

The Domain of Development

Print Technology • Audiovisual Technology • Computer-Based Technology • Integrated Technology

Development is the process of transforming the design specification into physical form through the use of technologies. During the development process, theory is applied to produce and select the validated instructional materials through technology; on the other hand, technology manifests its specific functions through theory. Technology has three key functions in the domain of development: design, production, and delivery. A material can be designed, produced, and delivered using separate types of technology. For example, a print-based detective story can be translated into script or storyboard form using a computer-based technology (Word with drawing tool); then, the script or storyboard can be produced using audiovisual technology (e.g., Television) and delivered using an integrated technology (internet). This example presents four technologies that the development domain involves: print technology, audiovisual technology, computer-based technology, and integrated technology. Although they developed in historical sequence, the older technologies did not disappear as new technologies evolved. They still continued to be used and were often incorporated in new technologies.

When making decisions on the use of technology, an instructional designer can't use media for media's sake. In order to select the best media for design and development of instruction, instructional designers use attributes of the media in light of learners' characteristics, learning objectives, content and environmental concerns. Procedures that ID professionals use for selecting media have been presented in forms of ISD models known as media selection models. Examples of such models are Reiser and Gagne's (1983) media selection flowchart, Lee and Owens's system approach to media selection, Seels and Glasgow's (1998) model, and Heinich, Molenda, Russell and Smaldino's (1996) ASSURE (**A**nalyze learners, **S**tate objectives, **S**elect methods, media, and material, **U**tilize media and materials, **R**epresent learner participation, and **E**valuate and Revise) model. Reiser and Gagne's (1998) flowchart shows a narrowing possessive procedure with questions in the form of decision tree on the basis of media attributes and learning tasks. Lee and Owens's model (See figure 2) describes a systematic process of selecting media, which involves four system components such as organizational assessment, information structure and objectives, media selection, and cost analysis. It is widely used in business and industry, focusing on human performance. Seels and Glasgow's model prescribes a linear process of making decisions about media:

- (1) identify learner characteristics,
- (2) identify channel requirements,
- (3) identify learning situation,
- (4) identify constraints and resources, and
- (5) determine media.

Many of such models embodied selection factors that affect media choices. Characteristics of learner, tasks and setting are identified as primary considerations in media selection. Learner characteristics may be psychological, physical, or sociological. Each characteristic has implications for media selection. Setting includes learning situation, resources and constraints,

time, cost, and technological skills of development members. Tasks refer to unique requirements of learning related to learning outcomes. Also, they incorporate the application of cognitive theories and cognitive load theories (e.g., Mayer's cognitive theory of multimedia learning). Cognitive load theory is based on the assumptions of limited working memory, dual-channel processing, and active processing. It indicates that human beings learn effectively using dual information processing system, and cognitive load can be reduced by the use of dual-mode (visual-auditory) instructional techniques.

As an ISD product takes physical form in the development phase, formative evaluation is ongoing. Formative evaluation during development will let instructional designers make changes immediately prior to utilization. Substantial resources, including money, personnel, time, and facilities, avoid being wasted.

Print Technologies

Print technologies are ways to design, produce or deliver materials, primarily through mechanical or photographic printing processes (Seels & Richey, 1994). The print technologies reflect on materials in hard copy form such as text, graphic and photographic materials, diagrams, or posters. Although they are usually static with one-way, receptive communication, they are learner-centered with advantages of allowing the user to reorganize, restructure, and control the pace of learning. The development of the print technologies relies heavily on the theory related to visual perception, information processing, learning theory, as well as principles of linguistics and visual perception.

Audiovisual Technologies

Audiovisual technologies are ways to design, produce or deliver materials by using mechanical or electronic machines to present auditory and visual messages (Seels & Richey, 1994). Films, television, videotapes, audiotapes, slides, transparencies are examples of the application of audiovisual technologies. Comparing to print technologies, audiovisual technologies are an important progress, involving duo-channel learning through both sight and hearing. However, information through audiovisual technologies is linear in nature and teacher-centered, involving little or no learner interactivity. The technologies were developed according to principles of both behavioral and cognitive psychology and used in a manner pre-determined by the designer/developer.

Computer-Based Technologies

Computer-based technologies are ways to design, produce or deliver materials using microprocessor-based resources (Seels & Richey, 1994). Such typical applications are computer-based instruction (CBI), computer-assisted instruction (CAI), and computer-managed instruction (CMI). Examples include, simulations, games, and instructional modules that developed by Adobe Captivate. Computer screen is the basic platform of using these technologies. They are distinguished from the above-mentioned technologies because information is stored electronically in the form of digital data rather than in analog form. Any media or materials through computer-based technologies can be accessed both in random ways and in linear ways and learner-centered, incorporating learner high interactivity.

Computer-based materials are often developed using principles of behavioral learning theories (e.g., drill and practice) or cognitive learning theory (e.g., interactive tutorial).

Integrated Technologies

Integrated technology refers to the combination of various technologies, such as print technology, audiovisual technology, and computer-based technology into achieving an integrated multisensory interactive application. Internet-based instruction delivered by commercial and open source Learning Management systems (LMS) such as WebCT, Blackboard vista, Web 2.0 such as Second Life, Social Networks and Internet-based interactive and collaborative games are examples of integrated technology. Integrated technology offers the potential to augment learning with a vibrancy that computer-based technologies and other technologies couldn't easily achieve. With the characteristics of random accessibility, high degree of learner activity, learner's control, and the application of constructivism, integrated technologies are very attractive in today's networked environment.

After completing an integrated product, what happens next? That is to put it into practice for potential users, **utilization**.