White Paper

An Introduction to the ADDIE Instructional Systems Design Model

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Introduction to Instructional Systems Design

The ultimate goal of designing instruction is to improve human performance. To achieve that goal, instructional design models have been developed that approach the design of instruction from a systems perspective. Instructional design (ID) was first introduced over 50 years ago, and over the years many ID models have emerged. As the learning and development field advanced in the 1960s and 1970s, instructional systems design (ISD) models began to emerge. The underlying concepts of ISD can be traced to the model developed for the United States armed forces in the mid-1970s (ADDIE Timeline, 2014).

While some of the principles of instructional design (ID) can be traced back to post-World War I, modern instructional design traces its roots back to World War II when aviation psychologist Robert Gagné worked with the Army Air Corps to test and design materials to train pilots. At the end of World War II, Gagné was part of the Psychology Branch, Aeromedical Laboratory at Wright Field in Ohio. Gagné published an article in the American Psychologist in the early 1960s which represented a consolidation of many of his findings from his military research. The article highlighted a variety of areas ranging from perceptual abilities to personnel selection research (Gagné 1962) and formed the basis for his epic book *The Conditions of Learning* (Gagné, 1965).

As the learning and development field advanced in the 1960s and 1970s, instructional systems design (ISD) models began to emerge. The underlying concepts of ISD can be traced to the model developed for the United States armed forces in the mid-1970s when the U.S. military created regulations and procedures pertaining to the design and development of instructional systems. These regulations and procedures were significantly influenced by Gagné and reflected much of his work and writings in the 1970s and 1980s (Molenda, 2003).

Instructional Systems Design (ISD) Process

Instructional Systems Development (ISD) is an adaptation of the systems engineering process to the process of curriculum development. Since ISD models are prescriptive, they approach the design of instruction by a suggested methodology by integrating the processes (phases) of analysis, design, development, implementation, and evaluation. ISD results in alternative solutions to instructional problems which may be more or less cost-efficient, depending on the instructional need and environmental constraints. ISD also clarifies that a systems approach, which involves choosing among alternative solutions, will produce the most effective results (Smith & Ragan, 2005).

ISD is a systematic, flexible, proven process for determining whether instruction is necessary in a given situation, for defining what instruction is needed, and for ensuring development of effective, cost-efficient instruction. Quality Improvement (QI) is constantly emphasized in the ISD Process. It provides a systematic approach to planning, developing, and implementing training and education. The goal of ISD is to increase the effectiveness and cost-efficiency of training by: developing instruction based on job performance requirements; eliminating irrelevant skills and knowledge instruction from courses; and ensuring that learners acquire the necessary skills, knowledge, and attitudes to perform the task.

The ADDIE Instructional Design Model

ADDIE is an acronym referring to the five major phases that comprise the generic ISD process: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is the probably the most widely used ID model in the industry since its development over 50 years ago, emerging in the late 60's (ADDIE Timeline, 2014). While the ADDIE model has been around since 1975, it was generally known as SAT (System Approach to Training) and later, ISD (Instructional System Design). The use of the ADDIE acronym did not come about until much later. Now there are probably earlier uses, but these three references are the earliest ones that I have been able to locate that actually use the acronym of ADDIE (ADDIE The Acronym, 2014).

The ADDIE ISD model consists of five phases. The analysis phase defines what needs to be trained. Next, an instructional design is crafted to meet this need. Only after the design is complete are the instructional materials developed. During development, individual and group tryouts of the materials are conducted. Results are iteratively fed back into design and development. Evaluation is a central feature of ISD and is performed in each phase (ADDIE Model, 2014).

Phase 1: Analysis - Determine if training is the appropriate solution; if so, define training requirements.

Phase 2: Design - Define objectives, design the training program, and select training methods and media.

Phase 3: Development - Develop all training materials in accordance with design. Conduct pilot training classes. Refine course, as necessary.

Phase 4: Implementation - Implement training, evaluate, and refine.

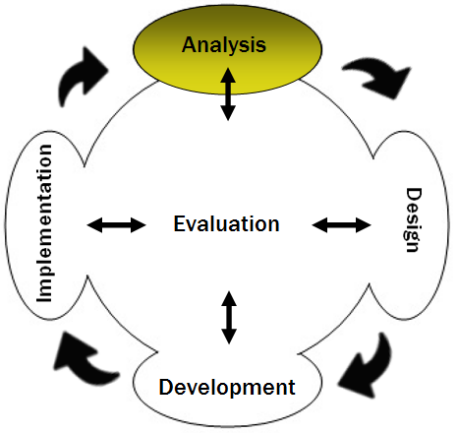
Phase 5: Evaluation - Performed during development, during implementation, immediately after training, and six months or more after training.

ADDIE model Infographic: http://www.learndash.com/addie-model-explained-infographic/

Analysis Phase

The first step in the analysis process is to decide if a problem can be solved with training by performing a needs assessment. A needs assessment is the process of identifying problems and their causes, then matching solutions to those problems (Dick, Carey, L., & Carey, J., 2009).

Note: It is important to distinguish between the *real need*, as opposed to the *perceived need*, that can be solved by instruction/training intervention. In most instances, the difference between what the learner knows and what the learner should know is the knowledge gap, which drives the requirement for instruction/training intervention to "bridge" the gap. Based on the knowledge/skill gap you identify, you then develop the instructional objectives which create the foundation of your learning module. From your objectives you would develop the content and instructional strategies to facilitate the transfer of learning to "bridge" the knowledge gap, as well as the student assessment to measure the attainment of the learning objectives



Occupational/Educational/Mission Analysis. This level of analysis identifies the duties and tasks of an occupation or job, the goals and content area of an educational requirement, or the characteristics of a mission. A needs assessment should already have been conducted to determine if there is a problem for which instruction is the appropriate solution. If the assessment confirmed an instructional need, you would usually begin instructional development at the analysis phase.

Occupational/Job Analysis - Identifies the jobs which define an occupational entity and identifies duties and tasks which comprise each job.

Educational Analysis - A process of reviewing the educational requirements, developing educational goals, and developing statements of how to achieve the goals.

Mission Analysis - A process of reviewing mission requirements, developing collective task statements, and arranging the collective tasks in a hierarchical relationship.

Task Analysis. When the instructional goal is to produce a capability to perform a particular job, the instruction developed should be tied directly to the job tasks. Task analysis is a method for describing the actions or behaviors that make up the tasks the student should learn to perform. A detailed task analysis identifies the behavioral elements the student should exhibit to demonstrate task mastery. Where task analysis is performed, it is important to accurately and completely describe all of the tasks, since these task descriptions or "statements" should be used to develop the instructional objectives which constitute the framework for instruction. During the task analysis, each task is examined in order to determine the job performance requirements. This includes identifying which tasks should be performed, under what conditions they are performed, and the standards of acceptable performance. This information becomes the training requirements for the system. These training requirements are stated in terms of task statements which are used to develop the instructional objectives for the course, construct a hierarchy of objectives, sequence the instruction, and determine resource requirements.

Performance Task Analysis. An outcome of the needs assessment process, performance tasks are derived from the knowledge/performance gap in that they require the learner to perform a series of tasks in order to “bridge” the knowledge/performance gap. The instructional designer generates a list

of tasks (task analysis) to be performed. The cognitive components (cognitive task analysis) of a task consist of:

Declarative knowledge -- tells us why things work the way they do and includes information about the concepts and elements in the domain and the relationships between them.
Procedural knowledge -- tells us how to perform a given task and contains the discrete steps or actions to be taken and the available alternatives to perform a given task
Strategic knowledge -- is comprised of information that is the basis of problem solving, such as action plans to meet specific goals, knowledge of the context in which procedures should be implemented, and/or actions to be taken

Learning Analysis. Learning analysis is the process of analyzing the tasks to be taught to establish learning outcomes in terms of types of learning involved and level of learning desired. Learning analysis should be done immediately after the task analysis has been completed and before designing the instructional system. However, this analysis may also be conducted while the objectives are being developed. When conducting a learning analysis, you should:

- Identify the skills and knowledge needed to support performance.
- Build a learning hierarchy of knowledge and skills to be taught.
- Identify the types of learning involved.
- Determine the level of learning needed.
- Identify prerequisite knowledge and skills required.

Identify knowledge and skills. Analyze each task and subtask to determine supporting skills and knowledge needed to enable task performance.
Categorize types of learning. There are many ways of categorizing types of learning. Some of the most common are:

- Intellectual skill
- Cognitive strategy
- Verbal information
- Motor skill
- Attitude

Identify prerequisite knowledge and skills. The next stage of learning analysis is the thorough analysis of each task statement. This analysis should allow the instructional developer to identify any prerequisite learning that may be necessary, such as skills, knowledge, and attitudes (SKA) the students should have before they can master the tasks to be taught in the course.
Resource Analysis. Resource analysis is the process of determining the type and quality of resources that are required to design, develop, operate, and support an instructional system. Resources should be analyzed in order to identify:

- Course development resources
- Quantity of those resources
- When the resource is needed to meet the scheduled training delivery date
- Total cost of resources

- Resource constraints

Target Audience Analysis. Target audience analysis is the process of determining the entry-level skills or behaviors that students should have prior to entering a course of instruction. Entry-level skills or behaviors are determined during task analysis. This analysis also identifies the general characteristics they should have such as reading grade level, physical strength, attitude, and previous experience. This information facilitates instructional design considerations such as instructional content, level of content, motivational needs, and instructional methods. Conducting an analysis of the target audience allows the designer to base the instructional system on the skills, knowledge, and attitudes (SKA) of the target audience. This reduces the likelihood that the instruction will be inadequate. Target audience analysis produces various data depending on the nature and scope of the analysis, i.e.,

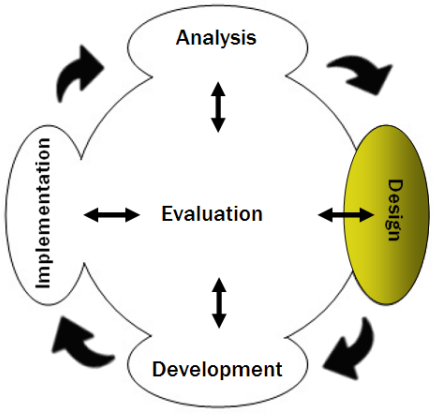
- Range of aptitudes
- Previous background and experiences
- Previous education
- Interests
- Size of target audience
- Demographics
- Computer literacy

Design Phase

During the design phase, learning objectives, learning strategies learning activities, media selection, etc., are developed (Dick, et al., 2009; Smith & Ragan, 2005).

The first activity in the design phase is to develop objectives for the tasks that were identified as requiring instruction in the analysis phase. During learning analysis, tasks are categorized into types of learning outcomes. When developing instructional objectives, it is important that they are consistent with the instructional need as presented in the overall system concept.

During this phase, instructional and cognitive strategies are designed. Cognitive strategies are mental activities performed by the learner and the teacher/trainer/instructional designers task is to plan the instruction so that the learner can use one or more of the cognitive strategies to mentally process the content and learn the material (West, Farmer, & Wolff, 1999).



Media Selection

The instructional media selection process is a systematic approach and an integral component of the instructional systems design (ISD) process. When selecting the most appropriate instructional media for distance learning, consideration must be given to a number of variables that may influence the selection of one medium over another. Using a systematic approach to media selection ensures that appropriate instructional media are employed to support desired learning objectives. Media selection analysis must evaluate general and specific criteria, including instructional, student, and cost aspects for each delivery technology (or instructional medium) to ensure attainment of the instructional goal (Holden & Westfall, 2012). Some instructional issues that must be considered are:

- Identification of knowledge and skill gaps
- Effective assessment and measurement tools
- Level of interaction
- Instructional strategies
- Complexity of content
- Rate of content change
- Level and domain (cognitive, affective, psychomotor) of learning objectives
- Symmetry
- Synchronicity

Synchronous versus Asynchronous Learning Environments. A synchronous learning environment supports live, two-way oral or visual communications between the instructor and the student. This exchange of information facilitates the transfer of knowledge from instructor to the student and can be achieved by 1) the use of audio response systems that support oral communications only; 2) the use of interactive keypad devices that support both the exchange of data and voice; or 3) the use of video-conferencing technologies. Synchronous learning also incorporates these elements:

- Provides an engaging learning environment with varying levels of interactivity
- Enhances spontaneity of responses
- Allows for optimal pacing for best learning retention
- Allows for immediate reinforcement of ideas
- Controls length of instruction when completion time is a constraint
- Is constrained by time, but not place

An asynchronous learning environment exists when communication between the instructor and the student is not real-time. Examples of asynchronous instruction in a distance learning environment are the use of text materials (print or electronic), and online discussion boards where students respond to questions from the instructor or other students. Asynchronous learning also incorporates these elements:

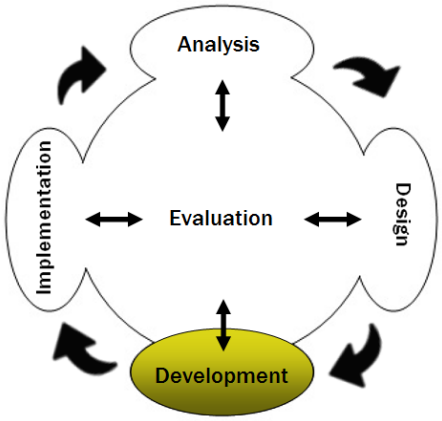
- Provides for more opportunity for reflective thought
- Not constrained by either time or place
- Delays reinforcement of ideas
- Provides for flexibility in delivery of content

- May have higher attrition rate and may extend time for completion

Difference between instructional media and instructional technology. In the past, many have associated instructional technology with instructional media, where early definitions of instructional technology were based upon instructional media, per se, the physical means by which instruction was presented to students. Not surprisingly, the term instructional media was widely accepted ad being the physical means by which instruction was presented to learners. However, with the emergence of computer-mediated and web-based technologies, the term instructional technology has taken on a much broader meaning. In their book on *Trends and Issues in Instructional Design and Technology*, Robert Reiser and John Dempsey (2012) defined instructional technology as "the analysis of learning and performance problems, and the design, development, implementation, evaluation and management of instructional and non-instructional process and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace."

Development Phase

The development phase results in the learning support products that are ready to provide to the target audience. This phase involves the actual creation of any "deliverables", e.g., print-based materials (handouts), electronic learning support tools (PowerPoint), and other supporting learning materials.



Some of the tasks to be developed in this phase include *plans of instruction*, *writing lessons*, *producing instructional materials,* and *developing interactive courseware*.

Plan of Instruction

Once the instruction has been designed, a plan of instruction (POI) or course syllabus should be prepared. The POI or syllabus serves as the overall plan for conducting instruction in a particular course; therefore, careful preparation of these documents should help ensure the effectiveness and efficiency of the instructional system. They help standardize the instruction while controlling the quality of the teaching-learning activity.

The POI/course syllabus documents the instructional events of a course. It expands the basic course control documents and provides detailed information needed to provide the instruction. Although POIs

or syllabuses can be in different formats, they are normally organized by units or modules of instruction with each unit containing information such as:

- Course description (title, number, and security classification)
- Statement of objectives
- Preferred instructional sequence
- Instructional hours and approximate allocations of those hours to objectives
- Portions of the training standard that the unit of instruction supports
- Instructor requirements, including multiple instructor requirements
- Instructional method, such as lecture, demonstration, performance or self-study
- Support materials, such as student instructional literature or technical orders
- Media utilization
- Equipment utilization
- Instructor guidance
- Lesson plans

Producing Instructional Materials

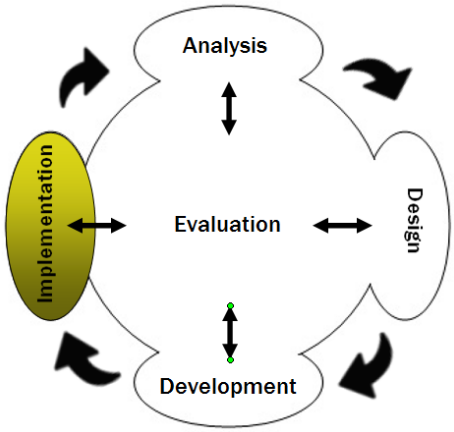
In the development phase, the instructional materials used to support the system should be developed. Material development is a time-consuming and exacting task regardless of the medium that has been selected. It is essential that quality materials be developed, since they carry the information to be learned to the students. Adequate resources are required to develop quality materials in a timely manner. Instructional materials refer to printed or other media intended to convey events of instruction or communicate information to the students.

Types of Instructional Materials

- Print-based material
- Transparencies
- Slide/tape
- Audio/video tapes
- Interactive courseware (ICW), including CBT and CMI
- Interactive video
- Mission scenarios
- Interpretive exercise

Implementation Phase

At this point in the ISD process, the instructional system functions are in place and ready to support implementation of the instructional system or course (Dick, et al., 2009; Smith & Ragan, 2005). The primary responsibilities of the implementation phase are sustained and efficient delivery of learning support to the target audience, maintenance of facilities and records, and ongoing management of the learning system.

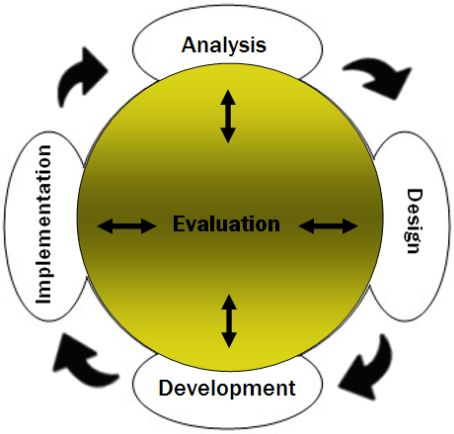


This implementation phase does just that…it implements (delivers) the instructional materials that were designed and developed in the prior stages. It includes scheduling the training event the development of a course/learning management plan consisting of these [but not limited to] components:

- Description of the learning platform
- Description of the audience (target population)
- Directions for administering the learning platform
- Directions for administering and scoring tests
- Directions for guidance, assistance and evaluations of students
- Learning platform map or learning platform sequence
- Lesson plans and learner guides
- Any other documents directly related to the administration of the learning platform

Evaluation Phase

Evaluation is integrated throughout each activity of the instructional development process. It starts in the planning stage with development of an evaluation plan and continues for the life cycle of the training system. The focus of evaluation is continuous improvement in instructional system quality evaluation phase consists of *formative evaluation*, *summative evaluation*, and *operational evaluation* (Dick, et al., 2009; West, et al., 1999; Smith & Ragan, 2005).



The main *goal* of evaluation is to increase learning by assessing the value of the learning experience to the target audience, instructors/facilitators, and other key stakeholders. An evaluation plan provides for end of course evaluation, learning evaluation, longitudinal tracking of results, and summarized results to management, leadership and educational staff/faculty. That said, the *purpose* of evaluation is to improve the effectiveness of instruction and ultimately improve human performance (Dick, et al., 2009).

Training evaluation can provide important diagnostic information and highlight areas in which training can be revised and improved to better meet the training objectives. Evaluation can provide an organization with useful information about the utility of their training programs and can strengthen the case for budget allocation towards training initiatives. When evaluating a learning program and learning effectiveness, there are two primary approaches: *formative* and *summative* evaluation.

Formative Evaluation

Any type of evaluation done before a course is implemented is considered *formative*. Formative evaluation is a process of ongoing feedback on performance. The purposes are to identify aspects of performance that need to improve and to offer corrective suggestions. Formative evaluation validates the goals of the instruction are being achieved and to improve the instruction, if necessary, by means of identification and subsequent remediation of problem areas.

Formative evaluation is conducted to provide program staff evaluative information useful in improving the program/course. It is a bit more complex than summative evaluation in that it is done to "test run" various aspects of instructional materials (Dick, et al., 2009).

Segments of the instruction, e.g., a unit or a lesson, are reviewed, and then you make specific curriculum decisions *before* the course is finalized. The objective is to find and correct problems in the early stages—saving time and money.

Summative Evaluation

The objective of summative evaluation is to determine the total effect of the instruction. Summative evaluation is conducted at the end of the instruction to determine the effectiveness of the teaching/learning process by collecting summative data after the course is finalized but before it is activated (Dick, et al., 2009).

Summative evaluation is a process of identifying larger patterns and trends in performance and judging these summary statements against criteria to obtain performance ratings.

Formative vs. Summative vs. Evaluation. *Formative evaluation* is a process of ongoing feedback on performance. The purposes are to identify aspects of performance that need to improve and to offer corrective suggestions. Formative Evaluation is a more complex than summative evaluation and is conducted to provide program staff evaluative information useful in improving the program. It is done with a small group of people to "test run" various aspects of instructional materials. Formative evaluation is typically conducted during the development a program or course with the intent to improve. The purpose of formative evaluation is to validate or ensure that the goals of the instruction are being

achieved and to improve the instruction, if necessary, by means of identification and subsequent remediation of problematic aspects.

Summative evaluation is a process of identifying larger patterns and trends in performance and judging these summary statements against criteria to obtain performance ratings. Summative evaluation provides information on the product's efficacy (its ability to do what it was designed to do). For example, did the learners learn what they were supposed to learn after using the instructional module? Summative evaluation is typically quantitative, using numeric scores or letter grades to assess learner achievement.

Summative Evaluation vs. Summative Assessment. Although both might look at the same data, a summative [learner] assessment generally looks at how an individual learner performed on a learning task. In other words, it measures student's learning on how they performed on specific instructional objectives, commonly referred to as a criterion referenced assessment.

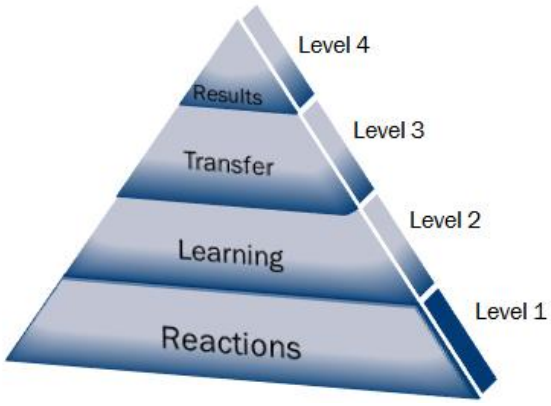
> Note: The criterion referenced instruction framework is a set of methods for the design and delivery of training programs and includes: Task analysis--what needs to be learned; Performance objectives--exact specification of the outcomes to be accomplished (the criterion); and evaluation of learning in terms of the knowledge/skills specified in the objectives (Mager, 1997).

A summative Evaluation, on the other hand, looks at more than one learner's performance to see how well a group did on a learning task that utilized specific learning materials and methods. By looking at the group, the instructional designer can *evaluate the learning materials and learning process*--hence the name Summative Evaluation.

Kirkpatrick's 4 Levels of Evaluation

The four levels of evaluation were developed by Donald Kirkpatrick (1994) where each successive evaluation level is built on information provided by the lower level. According to this model, evaluation should always begin with level one, and move sequentially through levels two, three, and four. Information from each prior level serves as a base for the next level's evaluation. Thus, each successive level represents a more precise measure of the effectiveness of the training program, but at the same time requires a more rigorous and time-consuming analysis (Kirkpatrick's Four Level Evaluation Model (2012).

Kirkpatrick's Four Levels of Evaluation



Level 1 - Reaction

Assesses students' initial reactions to a course, per se, what did the students think of the training program and measure students' satisfaction with a course. This offers insights into a perception of value and often assessed using a survey, sometimes referred to as a "smiley sheet." Occasionally, instructors use focus groups and similar methods to receive more specific comments (qualitative feedback) on the course.

Assessing students' reactions allows instructors to measure if students feel they are learning and satisfied with training. Reaction data can provide the instructor with diagnostic feedback that can be used to modify courses to meet the needs of students. It attempts to answer questions regarding the participants' perceptions, per se, did they like it and was the material relevant to their job?

Types of reactions include:

Affective Reactions. Affective reaction items assess whether or not the student liked or enjoyed the training. Examples of affective reaction items:

- I enjoyed this course
- Overall, I am satisfied with this course.
- I am enthusiastic about what I learned in this course
- During this course I thought about how much I enjoyed it
- This course was boring
- During this course I became frustrated about some of the material
- This course was anxiety provoking at times
- Some of what happened in this course was personally irritating

Utility Reactions. Utility reaction items assess students' perceptions the information and skills taught were useful and job relevant. Examples of utility reaction items:

- The information presented in this course is relevant to my job
- The training will help me perform my job
- This training will have a positive impact on my job performance
- I do not think I will use what I learned in this class
- The training was relevant to my job

Instructor Reactions. Satisfaction with instructor assesses the students' perceptions of the instructor's contributions to learning. Examples of instructor reaction items:

- The instructor explained things clearly
- The instructor was prepared for every class
- The instructor was competent
- The instructor was knowledgeable about the training content
- Overall, this instructor was effective at teaching this course

Course Delivery Reactions. Satisfaction with delivery assesses students' perceptions the material was presented in an organized and coherent manner. Examples of course delivery reaction items:

- The course content was well organized
- The material presented was appropriate for students at my level of experience
- The structure of the course made it easy to learn the material
- The pace of the course was appropriate
- The training was coherent

Technology Reactions. Satisfaction with technology assesses students' perceptions the course technology was easy to use and facilitated learning. Examples of technology reaction items:

- The technology enhanced my learning experience
- The technology interface was difficult to use
- Overall, I am satisfied with the technology used in this course
- The technology helped me learn the course content

Level 2 - Learning

Assessing at this level moves the evaluation beyond learner satisfaction and assesses if the student has advanced in skills, knowledge, or attitude (SKA). Basically, it assesses the amount of information the students learned. Instructors usually assess this with a criterion-referenced test. The criteria are objectives for the course: statements developed before a course is developed that explicitly state the skills that participants should be able to perform after taking a course. Because the objectives are the requirements for the course, a Level II evaluation assesses conformance to requirements. Measurement at this level is more difficult than level one. When measuring learning there are 3 types of learning outcomes that can be assessed:

Cognitive Outcomes. Cognitive outcomes include the acquisition of declarative knowledge—the facts and principles presented in the course. The test format used should match the desired learning outcomes.

Skill-based Outcomes. Skill-based outcomes involve the development of technical or motor skills. Indicates students' abilities to perform the skills demonstrated in the course. When evaluating skill-based outcomes, it is important to choose the criteria that are more applicable for the skill tested:

Speed—how fast can the trainee perform the task
Accuracy—how precisely can the trainee perform the task
Technique—how well did the trainee perform the task

Affective Outcomes. Affective outcomes include changes in trainees' attitudes and motivation levels. This includes measuring learning outcomes such as organizational commitment, tolerance for diversity, and self-efficacy.

Level 3 – Transfer

Behavioral outcomes indicate whether the material presented in training is successfully transferred to the workplace. This level measures the transfer that has occurred in learners' behavior due to the training program.

Evaluating at this level attempts to answer the question: Are the newly acquired skills, knowledge, or attitude being used in the everyday environment of the learner? Measuring at this level is difficult as it is often impossible to predict when the change in behavior will occur, and thus requires important decisions in terms of when to evaluate, how often to evaluate, and how to evaluate.

Level 4 - Impact

Assessing the results from training allows an organization to examine the impact of training on organizational objectives. This type of evaluation is often useful in showing the return on training investments, although collecting the data can be challenging and is the most difficult level to measure. The difficulties and challenges is that many times the methodology for assessing the impact in that the metrics used to collect the data (both qualitative and quantitative) may not be clearly defined.

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