated. ROI is a function of Net Present Value and amount of capital needed to make this investment. NPV is the difference between present value of the receipts and present value of the expenditures. There is usually a return to the company for making the investment which is used to capture the Net Present Value of the project.

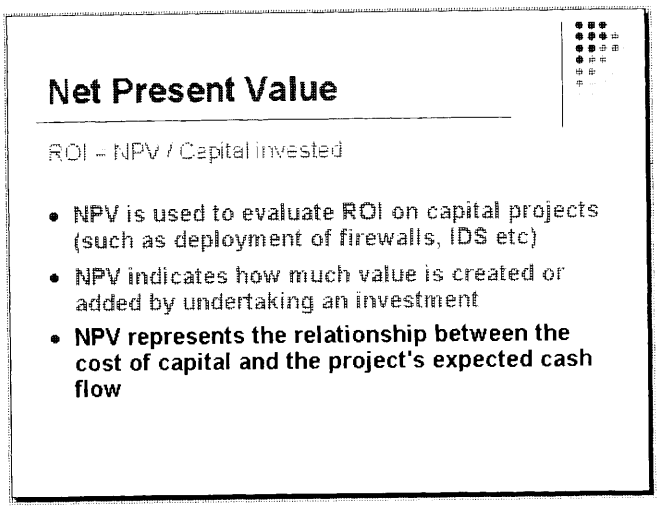

Figure 2: Use of Advanced Organizers and build effects (shown in lighter shade of color)
[Author's note: Although the print quality in the figure makes the first two bullet points appear very light especially in black/white print, and it is difficulty to show transitions in a static paper medium, the figure attempts to demonstrate an important concept of using progressive builds]

On showing the slide, it is not uncommon to see too much information being presented all at once on the screen. Because of this, the students may start taking notes to capture all material before the instructor advances to the next slide. But by using builds, when the slide appears, only the title ("Net Present Value") is shown. This establishes a structure for presenting new knowledge. Next, the formula is shown and acronyms in the formula can be inquired from students. (Note that at this time, the rest of the slide is blank). Definitions of formula elements can be expanded upon and when this concept is clear, the first bullet point that provides a textbook explanation of NPV is seen by the students. The verbal commentary is used to further reinforce concepts one line at a time, thus minimizing cognitive load for the students by helping them focus on relevant information at one time. Following the presentation of information on the slide, students are asked to discuss what would be the best financial choice for the company given different values of NPV. This type of presentation works best with an instructor led discussion, i.e. Presentation levels 1-3 (as defined earlier).

Constructivism

Constructivism is inquiry-based, discovery learning in which learners construct personal interpretation of knowledge based on their previous experience and application of knowledge in relevant context. The use of this concept in technology-as-

sisted presentations would be most relevant to Levels 2 and 3 (defined earlier) in which there is group interaction and the presentation is used to facilitate this interaction. For example, given a topic, student teams work together (teams may also be at remote sites) by accessing presentations located in a shared workspace so team members can create task lists, update relevant portions, and include content and links to various internal and external resources. In designing learning environments, researchers (Honebein, 1996; Lebow, 1993, Knuth & Cunningham, 1993) have recommended using constructivist theory for effective learning. The constructivist theory and instructional strategies focus specifically on students' motivation to learn and their ability to use what they learn. Constructivist strategies attempt to account for and remedy perceived deficiencies in behaviorist and information-processing theories and the teaching methods based on them (Buck, 2003). The constructivist approach incorporates pedagogical goals in the knowledge construction process by providing appreciation for multiple perspectives, embedding learning in relevant contexts, encouraging ownership in the learning process, embedding learning in social experience, encouraging use of multiple modes of representation, and encouraging self awareness of the knowledge construction process (Vygotsky, 1986; Bruner, 1990).

Using presentation software, it is possible to design visual formats so that mental problem solving models can be built by the audience viewing the presentation. Providing this format along with interactive question and answer screens can increase learner involvement. Other visual stimuli such as tables, charts, scanned images, and video clips can address the needs of learners having different learning styles such as field dependence, field independence (Witkin & Goodenough, 1981), or the learning styles defined under Gregorc Style Delineator that measures mediation or cognitive abilities using the four characteristics of Concrete Sequential, Concrete Random, Abstract Sequential, and Abstract Random (Gregorc, 1985). In recent years, the relationship between learning styles and rich interactive media environment that uses hypermedia for navigation (one of the characteristics of presentation software) has been studied by researchers (Ayersman, 1993; Liu & Reed, 1994; Toro, 1995). In these studies, it was found that differences exist in students' performance when they were engaged in cognitive tasks, and based on their learning styles students acquired information in different ways by either creating their own structure, relying more on one type of information (text vs. video). As students experience with the hypermedia environment increased, they were able to better navigate within the environment, but the ability to process, interpret, store, and recall stimuli were different based on the learning styles. This indicates that presentations need to be created to accommodate different learning styles of members in the target audience. Use of Multimedia and group discussions following the presentation was shown in Figure 1 earlier. This type of presentation would be best suited for Level 2-4.

Elaboration Theory

The Elaboration Theory by Reigeluth (1992) applies instruction to the cognitive domain. This theory is more focused on teaching sequences and cause-effect relationships rather than general facts. It is an extension of Ausubel's use of Advanced Organizers (mentioned earlier) to establish learner contexts and provide better control of the learning environment. Key elements of this theory refer to how instruction should be organized from simple to complex sequence to provide better retention and motivation in learners by demonstrating a sequence of tasks. The theory emphasizes development of a meaningful context into which the sequence of ideas is assimilated. Elaboration theory further proposes seven strategy components. These are: elaborative sequence, learning prerequisite sequences, summarizing, synthesizing, using analogies, cognitive strategies, and learner control. The theoretical framework has been applied to a number of settings in higher education and training (English & Reigeluth, 1996; Reigeluth, 1992). Hoffman (1997) has extrapolated Reigeluth's theory into the area of hypermedia by showing how different types of learning modes can be used for effective instruction using the elaboration theory.

One of the topics covered in the Information Security course was on Database Security. Because of a mixed audience of technical and non-technical students taking this MBA course, it was important to demonstrate the step-by-step sequence of how databases that form the vaults of many e-commerce sites have to be secured. For demonstration purposes, a popular industry software (Lotus Notes) that students had access to for hands-on exercise was used. Figure 3 shows presentation of core principles of securing a Lotus Notes database. Initially, the general idea about security attributes of databases was mentioned (this could be applicable to any database ranging from MS-Access to Oracle), and following this, steps taken to establish security using roles at different levels was explained. The broad concepts to focused application sequence represents a "cognitive zoom" for the learner to absorb information that is made familiar to the user by sequencing and using cognitive-strategy activators that use pictures, screenshots that help the user create a mental image and apply it to the software being studied. This type of presentation that shows specific sequence of actions and events can be applicable to Levels 1-6 presentation.

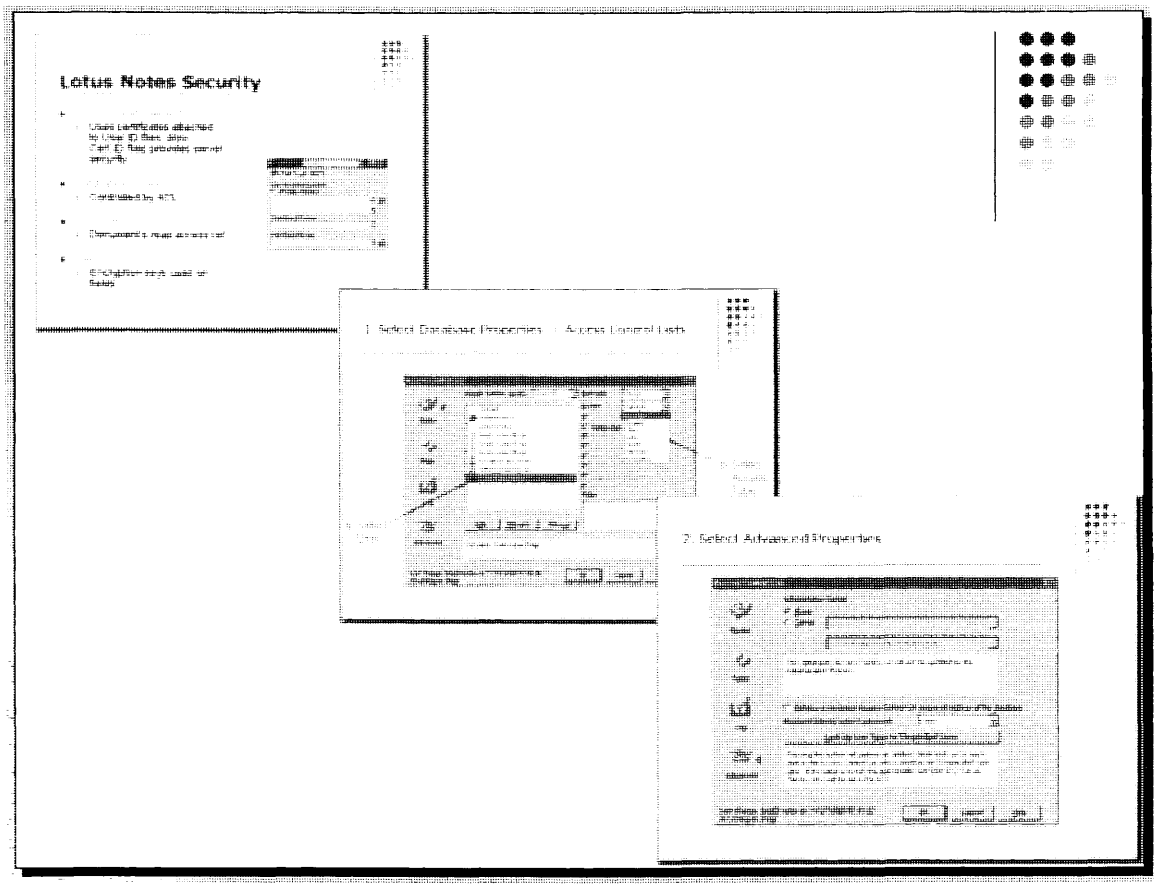

Figure 3: Sequencing instruction using Elaboration theory (Note: To show link, the three individual sequential slides are shown as one)

Dual Coding Theory

Developed by Paivio (1991), the Dual Coding Theory (DCT) uses the role of imagery in associative learning. Paivio's studies marked the first systematic objective measurement of the effects of imagery on memory. The theory states that memory has two separate but interrelated codes for processing information, one being Verbal and the other Visual. These can be activated independently, but there are interconnections between the two systems that allow dual coding of information. The interconnectedness of the two systems permits cueing from one system to the other, which in turn facilitates the interpretation of information being presented. Each of the two systems has different functions. The verbal system processes and stores linguistic information, and the visual system processes and stores images (Saavedra, 1999). There are three levels of processing that occur within or between the two systems. 1) Representational processing which is the activation of one type of code by the corresponding type of stimulus; 2) Referential processing which is the cross activation between either system; and 3) Associative processing – activation of additional information within either system. DCT states that information is easier to retain and retrieve when dual-coded because of the availability of two mental representations instead of one. Images are more likely to activate both coding systems and are easier to remember than words. Information in the visual system is recalled more quickly because it is a synchronous process, whereas verbal system is sequential.

In the example shown in Figure 4, the Open Systems Interconnect (OSI) model is being explained by using a graphic that shows building blocks and their function in transmitting data. Use of images and color help with gaining students' attention, providing textual information, relating this with visual information, showing a sequence, and helping arouse curiosity about the topic by presenting a fun and easy way to remember information that may be tested for recall at a later stage in a quiz or test. This helps reinforce the connection between the sequential order in which data communications travel between the seven layers of the OSI model, as well as support recall of information by remembering a certain phrase. This type of presentation that shows text but relies heavily on visuals and making connections to facts being presented can be applicable to presentations in Levels 1- 6.

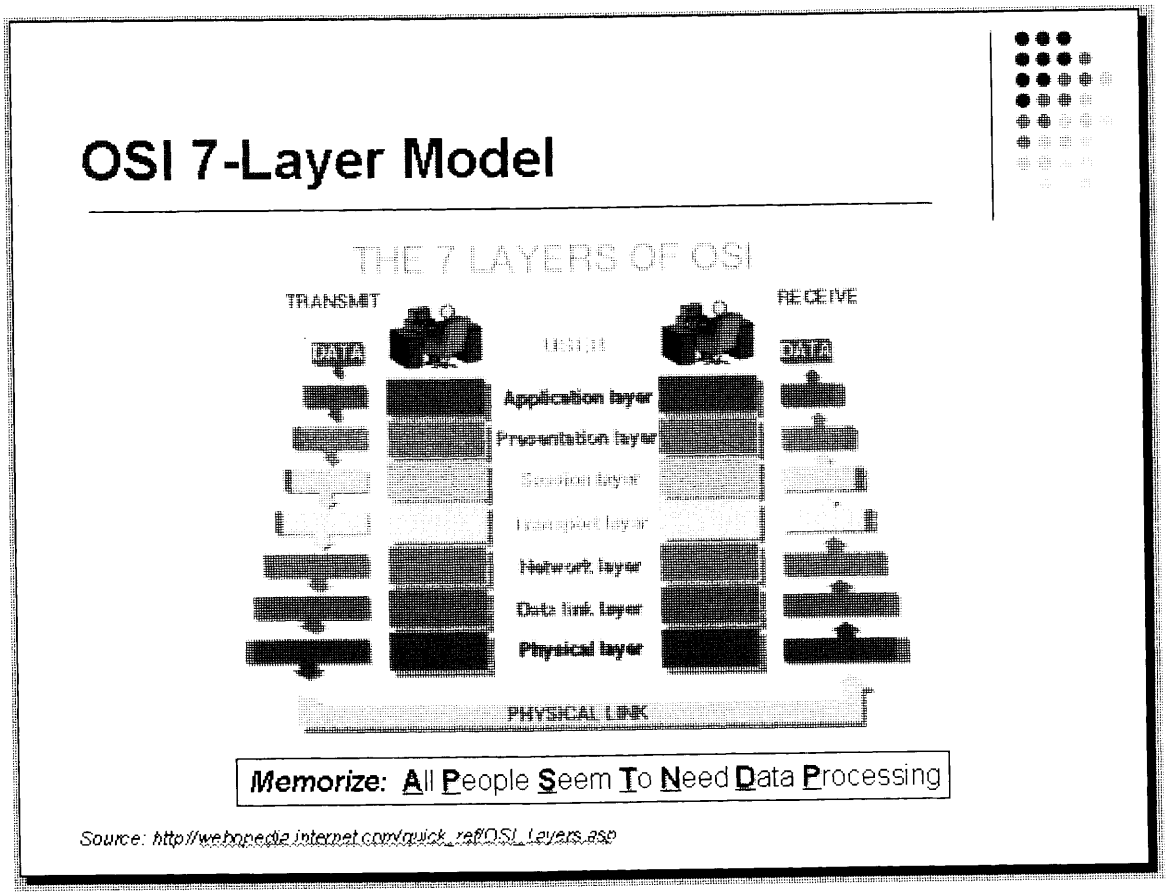

Figure 4: OSI model and associated data flow

Rieber (1994) proposed five applications of graphics that relate to learning outcomes and events of instruction. These are: Cosmetic, where the graphics serve only as decoration; Motivation, in which graphics serve to arouse curiosity; Attention gaining, where graphics serve to focus the learner's attention on the instruction; Presentation, where graphics serve to "demonstrate or elaborate a lesson concept" (p.50); and, Practice, where graphics serve to provide visual feedback.

Multimedia

Building on the Dual Coding Theory mentioned above, Mayer & Simms (1994) have also studied the extrapolation of dual coding theory from use of only graphics to multimedia learning. Multimedia elements can be embedded in presentation software to provide opportunities for students to interact not only with textual presentation, but also with audio, video, and graphics. As a multimedia presentation tool, software such as PowerPoint excels at presenting visual information. Lecture content that is supplemented by using figures, charts, colored diagrams, and complex visual graphics can be presented with greater clarity using multimedia. Meaningful knowledge can be created by learners by selecting, organizing words and pictures into mental representations, and then integrating verbal and visual representations with each other. Referential processing may produce an additive effect because the learner creates more cognitive paths that can be followed to retrieve the information. Using audio with video can promote engagement of multiple brain channels, resulting in increased retention of information (Brunning et. al., 1999). Huang (2003) states that many studies have investigated potential benefits of multimedia, and the use of multimedia in business presentations can include delivery of information items such as news, briefings, product introductions, and business analysis (Bieber, 1995). These items can be integrated and aggregated in business presentation thus providing a common platform from which dispersed types of information can be presented.

Using the example of a Level 5 presentation (described earlier as a self-paced presentation), a case study or scenario can be displayed in one window with accompanying audio, and following this presentation, an assessment module can be included that tests student knowledge and provides immediate feedback on performance (presented earlier in Figure 1). Evaluation and assessment remain an integral part of teaching in traditional as well as technology-assisted instruction (Hazari & Schnorr, 1999). This element of learning can be incorporated in presentations by utilizing not only

the Knowledge component but also questions in other categories such as Comprehension, Application, Analysis, Synthesis, and Evaluation as defined by Bloom (1984). Gagné and Briggs (1979) have also stressed the need for evaluating students' understanding, providing feedback during evaluation, and assessing complete understanding of each concept as part of the effective learning process. Interaction and feedback have significant impact on the learning process since they add value that results in improving quality and success in web courses. Moore & Kearsley (1996) and Cornell & Martin (1997) have specifically identified interaction and feedback components as factors that influence student motivation in completing a course. Multimedia offers an enjoyable, effective, and flexible method of instructional delivery to maintain learner's interest, attention, and accommodate a variety of learning styles (Hazari, 1992). Computers are playing a key role in delivery of education and training. One of the benefits of using interactive technology for teaching and learning is the integration of hypermedia within documents. Hypermedia makes it possible to link text, graphics, images, audio, and video with objects. Selecting an object can trigger associated elements in the presentation so learners can follow a non-linear path through the presentation. This contrasts with a textbook that sets a linear path for the learner (Stanton & Baber, 1992). Presentation designers should keep in mind that although this is an advantage, some users may find it a distraction, since users may not be able to cover all material within a presentation and/or fail to keep on task to accomplish the set learning outcomes (Small & Grabowski, 1992).

Conclusion

This article has explored instructional design principles applied to technology assisted presentations in the context of an Information Security course. For practitioners it underscores the importance that pedagogy should drive use of technology and not vice versa. Advancements in technology are offering new opportunities to deliver information and make learning more effective (Wild & Quinn, 1998). Realizing this, software developers are making their products easy to use, but the instructional design process has become transparent to the user. The goal is not to use presentation software as an end in itself (without a structured instructional framework), but to identify specific instances where technology-assisted presentation can add pedagogical value. It is often tempting to use special effects built into the software that are glitzy but are not instructionally sound. Use of these effects can distort the message. Although a case can be made that using templates and the auto content wizard feature built into presentation software can be easily used to develop cookie cutter type presentations, the focus would be mostly on the mechanics (not the theory or principles) behind effective presentation design. Providing a prescriptive format for creating presentations that include use of specific colors, font sizes, text/graphics, spacing, and related elements has been examined elsewhere (Russell & Shriner, 2000; Ober, 2003; Sloboda, 2003). Within the context of Human Computer Interface guidelines, a deeper understanding of instruction and cognitive principles is needed, especially as it relates to instructional presentations where learning outcomes are important in assessing if the presentation has helped meet learner goals specified for the lesson. The new genre of presentation software provides educators and trainers a richer set of elements and features. To take another example, the recently released version of Microsoft Office 2003 includes new features such as shared workspaces, controlled distribution using information rights management, standalone presentations, increased multimedia flexibility for different platforms, online research capabilities, real time updates to data (such as stock prices), and better integration with other tools such as databases and spreadsheets. To use these features effectively, educators and trainers must not only understand the mechanics, but also instructional design principles that lead to developing presentations based on sound pedagogy. Interactive features of this class of software can be used to address different learning styles and cognitive abilities of users making this area not only useful for practitioners who develop presentations, but also for researchers who are interested in further establishing a connection between instructional design and technology-assisted instruction and presentation. Further research should address specific issues such as which features in presentation software contribute most to effective learning, as well as conditions for its use for a specific audience.

References

Ausubel, D. P. (1960). The use of advanced organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology, 51,* 267-272.

Ayersman, D. J. (1993, February). *An overview of research on learning styles and hypermedia environments.* Paper presented at the Annual Convention of the Eastern Educational Research Association (ERIC Document Reproduction Service No. ED 356 756).

Berger, C. & Kam, R. (1996). *Definitions of Instructional Design.* Retrieved December 4, 2003, from the University of Michigan website: http://www.umich.edu/~ed626/define.html

Bieber, M. (1995). On integrating hypermedia into decision support and other information systems.

Decision Support Systems, 14(3), 251.
Bloom, B. (1984). *Taxonomy of educational objectives, Handbook 1: Cognitive domain.* CA: Addison-Wesley.
Bruner, J. (1990). *Acts of meaning.* Cambridge: Harvard University Press.
Bruning, R. H., Ronning, R. R., & Schraw G. J. (1999). *Cognitive psychology and instruction*(3rd ed.). NJ: Prentice-Hall.
Buck, T. (2003). *An investigation of field dependence-independence and cognitive abilities in a non-linear distance learning environment.* Unpublished doctoral dissertation, Walden University.
Cornell, R. & Martin, B (1997). The role of motivation in web-based instruction. In B. A. Khan (Ed.), *Web-based instruction* (pp. 93-100). Englewood Cliffs, NJ: Educational Technology Publications.
English, R.E. & Reigeluth, C.M. (1996). Formative research on sequencing instruction with the elaboration theory. *Educational Technology Research & Development, 44*(1), 23-42.
Gagné, R. (1977). *The conditions of learning* (3rd ed.). NY: Holt, Rinehart, and Winston.
Gagné, R. M. & Briggs, L. J. (1979). *Principles of instructional design* (2nd ed.). NY: Holt, Rinehart and Winston.
Gordon, H. R. (1995). Description of productivity and learning style preferences of on-and-off-campus distance education participants of Jefferson University. Unpublished manuscript (ED 390 308).
Gregorc, A. F. (1985). *Gregorc style delineator.* Maynard, MA: Gabriel Systems.
Hazari, S. I. (1992). Multimedia: Is it the right tool for your instructional application? *Journal of Educational Multimedia and Hypermedia,*1(2), 143-146.
Hazari, S. I. & Schnorr, D. (1999). Leveraging student feedback to improve teaching in web based courses. *Technological Horizons in Education Journal,* 26(11), 30-38.
Hoffman, S. (1997). Elaboration theory and hypermedia: Is there a link? *Educational Technology,* 37(1), 57-64.
Honebein, P.C. (1996). Seven goals for the design of constructivist learning environments. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 11-24). Englewood Cliffs, NJ: Education Technology Publications.
Huang, A. (2003). Effects of multimedia on document browsing and navigation: An exploratory empirical investigation. *Information & Management Journal.*
Kemp, J. (1985). *The instructional design process.* NY: Harper & Row.
Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Englewood Cliffs: Prentice Hall.
Knuth, R. A., & Cunningham, D. J. (1993). Tools for constructivism. In T. Duffy, J. Lowych, & D. Jonassen (Eds.), *Designing environments for constructivist learning*(pp. 163-187). Berlin: Springer-Verlag.
Lebow, D. (1993). Constructivist values for instructional systems design: Five principles for a new mindset. *Educational Technology Research and Development, 41*(3), 4-16.
Liu, M. & Reed, W. M. (1994, February). *The relationship between the learning strategies and learning styles in a hypermedia environment.* Paper presented at the Annual Conference of Association for Educational Communications and Technology and Association for the Development of Computer-Based Instructional Systems, Nashville, TN (ERIC Document Reproduction Service No. ED 372 727).
Mayer, R. E. & Sims, V. K. (1994). For whom is a picture worth a thousand words? Extensions of a dual-coding theory of multimedia learning. *Journal of Educational Psychology,* 86, 389-401.
Moore, M. G., & Kearsley, G. (1996). *Distance education: A systems view.* Belmont, CA: Wadsworth.
Ober, S. (2003). *Contemporary business communication* (5th ed.). NY: Houghton Mifflin.
Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review, 3*(3), 149-170.
Reiber, L. P. (1994). *Computers, graphics, and learning.* Madison, WI: WCB Brown & Benchmark.
Reigeluth, C. (1992). Elaborating the elaboration theory. *Educational Technology Research & Development, 40*(3), 80-86.
Russell, M. & Shriner, W. (2000). *Making effective PowerPoint.* Retrieved December 4, 2003, from: http://www.gst-2l.com/TLC/TLCPHo.html
Saavedra, L. (1999). *Dual Coding Theory: A Theoretical Foundation of Learning with Graphics* Retrieved December 22, 2003 from http://chd.gse.gmu.edu/immersion/knowledgebase/strategies/cognitivism/DualCodingTheory.htm
Sloboda, B. (2003). Creating effective PowerPoint presentations. *Management Quarterly,*44(1), 20.
Small, R. V., & Grabowski, B. L. (1992). An exploratory study of information-seeking behaviors and learning with hypermedia information systems. *Journal of Educational Multimedia & Hypermedia, 1*(4), 445-464.
Stanton, N. & Barber, C. (1992). An investigation of styles and strategies in self-directed learning. *Journal of Educational Multimedia and Hypermedia 1*(2), 147-167.
Toro, A. (1995). The effect of HyperCard authoring on computer-related attitudes and Spanish language acquisition. *Computers in Human Behavior, 11*(3-4), 633-648.

Vygotsky, L. (1986). *Thought and language.* Cambridge: MIT Press.

Wild, M. & Quinn, C. (1998). Implications for educational theory for design of instructional multimedia. *British Journal of Educational Technology, 29,* 84-86.

Witkin, H. A., & Goodenough, D. R. (1981). *Cognitive styles, essence and origins: Field dependence and field independence.* NY: International Universities Press.

About the Author

Sunil Hazari, Ed.D., is an associate professor at Richards College of Business University of West Georgia, Carrollton, GA 30118

shazari@westga.edu