Introduction to Instructional Systems Design--Overview of the ADDIE Model

2019

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INSTRUCTIONAL SYSTEMS DESIGN (ISD)

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 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).

Systems Approach. 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.

A systems approach includes the planning, development, implementation, and evaluation of instruction. The primary focus of a systems approach is at the outset ask the question “what learners are to know or be able to do when the instruction is concluded”? Consequently, establishing the link

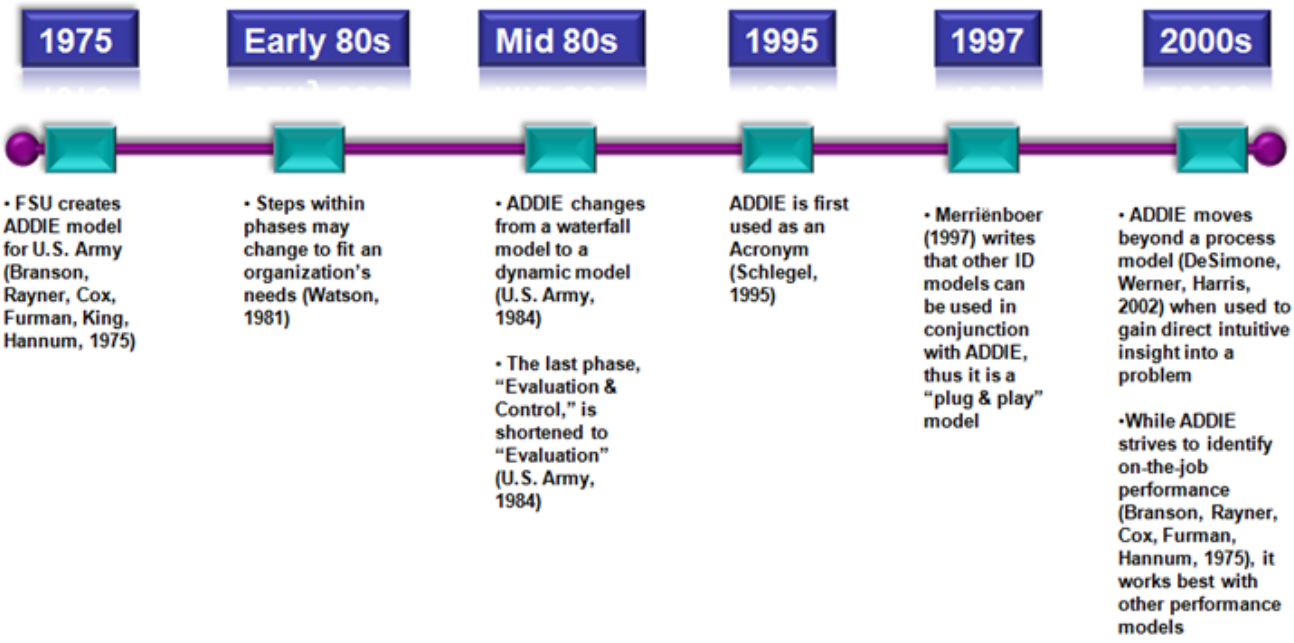
between the instructional strategy and the desired learning outcomes becomes paramount. The role of the instructional designer in this process cannot be overstated, and at the most basic level, the instructional designer/teacher's job is to answer three major questions:

- Where are we going? (What are the goals of the instruction?)
- How will we get there? (What is the instructional strategy and the instructional medium?)
- How will we know when we arrive? (What should our tests look like? How will we evaluate and revise the instructional materials?

The ADDIE Instructional Design Model

While there are a variety of ID models that have been generated since the 1970s, practically all ID models contain the core elements of ADDIE (http://www.learndash.com/addie-model-explained-infographic) based on a systematic product development concept. 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
(ADDIE Timeline, 2014)



While the ADDIE model has been around since 1975, the acronym "ADDIE" did not make its way into the popular literature until the mid 1990s (ADDIE the Acronym (2014). The use of ADDIE was probably done to distinguish it from other ISD models, and in the U.S. military, it became an integral component of the System Approach to Training (SAT), which emerged in the mid-1970s. However, ADDIE is not a specific, fully elaborated model in its own right, but rather a paradigm that refers to a family of models that share a common underlying structure (Reiser & Dempsey, 2012). According to Molenda (2003), the ADDIE label seems to have evolved informally through oral tradition, rather than having been

formalized as a term by a single author. Molenda further asserts that ADDIE has become a colloquial term used to describe a systematic approach to instructional design.

The ADDIE ISD model consists of five phases. The analysis phase defines the problem, what causes the problem, and if an educational/training intervention solution is warranted. 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 – The analysis phase forms the foundation of the learning or training process. In the analysis phase, instructional problem is clarified, the instructional goals and objectives are established and the learning environment and learner's existing knowledge and skills are identified.

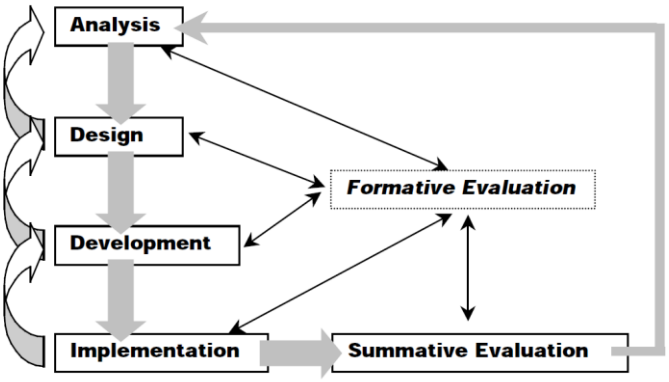
Phase 2: Design - Define learning objectives, define the learning solution, identify performance steps, and identify methods and media.

Phase 3: Development - Develop instructional materials in accordance with design. This phase elaborates and builds on the learning objectives and performance steps by developing the instructional content, learning activities and, develop appropriate instructional and cognitive learning strategies.

Phase 4: Implementation – The Implementation phase is where the learning, training, processes, products, and services are actually delivered to the learners.

Phase 5: Evaluation - Performed during development, during implementation, immediately after training, and six months or more after training. This phase includes both formative and summative evaluation.

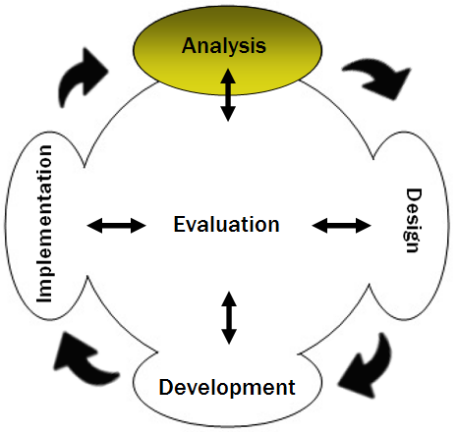
While the original ADDIE model was considered a serial process/waterfall model where each phase is perfected before moving on to the next one, the revised version provides a more dynamic, *flexible* guideline for developing effective and efficient instruction (*Instructional System Design (ISD): Using the ADDIE Model, 2000).*



Note : While the ADDIE is a very popular and common ID model used extensively throughout the education and training community, there are several other ID models, e.g., Rapid Prototyping, Dick and Carey, SAM, and AGILE. Rapid Prototyping is an iterative approach where learning is developed in a continual design-evaluation cycle. Similarly, SAM, an acronym for Successive Approximation Model, is a rapid development model where analysis, design, and development can all take place at the same time. The Dick and Carey model, popular in schools and educational environments, uses nine stages beginning with identifying instructional goals and ending with conducting a summative evaluation. The AGILE model offers an iterative approach to design and development.

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., 2015). During the analysis phase, there may be instances where it may appear a training intervention is warranted, but further investigation may reveal the problem should not result in a training solution (Needs Assessment, 2017).



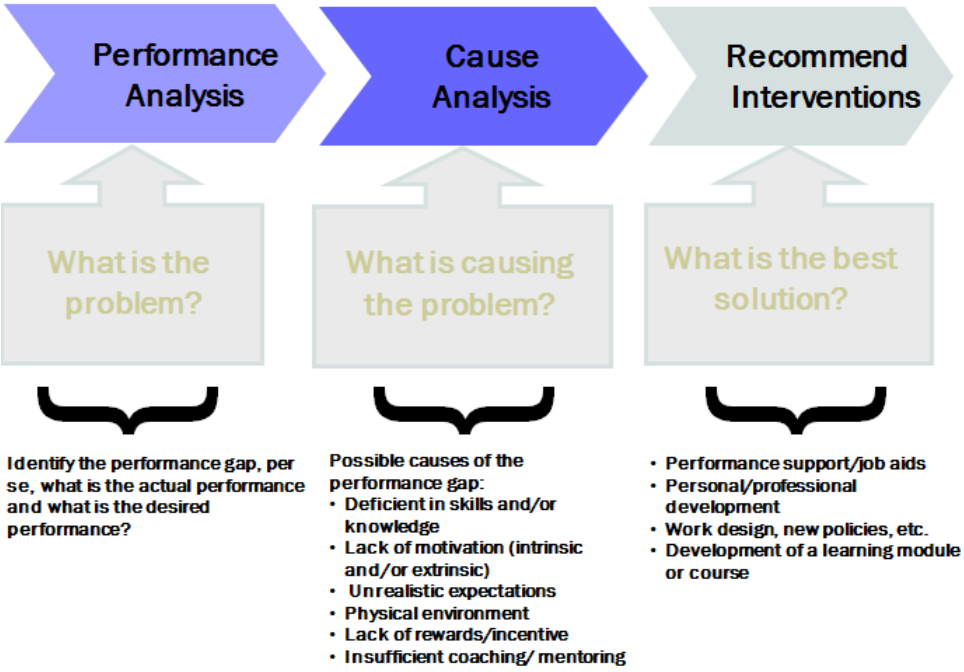
It is important to distinguish between the *real need*, as opposed to the *perceived need*, that can be solved by instruction/training intervention. In most instances, the difference between what the

learner knows and what the learner should know is the knowledge gap, which drives the requirement for instruction/training intervention to "bridge" the gap. Consequently, the identification of the performance "gap" results in the identification of the need, which results in the development of the needs statement (identification of the problem).

Based on the knowledge/skill gap you identify, you then develop the instructional objectives which create the foundation of your learning intervention solution. From your objectives you would then 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.

In the analysis phase, you are basically asking yourself:

- What is the problem
- What is causing the problem, and…
- How to fix the problem



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 teacher/instructional designer generates a list of tasks (task analysis) to be performed. The cognitive 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

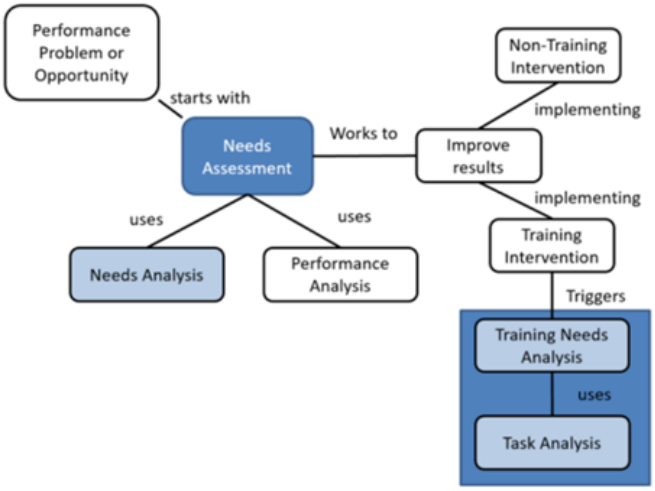
Target Audience Analysis. Target audience analysis is the process of determining the entry-level skills or behaviors that students should have prior to entering a course of instruction. Entry-level skills or behaviors are determined during task analysis. This analysis also identifies the general characteristics 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

Needs Analysis vs. Needs Assessment

A performance problem or new opportunity starts with a needs assessment. A needs assessment includes both a needs analysis and performance analysis. If a learning intervention is required, then you conduct a training needs analysis (TNA). The TNA uses task analysis to determine what has to be trained and what does not. A needs assessment identifies gaps between current and desired results and places those [gaps] in priority order on the basis of the costs to ignore the needs." They also stress that the gap *is* the need. Their book provides an excellent breakdown of the difference between ends and means, wants and needs, as depicted below (Watkins, Meiers, and Visser, 2012).

Needs Assessment vs. Needs Analysis Concept Map

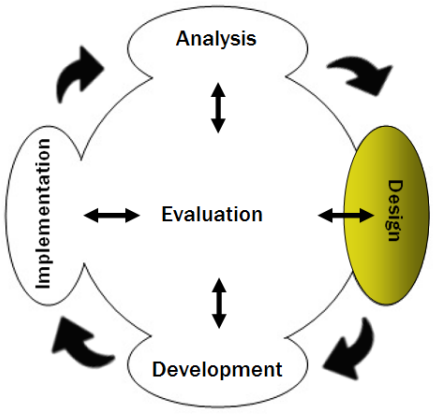


Design Phase

During the design phase, the *learning objectives*, *performance tasks*, *instructional strategies*, *learning activities*, and *media selection*, etc., are developed (Dick, et al., 2015; 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.

Objectives guide the designer in selecting content and developing an instructional strategy and assessment process. Furthermore, when developing instructional objectives, it is important 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).



Design Learning Objectives

Upon completion of the analysis phase, learning objectives are designed when it has been determined a learning intervention strategy/learning event is warranted. A learning event is designed as a response to education and/or training needs, and the degree of precision of articulating the learning

objectives is directly related to achieving the desired learning outcomes. Clearly identifying learning objectives improves the communication between the instructor and the learner for a given course/learning module so the student knows precisely what is expected of him/her. Clarifying your intended learning outcomes provides a basis for instructional planning and sets the stage for both teaching and assessment.

Since learning objectives are developed from a knowledge/skill gap analysis identified in the front-end needs assessment process, the goal of creating learning objectives is to ensure the training/ education and/or intervention is successful and the objectives are achieved.

When the objectives of a course have been clearly identified and presented in an orderly progression, the desired learning outcomes will be attained. They may also assist in the choice of the instructional delivery method(s) and instructional strategies when designing a learning activity, as well as establishing criteria for student performance when assessing student learning outcomes.

A properly written objective tells you what specific knowledge, skill, or attitude is desired and what method of instruction and criteria for learner achievement are required. A learning objective is a succinct statement that describes the specific learning activity and includes a description of a performance you want learners to be able to exhibit in order to evaluate competency. It is expressed in terms of the student and formulated in terms of observable behavior and the special conditions in which the behavior is manifested. An instructional objective describes an intended outcome of instruction rather than an instructional procedure.

Components of Learning Objectives

The purpose of a learning objective is to communicate to the learner what is expected of them in terms of performance, and a well-constructed learning objective should leave little room for doubt about what is intended. When the objectives have been clearly identified and presented in an orderly progression, the desired learning outcomes will be attained. They may also assist in the choice of the instructional delivery method(s), design of instructional strategies and learning activities, as well as establishing criteria for student performance when assessing student learning outcomes (Dick, Carey, L., & Carey, J.O., 2015).

A properly written objective tells you what specific knowledge, skill, or attitude is desired and what method of instruction and criteria for learner achievement are required. A learning objective (also referred to as instructional objectives, behavioral objectives, or performance objectives) is a succinct statement that describes the specific learning activity and includes a description of a performance you want learners to be able to exhibit in order to evaluate competency. It is expressed in terms of the student and formulated in terms of observable behavior and the special conditions in which the behavior is manifested. An instructional objective describes an intended outcome of instruction rather than an instructional procedure (Mager, 1997).

A well constructed learning objective describes an intended learning outcome, and contains four components that comprise each learning objective (Mager, 1997):

- The *audience* is the *who* the objective is directed toward, i.e., the student, the associate, the medical technician, the flight mechanic, etc.
- The *condition*, a statement that describes the conditions under which the behavior is to be performed, per se, what a learner is expected to be able to do given a specific situation

- A *behavioral* (performance) *verb* that defines the observable behavior itself
- The *degree* (criteria), to which a student must perform the behavior

Note: The essential components of instructionally sound learning objectives can be organized into a mnemonic: ABCD, which represents audience, behavior, condition, and degree. When designing learning objectives, relate the mnemonic ABCD to Who, What, Where, and How, specifically…

- The **A**udience is the **Who**, (e.g., the student, the associate, the technician, etc.)
- The **B**ehavior is the **What** (the measurable performance verb)
- The **C**ondition is the **Where** (the given the set of circumstances surround the objectives)
- The **D**egree is the **How** (describes the criteria used to evaluate how the measurable performance verb will be measured)

The components described above are used when developing criterion referenced tests. Criterion-referenced assessments measure how well a student performs against an objective or criterion. While the criteria/degree statement should clearly articulate to the learner how well the measurable verb is to be performed, an assessment is used to *measure the attainment* of the learning objective(s). Assessing learning objectives is an integral and critical component of the Evaluation Phase of the ISD model. Specifically, a summative assessment is the most common form used to measure if the learning objectives were actually attained.

Instructional Strategy

The term instructional strategy suggests a huge variety of teaching/learning activities, such as group discussions, independent reading, case studies, lectures, computer simulations, worksheets, co-operative group projects, etc. These essentially are *microstrategies* that represent pieces of an overall *macrostrategy* which take learners from a motivational introduction to a topic through learners' mastery of the objectives (Dick, et al., 2009). In other words, a *micro-level* strategy are ways to approach instruction on particular topics or learning goals, whereas developing instruction at the macro level is frequently referred to as *curriculum development* (Smith & Ragan, 2005. P. 286).

A *macroinstructional* strategy (the complete instruction) is created when an instructional designer/ teacher does everything to bring about learning, i.e., define the objectives, write the lesson plan and tests, motivate the learners, present the content, engage the students as active participants in the learning process, and administer and score the assessments (Dick, et al., 2009). Consequently, when designing instruction, it is necessary to develop an instructional strategy that employs the knowledge we have about facilitating the learning process.

There are two major learning strategies common to any instructional medium (including multimedia): *deductive* and *inductive* (Lee & Owens, 2004). In a deductive learning strategy, students draw general conclusions from specific information.

> The instruction presents the specific pieces of information from which students draw their general conclusions and apply them to broader situations. The inductive strategy requires students to draw specific conclusion general information. The instruction allows them to achieve the desired conclusion by establishing the situation and allowing them to gather the required information (Lee & Owens, 2004. 9. 141)

Transfer of learning means that something learned in one situation can be applied in another. Since transfer is the primary goal of instruction, it is imperative one must design for transfer. To that end, transfer is facilitated by the development of instructional strategies.

Instructional strategies focus on the delivery of knowledge, while cognitive strategies focus on how the learner processes the knowledge. Instructional strategies describe the general components of a set of procedures used to enable students' mastery of learning outcomes, and are developed in support of the instructional goal and specific learning (instructional) objectives.

Scholars have identified learning to be primarily a social, dialogical process. Social learning theory suggests that most learning takes place in a social context where learner behavior is modeled by others. This modeling can occur through lecture, guided discussion, role-playing, case study, and other instructional strategies. To that end, student activities are the product of an instructional strategy that facilitates the attainment of the instructional objectives.

When articulating an instructional strategy, you must clearly relate the instructional strategy with the corresponding learning theory. For example, in each phase of a learning activity, you would define and identify the key elements of the applicable learning theory and the appropriate instructional strategy that characterizes the specific learning theory. The student activities are the product of an instructional strategy that facilitates the attainment of the instructional objectives.

Instructional strategies focus on the delivery of knowledge, while cognitive strategies focus on how the learner processes the knowledge. Instructional strategies describe the general components of a set of procedures used to enable students' mastery of learning outcomes, and are developed in support of the instructional goal and specific learning (instructional) objectives.

Examples of instructional strategies are:

- Lecture
- Demonstration
- Role Playing
- Guided Discussion
- Brainstorming
- Case Study
- Simulation
- Games & Gamification
- Modeling

Cognitive Learning Strategies

While instructional strategies focus on the transmission of knowledge and describe the general components of a set of procedures used to enable student mastery of learning outcomes, cognitive learning strategies are methods used to help learners link new information to prior knowledge (Driscoll, 2005; Bruning, Schraw, Norby, & Ronning, 2004). To that end, cognitive strategies focus on how the learner processes knowledge and provides a structure for learning through mental strategies, and these are used to facilitate the activation and retention of prior knowledge by integrating active and exploratory learning techniques into the design process. Consequently, cognitive learning strategies focuses on how the learner processes the knowledge and supports the learner as they

develop internal procedures that enable them to perform tasks that are complex, and can increase the efficiency with which the learner approaches a learning task (Driscoll, 2005).

The utility of cognitive learning strategies can be employed by trainers and/or instructional designers to facilitate the activation and retention of prior knowledge by focusing on *knowledge construction*. Since cognitive learning strategies primarily focuses on how the learner processes the knowledge, it provides a structure for learning when a task cannot be completed through a series of steps, e.g., *scaffolding*.

Cognitive learning strategies can be *represented* based on the information presented, and is used as tools to construct knowledge in new concepts (Driscoll, 2005).

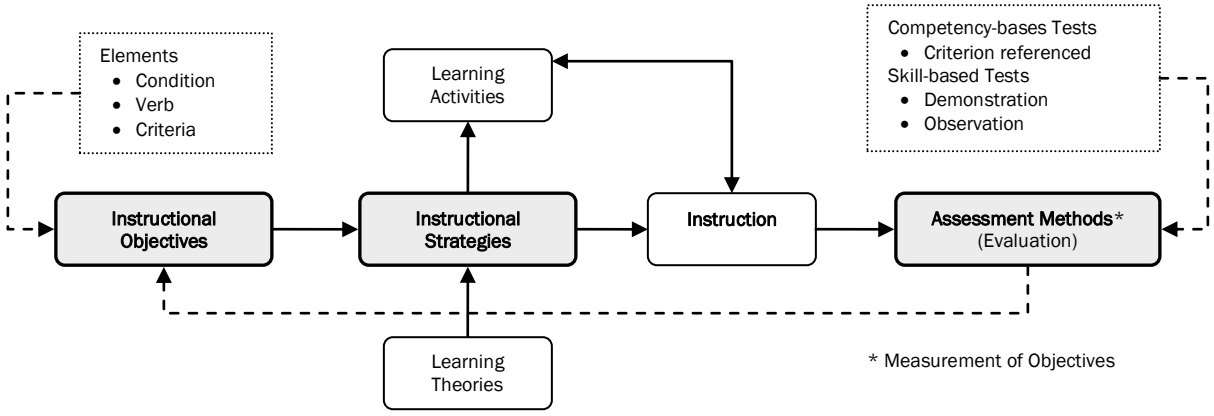
Examples of cognitive strategies are:

- Organizing Strategies
  - Chunking
  - Rehearsal
- Spatial Strategies
  - Frames
  - Concept mapping
- Bridging Strategies
  - Advance Organizer
  - Metaphor, analogy, simile
- Mnemonics
- Imagery

Learning Activities

The utility of cognitive learning strategies can be employed by teachers/instructional designers to facilitate the activation and retention of prior knowledge by integrating active and exploratory learning techniques into the design process. While active learning involves activity, exploratory learning requires exploration on the part of the learner. When translating learning theory into the design of content, integrating multimedia components can lead to effective learning.

Learning Activity Design Model



Robert Gagné's Nine Events of Instruction

Robert Gagné created a nine-step process referred to as *The Events of Instruction* (Gagné, 1985). The events of instruction of instruction are related to the learning process in that it supports the internal processes of learning. Information undergoes a series of transformation as it passes through the stages of memory. Processes thought to be responsible for these transformations include attention, pattern recognition, retrieval, rehearsal, encoding, retention, and so on. Modifying the information flow, as well as setting processing priorities, are executive control processes (Driscoll, 2005). Because learning takes place only when these processes are activated, the goal of instruction, according to Gagné, should be to facilitate this activation through his nine-step process.

The Nine Events of Instruction:

- Gain attention
- Inform learner of objectives
- Stimulate recall of prior learning
- Present stimulus material
- Provide learner guidance
- Elicit performance
- Provide feedback
- Assess performance
- Enhance retention and transfer

Selecting Instructional Media

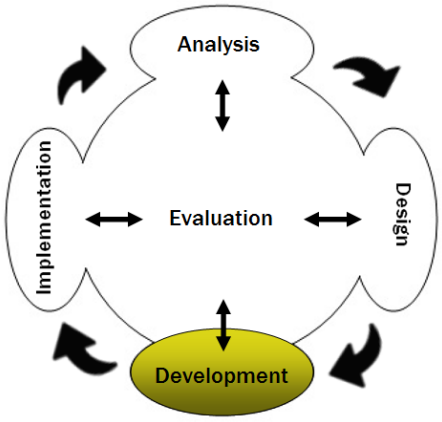
The instructional media selection process is a systematic approach and an integral component of the instructional systems design (ISD) process. When selecting the most appropriate instructional media for distance learning, consideration must be given to a number of variables that may influence the selection 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

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), instructional media delivery tools

(computer mediated), and other supporting learning materials. Some of the tasks to be developed in this phase include *plans of instruction and producing instructional materials*.



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

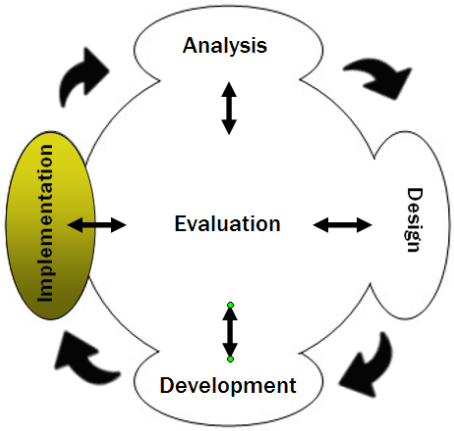
materials in a timely manner. Instructional materials refer to printed or other media intended to convey events of instruction or communicate information to the students.

Types of Instructional Materials

- Print-based material
- Transparencies
- Slide/tape
- Audio/video tapes
- Interactive courseware
- 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., 2015; 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.



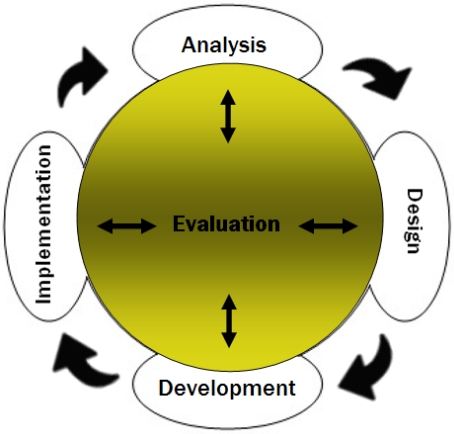
This implementation phase does just that…it implements (delivers) the instructional materials that were designed and developed in the prior stages. It includes scheduling the training event the development of a course/learning management plan consisting of these [but not limited to] components:

- 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

The purpose of evaluation is to improve the effectiveness of instruction and ultimately improve human performance. Consequently, 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., 2015; 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. Overall, the *purpose* of evaluation is to improve the effectiveness of instruction and ultimately improve human performance (Dick, et al., 2015).



Learning evaluation can provide important diagnostic information and highlight areas in which the learning event can be revised and improved to better meet the training objectives. Evaluation can provide an organization with useful information about the utility of their instructional programs and can strengthen the case for budget allocation towards learning/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., 2015).

Segments of the instruction, e.g., a unit or a lesson, are reviewed, and then revised [if necessary] to make specific curriculum decisions *before* the course is finalized. The goal 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., 2015). 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 assessment *measure*s the attainment of the learning objectives in terms of the knowledge/skills specified in the learning 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.

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. 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 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 the learner performs the task
Accuracy—how precisely can the learner performs the task
Technique—how well learner performs 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 and challenging to predict when the change in behavior will occur, 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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