Domain of Instructional Development

Instructional development, in simplified language, is the process of creating materials for use by facilitators and learners as instruction or training occurs.

Throughout the analysis and design processes, the instructional technologist has asked several questions and made a number of important decisions. The domain of instructional development is "the process of translating the design specifications into physical form" (Seels & Richey, 1994, p.35). Dick, Carey and Carey (2005) suggest that the material development process can begin after the delivery system is specified and the instructional strategy is developed. At the development phase of the ADDIE process, instructional products are constructed, reviewed, produced and validated.

Delivery systems are selected during the design phase of ISD (Instructional Systems Design) according to the instructional goals and objectives, learner characteristics and constraints of the organization, but the actual construction of instructional messages occurs within the domain of development. Seels and Richey (1994) describe the domain of development as (1) the content-driven messages and (2) the theory-driven instructional strategies through the physical manifestation of the technology – the hardware, software and instructional materials. During the development process, instructional technologists utilize theories of instructional media design such as Mayer's Multimedia Instruction (2001) with classic graphic design, Gestalt and human interface theories to guide their work (Skaalid, 1999).

Seels and Glasgow (1998) identify the subcomponents of the development domain as "delivery systems," or "ways to carry information from a source to a receiver . . . for the purpose of instruction" (pg. 35). In their definition of instructional technology, Seels and Richey (1994) organize the domain into four sub-components, their order reflecting the chronologic changes in technology:

Print Technologies

Print technology describes the delivery of instruction through static visual material such as books, manuals and other printed media (Seels & Richey, 1994). Usually, this media includes the use of printed text, graphics and photographic representations. Learners can interact with the content through reading and symbol comprehension, but cannot manipulate or see processes demonstrated without the use of additional resources.

Audiovisual Technologies

Audiovisual technology describes the production of instructional materials that include "the use of mechanical or electronic machines to present auditory and visual images" (Seels & Richey, 1994, p. 38). These images are most commonly motion pictures, audio recordings or projected images that allow learners to interact without the use of word or symbol comprehension, utilizing their senses of sight and hearing to process communicated messages (Seels & Richey, 1994). Audiovisual technology is linear in nature, not allowing for user interaction or manipulation. This technique is effective for the presentation of material, but does not serve as an interactive delivery system.

Computer-based Technologies

Computer-based technology describes the delivery of instruction using "microprocessor-based resources. The information is stored "electronically in the form of digital data rather than as print or

visuals" (Seels & Richey, 1994, p. 39). Included in this delivery system is computer-based instruction (CBI), computer-assisted instruction (CAI) or computer-managed instruction (CMI). Computer-based technology offers learners a higher level of freedom, flexibility, interactivity and abstraction than the print or audio/visual above technologies due to the ability of the user to access, apply and manipulate their learning through a variety of activities including games, simulations, practice activities, and more recently communication and collaboration tools.

Integrated Technologies

Integrated technology is an inclusive term that describes the delivery of instruction utilizing "several forms of media under the control of a computer" and is viewed by many as the "most sophisticated technique of instructional delivery" (Seels & Richey, 1994, p. 40). Integrated technology could include the use of multiple peripherals, display devices, networking hardware and digitized information to allow learners to access information on multiple levels (print, audiovisual or computer-based). An integrated approach provides learners with flexibility of use and sequence as well as a realistic and controllable environment. Learners are able to construct meaning using a variety of media using a high degree of interactivity using provided presentations, software, text elements and audiovisual imagery.

The increased development of integrated technologies is in part a response to the expectations of a younger generation who has instant access to commercial resources at any time in any setting. The new learner, the "millennial," expects an elimination of delays in access to information, superior "24x7"customer service, experiential and authentic learning and the ability to stay connected to the learning environment (Oblinger, 2003). The implication is that the development of integrated technology will become much more important to the instructional technologist as the popularity of "learning-on-demand" becomes more widespread. As this is the most sophisticated technique, considerations at every level must be made within the process of development and the technologist must be aware of development principles for a variety of media.

As a process, the instructional technologist's work within the domain of instructional development includes a number of considerations and decisions. This will ensure a quality instructional product that is effective in delivery of the content, whether in print or used as an integration of formats. In this section, I describe some questions that technologists consider in the process of developing instructional materials:

Are the materials effectively designed to teach the objectives?

This consideration is most important, as the goal of instruction is for learning to occur. While working within the domain of development, the instructional technologist must always refer to the design of instruction to ensure the integrity, accuracy and effectiveness of the materials. Whether the materials are to be used for information acquisition or knowledge construction, the accuracy and precision of language, clarity and appropriateness of graphics and usability and relevance of activities must be considered.

Due to the accessibility of multimedia, instructional technologists must have a working knowledge of graphic, audio and video design. However, instructional technologists must consider the results of the research that shows "people learn better from words and pictures than words alone," (Mayer, 2001, p. 63). They also must ensure messages are clear and easily interpreted by the learner (Mayer, 2001).

Mayer (2001) suggests that, when designing multimedia instructional materials (using words and images), the technologist must carefully consider a number of principles:

- Spatial Contiguity – words and corresponding images should be in close spatial proximity to one another.
- Temporal Contiguity – animation and narration should be simultaneous, rather than successive.
- Coherence – extraneous words, sounds and images should be excluded.
- Modality – in designing presentational materials, words should be presented as narration rather than as on-screen text.
- Redundancy – presenting words as narration and on-screen text together is not as effective as when words are presented as narration.

Sweller's theory of "cognitive load" must also be taken into account when determining the effectiveness of instructional materials. Cognitive load theory proposes that humans learn best when use of the working memory is limited to best facilitate the changes in long term memory (Sweller, 1994). Overloading the working memory can have detrimental effects on a learner's ability to process and learn information if an instructional developer does not consider it. Chunking information into related units, providing worked examples or goal-free problems can limit cognitive load (Sweller, 1994).

The principles of graphic design must also be considered while developing materials. The technologist must also be knowledgeable of principles of graphic design including the use of color, contrast, alignment, proximity, repetition, typography, space and placement in order to develop effective and accessible graphical elements.

While developing materials, careful considerations must be made to ensure their effectiveness, especially when developing print and graphical elements. When designing instructional audio and video, technologists are presented with a number of other considerations.

How will the materials look and sound?

In developing graphics for print, screen or projected display, the instructional technologist must understand the decisions that a graphic designer must make, at least at the basic level. Careful attention should be paid to line, shape, texture, color and space and their effect on the way a learner understands a graphical representation. For example, a graphic with predominantly horizontal lines may have a calming effect on a learner, while vertical lines tend to suggest more of a potential for movement (Skaalid, 1999). Other factors such as contrast, repetition and symmetry address how easily text or graphics can be recognized in both print and audiovisual technologies (Skaalid, 1999).

The use of sound in audiovisual content can be quite effective, as discussed earlier. Use of audio, if done correctly, can enhance a multimedia presentation. Time must be taken by a developer, however, to capture a "clean" audio sample, as low-frequency background noise will be inseparable from an audio track and distract learners (Lynch & Horton, 2002). In creating a multimedia presentation that includes the use of audio and images (i.e. educational podcast or instructional video), instructional technologists must carefully consider the quality of sound so that it does not serve as a distraction to the learning process.

Are the materials appropriate for the intended audience?

As in the discussion of the domain of design, learner characteristics and system requirements weigh heavily on the design and development of instructional materials. Specific criteria identified in the learner analysis includes (1) vocabulary and language levels, (2) developmental, motivation and interest levels, (3) backgrounds and experiences, and (4) special language or other needs (Dick, Carey & Carey, 2005). Other criteria such as cultural background are identified by researchers (Dick, Carey & Carey, 2005, Lynch & Horton, 2002, Smith, 2005). Lynch and Horton (2002) suggest that, especially when designing web-based instruction, developers must consider a global audience, avoiding the use of puns and metaphors that only make sense within the context of a certain language. The Handbook of Visual Communication (Smith, 2005) includes assertions regarding the use of culturally sensitive graphics and suggests the creation of a "culture palette" in order to utilize culturally sensitive images.

During the development phase of the ISD process, materials should be put through a process of formative evaluation where they are tested (Seels & Glasgow, 1998, Dick, Carey & Carey, 2005). In addition to other questions regarding effectiveness and improvement, the question of relevancy is quite important. Materials should be tested on two levels: (1) by a subject-matter expert to determine accuracy, (2) on the target population of the instruction to determine appropriateness and effectiveness (Seels & Glasgow, 1998). The results of formative evaluation will drive the revision process.