

Definition of Design

The domain of instructional design is in many ways the baseline or glue that holds the field instructional technology together. Without solid instructional design processes and principles nothing else matters.

Instructional design encompasses both the analysis and design stages. An effective analysis is necessary to identify any gaps to be addressed in the design. In the analysis stage information is gathered on what needs to be taught, the characteristics of the learners, the contexts in which the instruction will be delivered, and the contexts in which the skills will eventually be used (Dick, Carey, & Carey, 2005). This data is gathered using a variety of tools including a needs analysis, job analysis, and task analysis. Using the information gathered in the analysis stage, the instructional designer determines the instructional goals, the delivery system, and sequence of the instruction.

The design stage uses a systems approach to solve performance problems exposed during the analysis stage. Design is the planning function which organizes the remaining domains (Seals & Richey, 1994). Not only does design occur at the micro-level (lessons and modules) but also at the macro-level (programs and curricula). Once the instructional designer has conducted a thorough needs or front-end analysis, they develop strategies and products to fill the performance gaps. The instructional design domain is further divided into four sub-domains: instructional systems design, message design, instructional strategies, and learner characteristics.

Instructional Systems Design

Instructional Systems Design (ISD) is “an organized procedure that includes the steps of analyzing, designing, implementing, and evaluating instruction” (Seals and Richey, 1994, p. 31). “A system is a group of interrelated parts working together toward a defined goal” (Dick, Carey, & Carey, 2005, p. 367). ISD follows a systemic and systematic approach to designing instruction. A systemic framework assumes that all parts of a system are interrelated and change in one component of the system will affect other components. A systematic approach offers a step-by-step procedure for the evaluation of students' needs, the design and development of instructional/training materials, and the evaluation of the effectiveness of the instruction/training intervention. There are a number of ISD models, but almost all are based on the generic "ADDIE" model, which stands for Analysis, Design, Development, Implementation, and (see Dick and Carey (2005), Seals and Glasgow (1998)). In ISD, each of these generic steps or stages affects the step before and after it. This section will describe the first two steps of the ADDIE model with each of the other steps having their own definition.

Analysis is the process in which the cause of a performance issue is identified. This is the first step in the ADDIE model because understanding the gap between the ideal performance of the system and the current performance is imperative. The analysis phase often encompasses a needs assessment, goal/task analysis, context/environmental analysis and learner analysis. There are a number of models which instructional designers use

when conducting needs analysis and needs assessment. The widely used needs assessment models include Allison Rossett's Training Needs Assessment (1987), Dick and Cary's ISD Model (2005), Seals and Glasgow's ISD Model (1998), and Heinrich's ASSURE Model (1998). Instructional designers also use Keller's Attention Relevance, Confidence, and Satisfaction (ARCS) Model (1983) to analyze learner motivation.

A needs assessment is a process which identifies the gaps between "what-is" results and "what-should-be" results and prioritizes these needs based on the cost to fulfill the need versus ignore the need (Kaufman, 2000). Data for a needs assessment is gathered in the form of surveys, observation, and interviews.

A learner analysis identifies general characteristics, experience levels, attitudes, skills, motivation and the number in the learner group. Once the learner analysis is conducted a learner profile can be created making it much easier to design the rest of the instruction. Analysis is used to simply understand exactly what is to be learned.

Once the analysis is complete it is time for the second step in the ADDIE model: design. Design is the process of determining the appropriate goals and objectives, assessment strategies and instructional approaches while taking into account the results of the learner, environmental and performance analysis. The first step in designing instruction is selecting an appropriate model for decision making. Depending on their philosophical orientation some instructional designers follow Bloom's Taxonomy of Learning or Gagne's Conditions of Learning while others subscribe to constructivist design models. Using one of these frameworks helps to determine the focus, appropriate learning outcomes (goals and objectives), best assessment and instructional strategies.

Message Design

Message design is how information is presented to the learners. In order to effectively design a message it is important to determine how the message will be delivered and what media will be utilized. Messages can come in the form of still images, moving images, static words on a page, and recorded sounds. The message is much more important than the media that is used to deliver that message. Messages can be delivered using a variety of media including print (textbook), moving images (television), and computer (computer-based instruction). Whether it is delivered via the Web or in print greatly affects the message design. When determining the appropriate message design many instructional designers consult Richard Mayer's "Cognitive Theory of Multimedia Learning" (Mayer, 2001), as well as John Sweller's Cognitive Load Theory (Sweller, 1990).

Richard Mayer's Cognitive Theory of Multimedia Learning assumes that learners have dual channels, a limited cognitive capacity, and active processing. Dual channels assume that humans have two separate channels for processing incoming information. A limited cognitive capacity means that humans have a finite amount of information that can be processed by each channel at any given time. Active processing assumes that "humans engage in active learning by attending to relevant incoming information, organizing

selected information into coherent mental representations, and integrating mental representations with other knowledge” (Mayer, 2001, p. 44).

An instructional designer could apply this research by designing messages which address both the eyes and ears of the learner (dual channels), restricting extraneous messages such as sound or colors that may distract the learner (limited cognitive capacity), and by designing an easy to follow hierarchy of text and images which make it easy for the learner to select the most relevant words and text (active processing).

Cognitive Load Theory suggests that there are instructional techniques which if designed into the instruction can facilitate learning and conversely if not utilized can hinder learning (Sweller, 1994). Cognitive load is the number of interacting elements in a content area. There is both intrinsic and extrinsic cognitive load. Intrinsic cognitive load “depends on the inherent difficulty of the material” (Mayer, 2001, p. 50) while extrinsic cognitive load can be controlled by the instructional strategies a designer implements. For instance, if a an instructional designer was designing the user-interface for a computer-based instructional module (CBI) and subscribed to cognitive load theory they would be careful not to include any extraneous sounds, colors or graphics which may distract the learner and add to the cognitive load of the module.

Selecting the appropriate media for a project involves consulting the needs analysis and will be directly connected to the instructional strategies.

Instructional Strategies

Instructional strategies are “an overall plan of activities to achieve an instructional goal” (Dick, Carey, and Carey 2005, p. 365). Using the results of the needs assessment, goal/task analysis, context/environmental analysis and learner analysis helps the instructional designer to determine the appropriate instructional strategy. The instructional theory that the instructional designer adopts often defines the instructional strategies.

Instructional designers have a number of instructional design models to use depending on the results of the analysis stage including: Hannafin’s Open Learning Environment, Gardner’s Multiple Intelligences, Schanks’ Learning by Doing, Merrill’s Instructional Transaction Theory, Gagné’s Nine Events of Instruction, and Mayer’s SOI Model for Constructivist. Instructional activities often include: pre-instructional activities, content presentation, learner participation, assessment, and follow-through activities.

Learner Characteristics

Learner characteristic data is gathered as part of the front-end analysis and is used to create a profile of the target population. This data often includes the learner’s demographics, thinking style, cultural background, age group, prior attitude, knowledge of the content to be taught, and attitudes toward the organization and work environment (Dick, Carey, and Carey, 2005). This information is gathered through surveys, face-to-

face interviews, and observation. Fully understanding the learner helps the instructional designer select instructional strategies, and delivery methods that are in the learner's best interest. For instance, if an instructional designer was designing instruction for senior citizens who have little or no computer skills (learner characteristic), then a print-based workbook would be preferable to a computer-based module.