Domain of Development

Instructional development is the process of interpreting instructional design requirements into a prototype or physical form (Seels & Richey, 1994). According to Seels and Richey (1994), the domain of instructional development has its origin in the audiovisual and media production field. Since the 1930s, the development domain has changed significantly due to the advancement of technologies. Currently, there are varying types of instructional media that are available to instructional designers. As a result, part of an instructional designer’s job is selecting the appropriate media to utilize when relaying information to learners. Instructional designers utilize the information from front-end analyses to determine what type of instructional solution will best fit with a client’s needs. Depending on the learner characteristics, the context analysis, and the type of desired learning outcomes, designers determine which types of media will be appropriate. For example, if the client needs a tutorial on how to wash your hands appropriately, a print-based technology may suffice. But, if the client needed a universal employee training program that is asynchronous, then a computer-based technology may be appropriate. Instructional designers are the people responsible for taking the design decisions and using instructional theories and strategies to develop instructional materials that meet the client’s needs. The connection between instructional strategies and development shows the relationship between theory and practice. According to Seels and Richey (1994), “Basically, the development domain can be described by:

- the message which is content driven;
- the instructional strategy which is theory driven; and
- the physical manifestation of the technology – the hardware, software and instructional materials” (p.36).

Part of the development process is to decide what media to utilize to deliver the intended instructional message to the learners. Once instructional designers have selected the media based on learner characteristics, context analysis, and learning outcomes, designers begin the storyboard process. Storyboarding outlines how the message will be designed using the selected type of media. Not all project storyboards are the same because they vary depending on the type of project and the media available. For the instructional development process, storyboards are crucial because they graphically represent the design specifications. Therefore, when storyboards are completed, instructional designers can take the different storyboards and determine if the storyboards reflect the overall goals and objectives of the instruction. The process of developing instructional materials requires the utilization of theories and instructional strategies to first determine the design of instruction. After designing instruction and selecting the best delivery system, designers create instructional materials that convert the design requirements (based on instructional message design) appropriately and utilize the proper media. The development domain encompasses micro and macro-level instructional systems design; along with a specialized applications design (Seels and Richey, 1994). “Specialized application design” refers to the development of a user interface or the creation of a job-aid (Seels and Richey, 1994). As media evolves within the development domain, different sub-categories are added to the domain. The current sub-categories (print technologies, audiovisual technologies, computer-based technologies, and integrated technologies) of the development domain show the evolution of technologies over the years (Seels and Richey, 1994).

Print Technologies

Print technologies refer to the production of instructional materials that are static visual materials by utilizing photographic or mechanical printing processes (Seels & Richey, 1994). Using print technologies means that the instructional designer has produced materials that are in a hard copy form that learners can utilize. Print technologies have specific characteristics that instructional designers recall during the development process as tips to how to effectively design and develop print technologies. According to Seels and Richey (1994), the following are the general characteristics of print technologies:

- "text is read linearly, whereas visuals are scanned spatially;
- both usually provide one-way, receptive communication;
- they present static visuals;
- their development relies strongly on principles of linguistics and visual perception;
- they are learner-centered; and
- the information can be reorganized or restructured by the user" (p.38).

Manuals, job aids, graphical representations, posters, photographs, textbooks, and diagrams are all examples of print technologies that instructional designers may develop.

Print technologies have two components: verbal text and visual materials (Seels & Richey, 1994). When developing instructional materials using print technologies, there are development guidelines that instructional designers need to take into consideration. Development requires instructional designers to reflect on the different theories of visual perception, learning, cognitive load, and information processing. Print technologies require the learner to interact with instructional materials and process the information by decoding, sight recognition, and reading. Using instructional systems design models and theories help designers make development decisions.

For example, using Robert Mayer's SOI model, designers can select relevant information, organize it using print technologies, and integrate prior knowledge with the new knowledge that is being presented in the instructional materials (1999). Mayer's model suggests activities such as eliminating information that is irrelevant and highlighting information by using headings or bold font to gain the learner's attention and help the learner select the relevant information (1999). Mayer's model also helps instructional designers make design and development decisions about how to organize the material so that the information is presented in coherent manner (1999). Lastly, Mayer's SOI model provides instructional designers with examples that demonstrate how to integrate prior knowledge so the learner can better understand the content of the instructional materials. Mayer suggests using elaborative questions, worked-out examples, and other techniques to integrate prior knowledge with instructional content to effectively develop instructional materials (1999).

Audiovisual Technologies

Audiovisual technologies refer to the production of instructional materials that present auditory and visual messages using mechanical or electronic machines (Seels & Richey, 1994). When instructional designers develop audiovisual technologies, designers utilize hardware in the development of instructional materials. Audiovisual technologies have specific characteristics that instructional designers evoke during the development process as guidelines that help designers effectively design and develop audiovisual technologies. According to Seels and Richey (1994), the following are the general characteristics of audiovisual technologies:

- “they are usually linear in nature;
- they usually present dynamic visuals;
- they typically are used in a manner pre-determined by the designer/developer;
- they tend to be physical representations of real and abstract ideas;
- they are developed according to principles of both behavioral and cognitive psychology; and
- they are often teacher-centered and involve a low degree of learner interactivity” (p.39).

Examples of audiovisual technologies are: audio recordings, video recordings, films, compact discs (read-only memory), digital versatile disc, slides, and transparencies.

Audiovisual technologies are more presentational as opposed to interactive. Instructors utilize audiovisual technologies to present information in a manner so that the learner can process the information using dual channels (auditory and visual). In other words, audiovisual technologies focus on relaying information to learners so that learners can see the information and also hear the explanation at the same time. Often instructional designers turn to Robert Mayer’s Cognitive Theory of Multimedia Learning (2001) to discern principles that ensure that learning occurs when using audiovisual technologies. The principles of Mayer’s theory are:

- Multimedia Principle: Learners gain knowledge better when both pictures and words are utilized rather than using just words.
- Spatial Contiguity Principle: Learners gain knowledge better when analogous words and pictures are proximal to one another when presented to the learner.
- Temporal Contiguity Principle: Learners gain knowledge better when analogous words and pictures are simultaneously presented to the learner. Successively presenting analogous words and pictures is not effective.
- Coherence Principle: Learners gain knowledge better when irrelevant items are not used. Providing learners with irrelevant items, such as words, pictures, or sounds, causes them to have a harder time focusing on the relevant information.
- Modality Principle: Learners gain knowledge better when narration accompanies animation rather than text and animation.
- Individual Differences Principle: Learners that are considered to be low knowledge or high spatial learners benefit the most from design effects. Learners that are considered to be high knowledge or low spatial learners do not benefit from design effects (2001, p. 184).

Mayer’s theory explains that individuals process information using both a visual/pictorial and a verbal/auditory channel (2001). At the same time, Mayer acknowledges that each of these channels has a limited capacity to process the incoming information (Mayer 2001).

Computer-Based Technologies

Computer-based technologies refer to the production or delivery of instructional materials using a resource that is micro-processor oriented (Seels & Richey, 1994). Computer-based technologies are different from audiovisual and print technologies because they store information in a digital or electronic format (Seels & Richey, 1994). Computer-based technologies are known as computer-based instruction (CBI), computer-aided instruction (CAI), or computer-based training (CBT). According to Seels and Richey (1994), the following are the general characteristics of computer-based technologies (both software and hardware):

- “they can be used in random or nonsequential, as well as linear ways;
- they can be used the way the learner desires, as well as in ways the designer/developer planned;
- ideas usually are presented in an abstract fashion with words and symbols and graphics;
- the principles of cognitive science are applied during development; and
- learning can be student-centered and incorporate high learner interactivity” (p.40).

Tutorials, drill and practice, games and simulations, databases, software compact discs (CDs) and digital versatile discs (DVDs) are all examples of computer-based technologies that instructional designers may chose to develop. Computer-based technologies could also refer to using instructional materials through various types of devices that learners interact with during instruction. Personal digital assistants (PDAs), cell phones, iPods, netbooks, and laptops are all examples of devices that deliver computer-based instructional materials.

Computer-based technologies are similar to other technologies developed by instructional designers because they are designed and developed based on instructional design models and theories; they are also driven by instructional strategies to ensure that the correct technology is utilized to develop instructional materials. Rapid prototyping is a just one strategy that instructional designers can utilize when developing computer-based instruction. Rapid prototyping refers to the process of developing, testing, exploring, revising, and reflecting on the effectiveness of a small-scale prototype (Wilson et al., 1993). After the rapid prototyping process is complete, instructional designers start over and develop the large-scale version of the instructional materials. According to Tripp and Bichelmeyer (1990), rapid prototyping is a viable model for instructional design, especially for computer-based instruction.

Integrated Technologies

Integrated technologies are highly regarded in the field of instructional design and development because they provide designers with a way to use a computer to integrate various types of media (Seels & Richey, 1994). Integrated technologies allow for flexibility of use for the instructor and the learner. According to Seels and Richey (1994), the following are the general characteristics of integrated technologies:

- “they can be used in random or nonsequential, as well as linear ways;
- it can be used the way the learner desires, not only in ways the developer planned;
- ideas are often presented realistically in context of the learner’s experiences, according to what is relevant to the learner, and under the control of the learner;
- principles of cognitive science and constructivism are applied in the development and utilization of the lesson;
- learning is cognitively-centered and organized so that knowledge is constructed as the lesson is used;
- materials demonstrate a high degree of learner interactivity; and
- materials integrate words and imagery from many media sources” (p.41).

There are three different subcomponents of integrated technologies: hardware, peripheral devices, and software. Examples of integrated technologies hardware are: computer, monitor, projector, Mimio interactive bars, Smartboards. Examples of peripheral devices are: palm pilot, iPod touches, compact disc players, stereos, etc. Lastly, examples of integrated technologies software are: networking software, software compact discs, and videodiscs (Seels & Richey, 1994).

Learners are presented with information in multiple different formats when utilizing integrated technologies. Part of the job of an instructional designer is to appropriately ensure that the instructional materials presented to the learner effectively deliver the intended content of the instruction. David Jonassen's "Designing for Constructivist Environments" model (1999) is very helpful to instructional designers when they are making integrated technology decisions. The model requires learners to solve ill-defined problems or domains that are ill-structured (Reigeluth, 1999). Jonassen's model focuses on constructing learning environments that propose problems to challenge the learner that result in meaningful learning (1999). Meaningful learning incorporates examples that are applicable to real-world situations and learners are required to manipulate the information to determine a solution for the proposed problem. Jonassen's model provides designers with "cognitive tools" that are computer tools that assist learners in understanding the goals of the instruction. Utilizing the different cognitive tools, as well as, the different types of technologies, information can be presented to the learner so that manipulation of the materials and feedback occur simultaneously. When utilizing integrated technologies, learners can sometimes feel intimidated. Thus, developing integrated technologies requires instructional designers to reflect on the design decisions and determine a model that will help them develop instructional materials that appeal, interest, and engage the learner. Jonassen's model addresses this need by accounting for the support of the learner in an emotional and cognitive way. In addition, the model offers three ways to provide the help needed for learners: modeling the intended behavior, scaffolding the learner by restructuring the activity or task, or coaching the learner to provide feedback and ensure that the learner is progressing appropriately to determine the solution to a problem (1999).

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