Domain of Design

The domain of instructional design is the catalyst for the instructional design process. Instructional design is the process of systematically developing instructional specifications using learning and instructional theories (Seels & Richey, 1994). Before engaging in instructional design process, instructional designers conduct comprehensive analysis. Thus, analysis is also included within the domain of design. Analysis pertains to the process of determining what current problem exists within an organization and then resolving it by creating an effective instructional solution.

Various names have been used for the analysis domain. For example, front-end analyses refer to pre-training analysis, problem analysis, needs assessment, cause analysis, and solution analysis (Rossett, 1987). During the analysis phase, the instructional designer determines the need of the client or organization. The need is the gap between current performance and optimal performance. The analysis process also entails environmental, goal, task, performance, and learner analysis. The instructional designer uses the information gathered from the front-end analysis to identify the best possible solution for the problem. If the solution is a learning solution, then instructional designers engage in four focus areas within the design domain, which are: 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, developing, implementing and evaluating instruction" (Seels and Richey, 1994, p.31). There are numerous instructional systems design models available to instructional designers. Instructional designers often use models and theories to design and develop instruction. But, each of the models follows the basic principles of analysis, design, development, implementation, and evaluation (ADDIE). ADDIE is a generic model that identifies the five major phases of the instructional systems design process.

As explained earlier, during the analysis phase instructional designers determine the need, or the performance problem, by completing the needs analysis process. During the needs analysis process, instructional designers conduct a series of analyses to define the problem based on data that is gathered and determine whether or not instruction will solve the problem. Instructional designers never assume that instruction is always the solution to a performance problem; it is only when instruction is the best solution that the instructional systems design process begins (Morrison, Ross, & Kemp, 2007).

During the design phase instructional designers identify goals, write learning objectives, determine assessment strategies, and select proper instructional methods and instructional media. During the development phase instructional designers focus on producing materials based on the content that was decided during the design phase. At this time in the systems design process, instructional designers focus on how the materials are going to look and how to integrate appropriate media to present information to the learners. After the instructional materials are developed, they are formatively evaluated to ensure that the materials meet the needs and quality standards that were determined in the analysis and design phases. If feedback on the materials requires revisions, then the revisions will be completed before the instructional materials are implemented.

During the implementation phase instructional designers diffuse an innovation within an organization and ensure that the innovation, whether it is new media or technology, is accepted and utilized in a real world context. Instructional designers specify the requirements of implementation, such as, time, training facilities, materials, equipments, etc. According to Seels and Glasgow (1998), there are four essential steps that instructional designers complete in order to successfully implement an effective instructional system design project: diffusion and adoption of an innovation, planning for the actual implementation within the organization (to limit the number of possible problems that may arise), evaluate summatively to determine whether or not the innovation meets the needs of the clients, and dissemination of information regarding the findings of the summative evaluation.

During the evaluation phase which consists of both a formative and a summative evaluation, designers determine whether or not the instruction met the needs of the client. It is during the formative evaluation that professionals can determine whether or not the instructional materials need to be revised again. Formative evaluation serves as the way in which instructional designers improve the instruction. Summative evaluations determine whether or not the training taught the information to the learners. Summative evaluations determine how effective the training was and whether or not learners can transfer what they have learned to real-world situations.

There are two different types of models that instructional designers utilize to design, plan, and develop instruction. The first type of model that instructional designers select and utilize is a procedural model. Procedural models detail the different stages or phases of an instructional design project. Procedural models walk the instructional designer through the process of analysis, design, development, implementation, and evaluation. Instructional designers can compare the varying instructional systems procedural models to determine the best framework to utilize when starting an instructional systems design project.

Although some instructional systems process models are perceived as being linear due to the visual representation of the models; instructional systems design process models require feedback and revision, which results in a cyclical and systematic process for completing an instructional systems design project. Some examples of instructional systems procedural models are: Dick, Carey, and Carey's Systems Approach Model (1996) which is a more comprehensive model; Kemp, Morrison, Ross Model (1994) which is flexible and often used more in educational (K-12 and higher education) settings; R2D2 (1995), which stands for recursive reflective design and development, is based on a constructivist philosophy; and the Air Force Model (1975) which was used to for designing instruction for military courses (Seels & Glasgow, 1998). Each of these models may be used in different contexts, but they all provide instructional designers with a systematic approach to designing instruction to solve performance problems.

The second type of model that instructional designers utilize to plan, design, and develop instruction is an instructional design model. As an instructional designer, selecting the correct instructional design model helps guide the designer in determining the best instructional strategy to utilize when designing instruction. The instructional designer selects an instructional design model based on the information that is gleaned from the analysis phase. By taking into consideration environmental factors, learner characteristics, and the objectives of the instruction; instructional designers are able to make well-informed decisions about which instructional design model is best. In order to determine the best instructional systems design model instructional designers may utilize Charles M. Reigeluth's "Framework for Comparing

Instructional Strategies" (1999). This framework helps the instructional designer analyze the key characteristics of the instructional systems and on the basis of this analysis determine which model has all the components to effectively design instruction for a project.

Reigeluth provides instructional designers with a series of guiding questions that help to compare instructional design models to determine which model would be best based on the learning objectives, learner characteristics, and an environmental analysis. So, it is the instructional designer's job to determine which model is the best, given the following focal points of comparison: type of learning, control of learning, focus of learning, grouping for learning, interactions of learning, and support of learning. The comparison framework is helpful because it narrows down the selection of models and theories, and points out that not all theories are going to meet the needs of the learners. For example, using Reigeluth's comparison framework, when the type of learning requires learners to apply skills and understand relationships; and the control of learning is given to students the designer may consider an open learning model such as Schwartz, Lin, Brophy, and Bransford's "Flexibly Adaptive Instructional Design". However, if the type of expected learning requires understanding the relationship, but the control of learning is more teacher-centered then a model such as Howard M. Gardner's "Multiple Approaches to Understanding" could be utilized. Therefore, by selecting the appropriate instructional systems design model, instructional designers can then utilize specific instructional strategies to ensure that the instructional materials match the desired learning behaviors.

Message Design

Message design involves planning and deciding on the medium through which instruction is delivered to the learner. According to Seels and Richey (1994), message design "encompasses principles of attention, perception and retention that direct specifications for the physical form of messages which are intended to communicate between a sender and receiver" (31). Message design specifically focuses on the micro level of design; it breaks the instructional message into easily manageable pieces. Then the message is displayed by putting it on a page or screen. For example, a user interface lets learners interact with a system to receive the designed message that is being displayed. So, in order to communicate the message effectively to the learner; designers organize information, which is presented to learners, in a way that is easy to understand, attracts the learners' attention, and effectively combines words and pictures. These are examples of multimedia design principles that should be utilized when determining message design.

Also, instructional designers refer to theories and models to help determine message design; such as, Richard Mayer's "Cognitive Theory of Multimedia Learning" (2001) that focuses on three assumptions in regards to multimedia learning environments:

1. People possess separate channels (visual and auditory) to process information.
2. People have a limited capacity for how much information they can process at any given time.
3. People participate in active processing of information by selecting relevant information, organizing information, and integrating knowledge acquired with representations of the information within their own minds. (p. 44).

This theory as well as others in the field focuses on how information is presented to learners to ensure that learning occurs. Also, when the learner is presented with information, it should be presented in a manner so that the learner can easily recognize the information. John Sweller's "Cognitive Load Theory" is also helpful to instructional designers because it further explains that working (short-term) memory has a limit. When there is an overstimulation of the working memory then it is hard for learners to retain the new information and convert it to long-term memory. Therefore, when instructional designers utilize theories such as Sweller's and Mayer's, designers utilize techniques to ensure that the message design is appropriate for the learning outcome.

Richard Mayer's book, *Multimedia Learning* (2001) identifies and explains different multimedia principles that instructional designers should use when designing how the message will be put onto paper, screen, or represented in another type of medium. There are many mediums that can be used to present information to learners, such as: print-based materials, computer-based materials, face-to-face instruction, etc. Instructional designers focus on which type of medium will be the most useful when dealing with specific tasks and a specific group of learners. This is the reason why the characteristics of learners are analyzed during the design process. By determining entry-level behaviors and current feelings and attitudes, instructional designers can effectively select the best delivery method for the information. At the same time, principles of visual design do not change based on the medium. Whether a job-aid or computer-based medium, the principles of visual design still apply to ensure that the message design meets the learners' needs easily and effectively.

Instructional Strategies

Instructional strategies help to sequence events to ensure that learning objectives are met and that learning occurs. Instructional strategies vary based on learning objectives. Instructional strategies also assist instructional designers by taking into consideration learners and different types of learning environments. In addition, selecting strategies and sequencing instructional events are informed by the domain and categories of learning outcomes. Robert Gagne's "Taxonomy of Learning" and his "Conditions of Learning" (1970) are widely used by instructional designers to make decisions about instructional strategies and instructional events. Gagne's events of instruction theory explains a series of events for instruction that support learners.

The Nine Events of Instruction:

1. "Gaining attention
2. Informing learner of the objective
3. Stimulating recall of perquisite learning
4. Presenting the stimulus material
5. Providing learning guidance
6. Eliciting the performance
7. Providing feedback about performance correctness
8. Assessing the performance
9. Enhancing retention and transfer" (Dick, Carey, & Carey, 2005 p. 189)

According to Dick, Carey and Carey (2005), instructional strategies promote student learning through the use of pre-instructional activities, content presentation, learners' participation, assessing the learner, and follow-through activities. As an instructional designer goes through the design process, they take into consideration the context, content, learning goals and objectives to select the instructional strategy that fits the learners' needs.

Charles M. Reigeluth's book, *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory, Vol. II*, is an excellent source for instructional designers that are trying to determine the best instructional strategy for their project.

Learner Characteristics

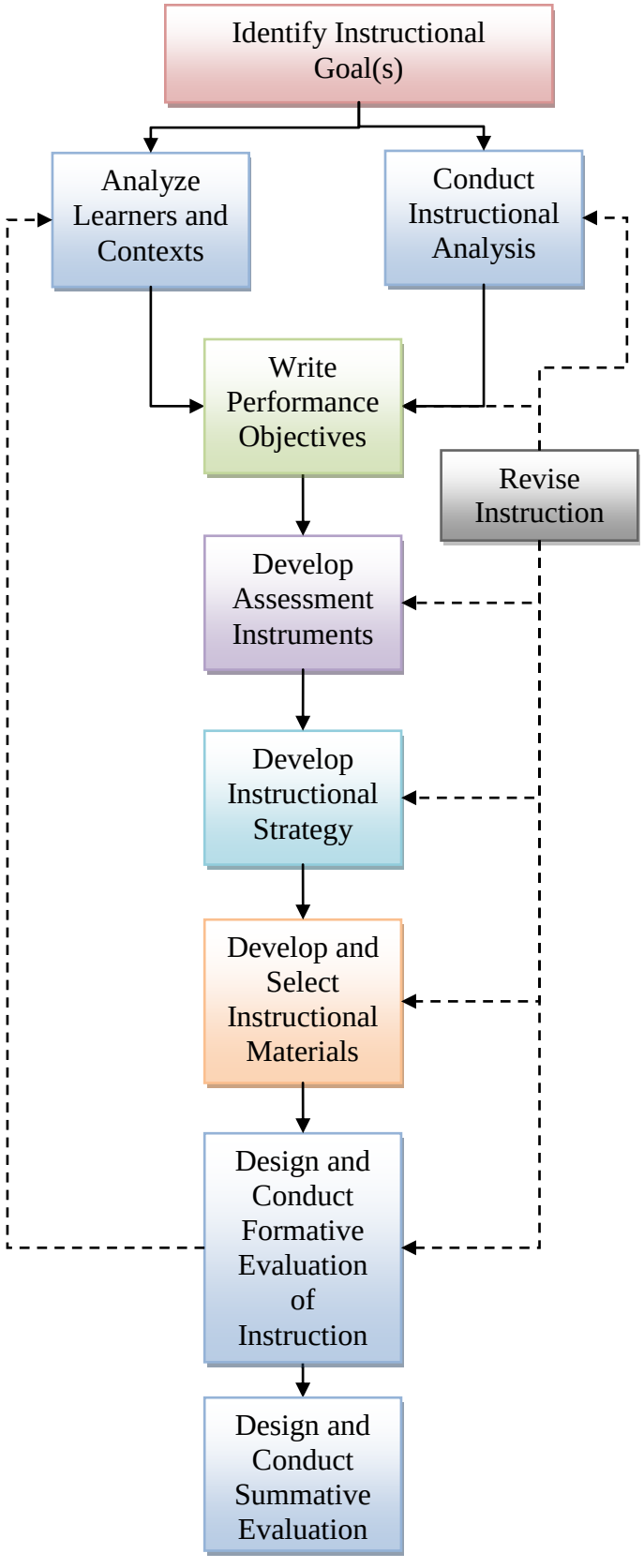
According to Dick, Carey and Carey (2005), learner characteristics provide the following types of useful information to instructional designers: entry behaviors; prior knowledge of the topic area; attitude towards content, delivery, and the training organization; academic motivation; education and ability levels; learning preferences; and degree of group heterogeneity and overall impression of the learners. Learner characteristics are important because they help guide the overall design of instruction during a process. Often when determining the learner characteristics, instructional designers utilize John Keller's (1987) "ARCS Model" (Attention, Relevance, Confidence, and Satisfaction) to identify the motivation that is necessary to make sure that learning is successful (Dick, Carey & Carey, 2005). Utilizing the ARCS model helps instructional designers think about how to keep learners motivated. John Keller's ARCS model is a systematic way to gain and keep attention, make sure instruction is relevant to the learner, make sure learners are confident when completing the instructional objectives, and make sure learners are satisfied after instruction has happened.

Due to research findings and current work being completed in the field of brain research, researchers have found that differences in each person's brain makes an impact on how they learn. So, as an instructional designer it is vital to obtain as much information as possible about each learner. By acquiring knowledge about the learners, instructional designers determine each person's distinct learning style. As a result, instructional designers can then make well-informed decisions about how to present information to learners while linking current trends in learning.

Appendices

Dick and Carey Systems Approach Model (1996)

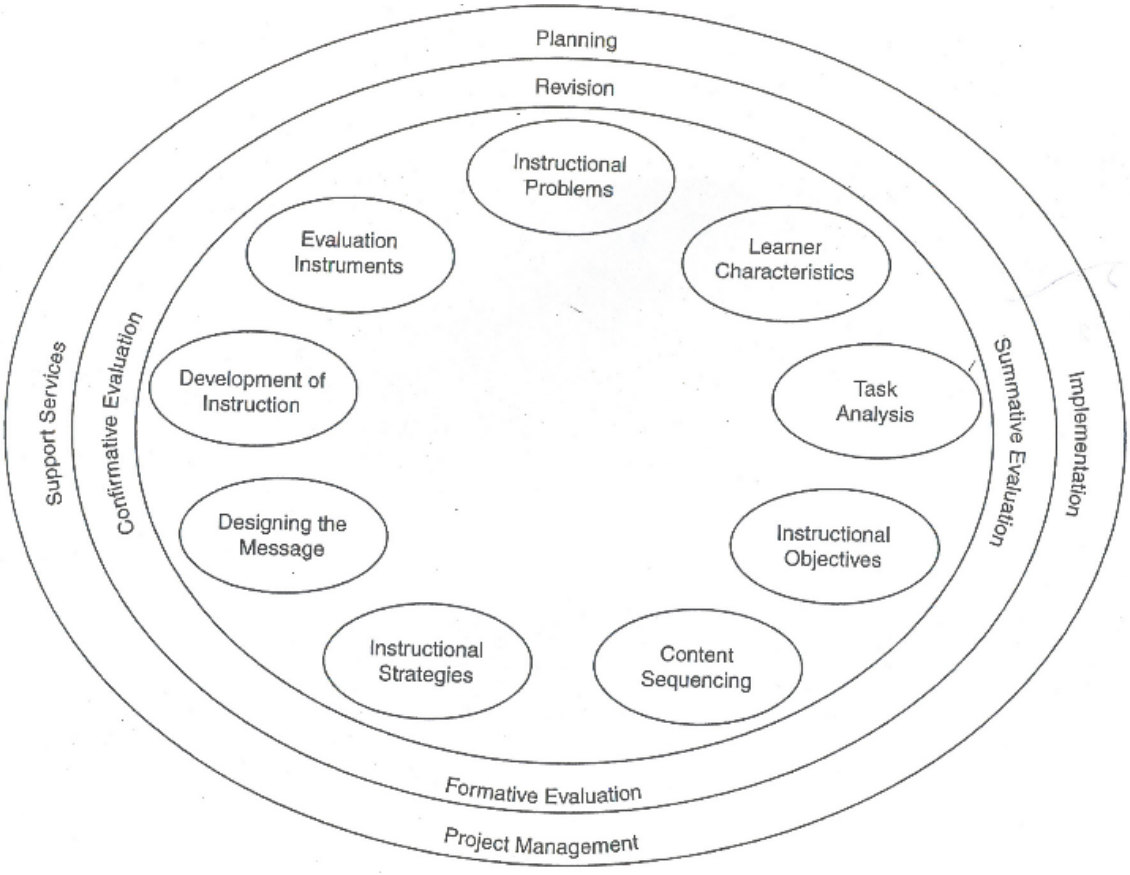
The Dick and Carey Systems Approach Model provides instructional designers with a more detailed approach than the ADDIE model. This model is a commonly utilized model that is comprised of interconnected boxes that drive the instructional design process. "The boxes represent sets of theories, procedures, and techniques employed by the instructional designer to design, develop, evaluate, and revise instruction" (Dick, Carey, & Carey, 2005). The Dick and Carey Model is presented to instructional designers in a linear format. At the same time, there is a major line that connects revision of instruction and feedback from the formative evaluation box back to the analysis portion of the model. This shows that even though the format is linear, instructional designers are constantly cycling through the process to make the revisions needed to ensure that the products satisfy the needs of both the learners and the clients.



Dick and Carey Systems Approach Model (adapted from Dick, Carey, & Carey, 2005).

Morrison, Ross, and Kemp Model (1994)

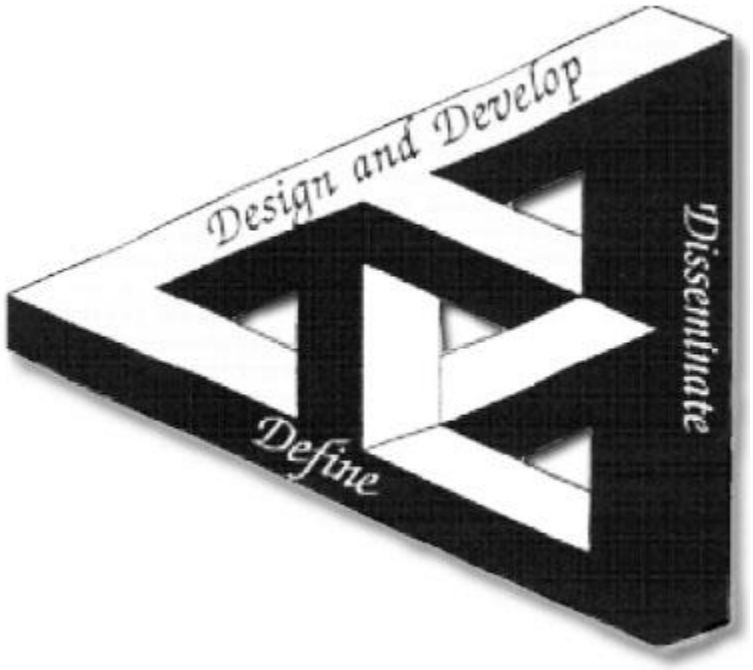
Morrison, Ross, and Kemp's (MRK) model provides instructional designers with a cyclical model that does not present phases in the instructional systems design process in a linear manner. Instead, this model provides instructional designers with a model that can be used regardless of where an instructional designers starts within the process. The authors of this model believed that with each instructional design project, instructional designers should be able to choose the starting place and possibly change the order in which the steps of the process are completed. The MRK model provides instructional designers with a model that can be used when a client decides the specific instructional strategies, technologies, and/or delivery method that the instructional designer must utilize to complete a project.



Morrison, Ross, & Kemp Model (adapted from Morrison, Ross, & Kemp, 2007)

R2D2 Model (1995)

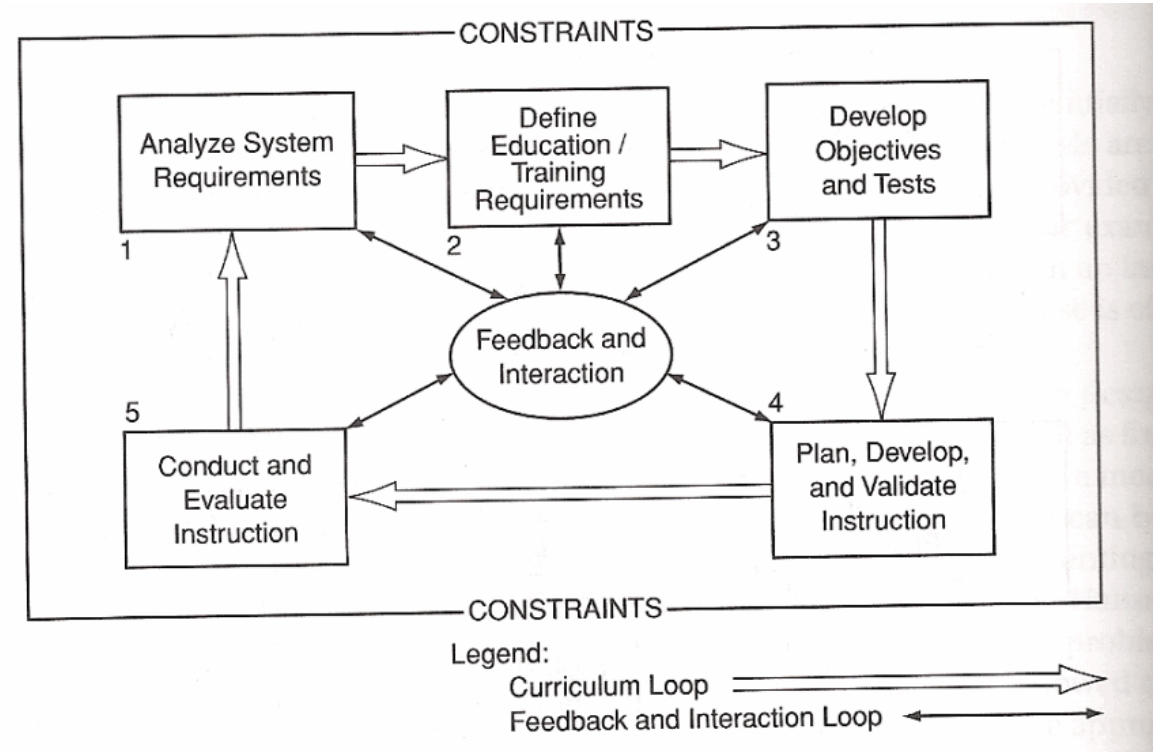
The R2D2 Model stands for recursive, reflective design and development (Willis, 1995). Recursive refers to the fact that decisions may be dealt with multiple times during the instructional systems design process because the R2D2 model does not require extensive analysis to be conducted (Seels & Glasgow, 1998). Reflective refers to how designers collaboratively provide feedback and reflection on the process to determine the best possible design and development of instructional materials (Seels & Glasgow, 1998). This model also focuses on design and development as a way of determining the learning objectives after focusing on creative solutions first. This is different from other ID models because the R2D2 model allows the instructional designer to collaborate to develop and instructional solution and the objectives of the instruction becomes clearer as the project progresses. The define focus of the model deals with how instructional designers define the problem using the help of project team members and end-users as well. The disseminate focus of the model deals with diffusion and adoption rather than information gleaned from a summative evaluation.



R2D2 Model (adapted from J. Willis, 1995)

Air Force Model (1975)

The U.S. Air force model has five phases that are completed systematically but not necessarily linear. Although different phases of the model can be completed simultaneously, each step produces information that an instructional designer must use to accomplish later steps in the instructional systems design process (Seels & Glasgow, 1998). The Air Force Model also allows for feedback and interaction during each of its phases. This is to ensure that instructional designers reflect, communicate, and revise instructional materials to ensure that the instruction designed meets the needs of the clients. This model also emphasizes the management of both systems and instruction (Seels & Glasgow, 1998).



Air Force Model (adapted from Seels and Glasgow, 1998)

Reigeluth's Description of Comparison Framework (1999)

Reigeluth provides instructional designers with a series of guiding questions that help to compare instructional design models to determine which model would be best based on the learning objectives, learner characteristics, and an environmental analysis. Using Reigeluth's framework, designers compare models based on six points of comparison.

Type of learning – Reigeluth provides four taxonomies that are distinct and interconnected simultaneously (1999). Depending on the type of learning that is going to occur during instruction, instructional designers can then look at ID models to determine which model addresses the same type of learning.

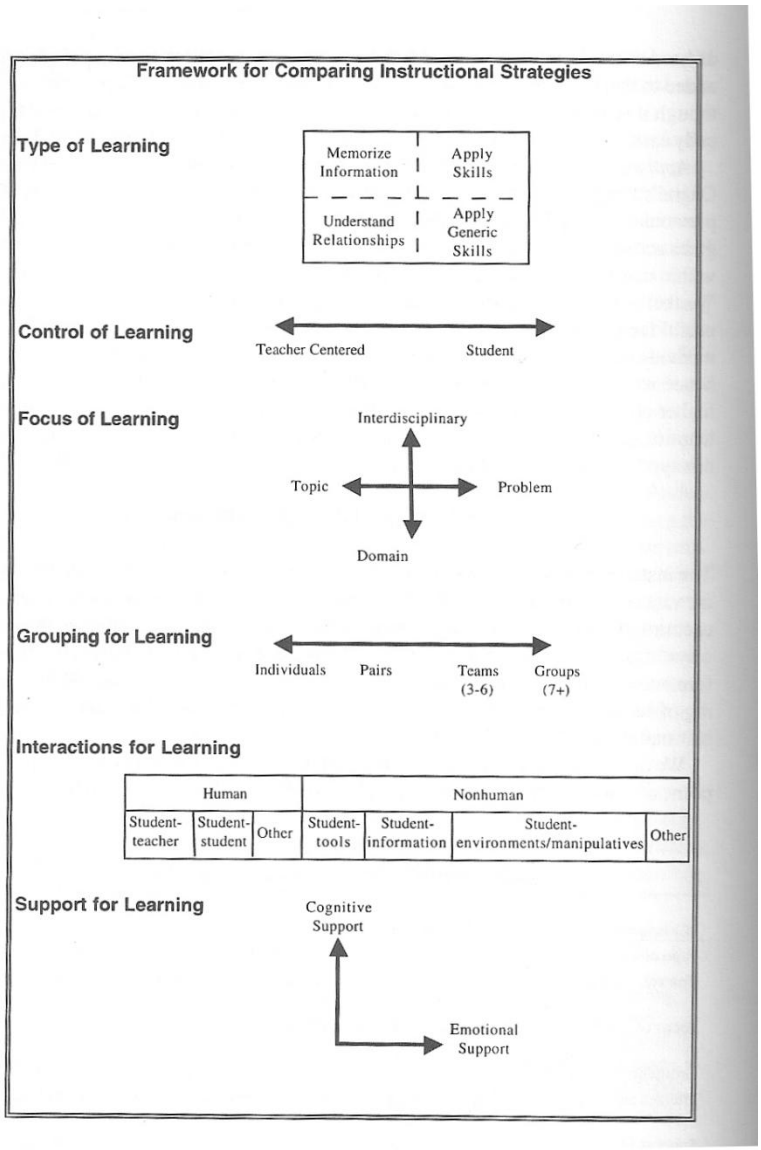
Control of learning – Reigeluth's framework takes into consideration that students learn today is vastly different from the traditional lecture style of teachers. The new paradigm of instructional theories shows that there is actually a continuum between the teacher centered approach and the learner centered approach. Depending on desired control of learning, instructional designers can compare ID models to find a model that matches with the desired control of learning.

Focus of learning – Reigeluth's framework compares both content and the learning activity that is taking place during instruction (1999). The focus of learning can be topic or problem oriented, as well as, interdisciplinary or domain specific. Reigeluth's comparison framework guides the instructional designer in determining which ID model will provide the type of learner activities that fit the instructional content.

Grouping for learning – Reigeluth's framework simply helps instructional designers think about how the learners will be learning (1999). Are the learners going to work together as a big group or a small group? Are the learners going to work individually and then come together to collaborate and share ideas? Instructional designers answer these questions and then use the answers to determine which ID model utilizes the same grouping.

Interactions of learning – Reigeluth divides interactions into two categories: human and non-human (1999). Interactions can occur between teacher and student, student and tools, student and student, etc. Reigeluth's framework helps to determine which type of interactions are going to occur during instruction. Once that has been identified by the instructional design, then an ID model can be chosen.

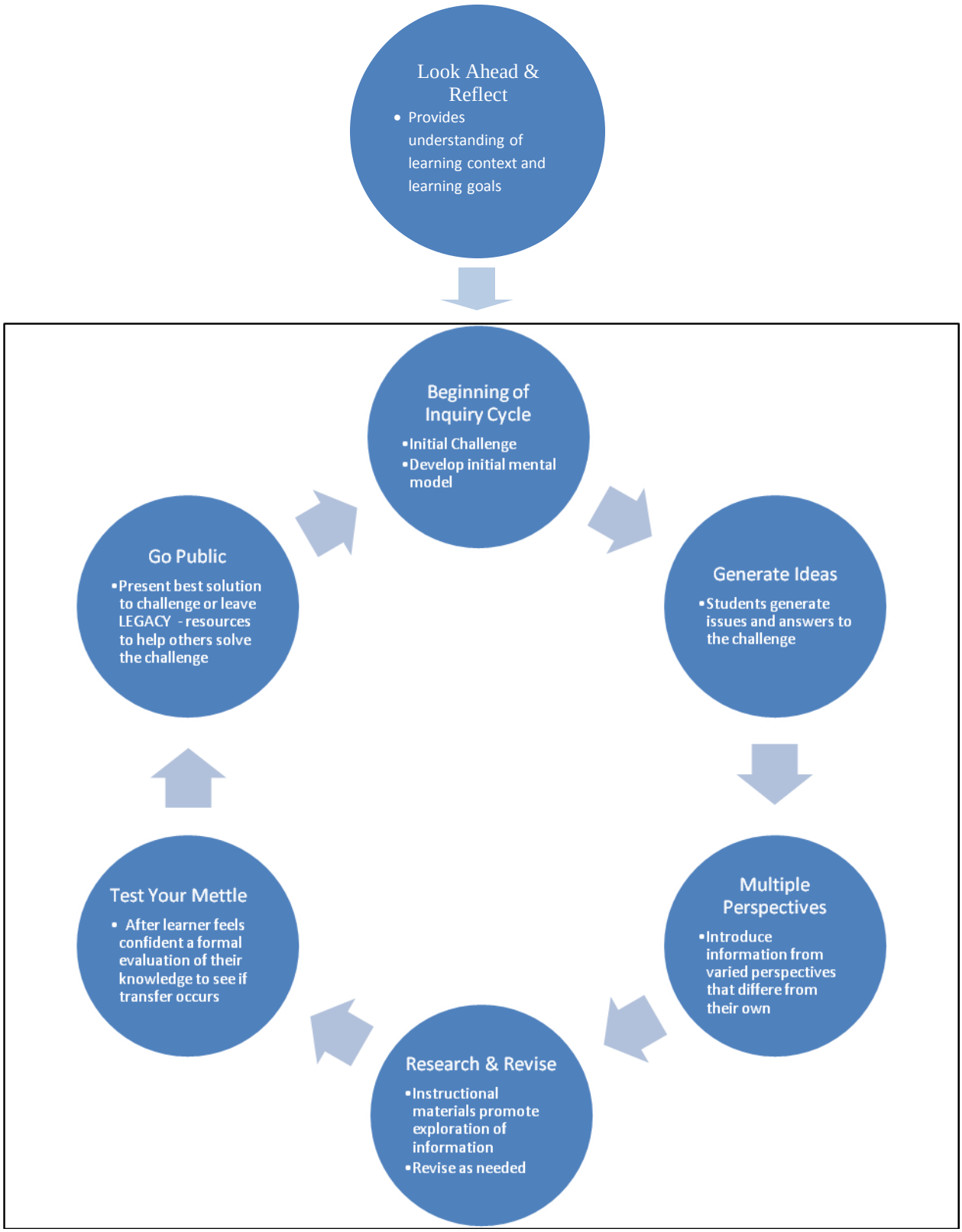
Support for learning – Reigeluth compares ID models based on the level of cognitive and emotional support given to learners. Cognitive supports deals with the way in which the instruction will support learners through the process of building an understanding of the content (Reigeluth, 1999). Emotional support deals with the learner's feelings and how to provide the needed elements of support to ensure learners are motivated and confident (Reigeluth, 1999). Depending on the strategies outlined in the ID models, instructional designers can compare and determine the best model to utilize to support the learners.



Framework for comparing instructional strategies (image from Reigeluth, 1999)

Schwartz, Lin, Brophy, and Bransford's - Flexibly Adaptive Instructional Design

Schwartz et al. developed a framework that supports flexibly adaptive design that outlines ten steps to effectively design instruction. The goal of this model is to provide instruction that requires problem solving, collaboration, and communication within a problem-based learning environment (Reigeluth, 1999).

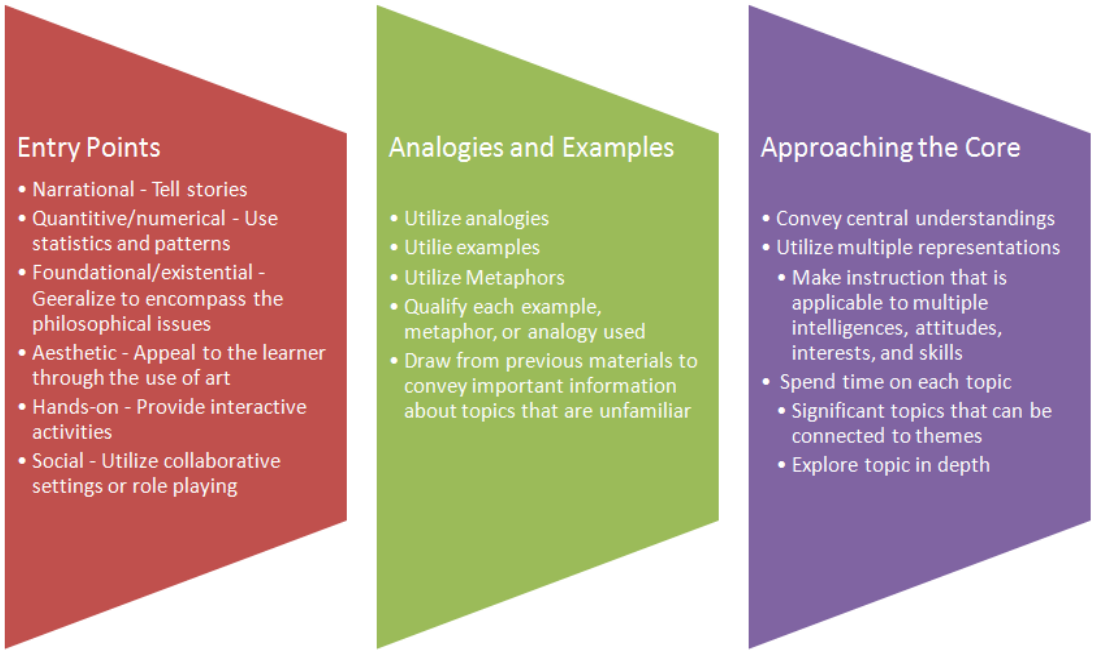


After inquiry cycle complete the following:

Representation of Flexibly Adaptive Instructional Design (adapted from Schwartz et al., 1999)

Howard M. Gardner's – Multiple Approaches to Understanding

Gardner's goal is to present information to learners in a way that is tailored to the students' multiple intelligences (Reigeluth, 1999).

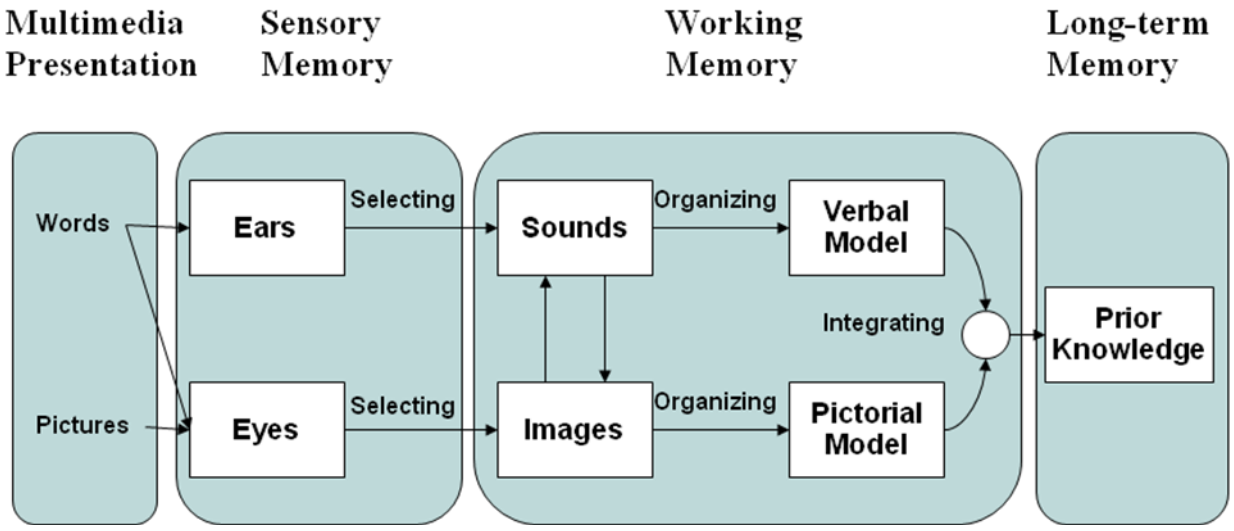


Multiple Approaches to Understanding (adapted from H. M. Gardner, 1999)

Richard Mayer's - Cognitive Theory of Multimedia Learning (2001)

Focuses on three assumptions in regards to multimedia learning environments:

1. People possess separate channels (visual and auditory) to process information.
2. People have a limited capacity for how much information they can process at any given time.
3. People participate in active processing of information by selecting relevant information, organizing information, and integrating knowledge acquired with representations of the information within their own minds. (p. 44).



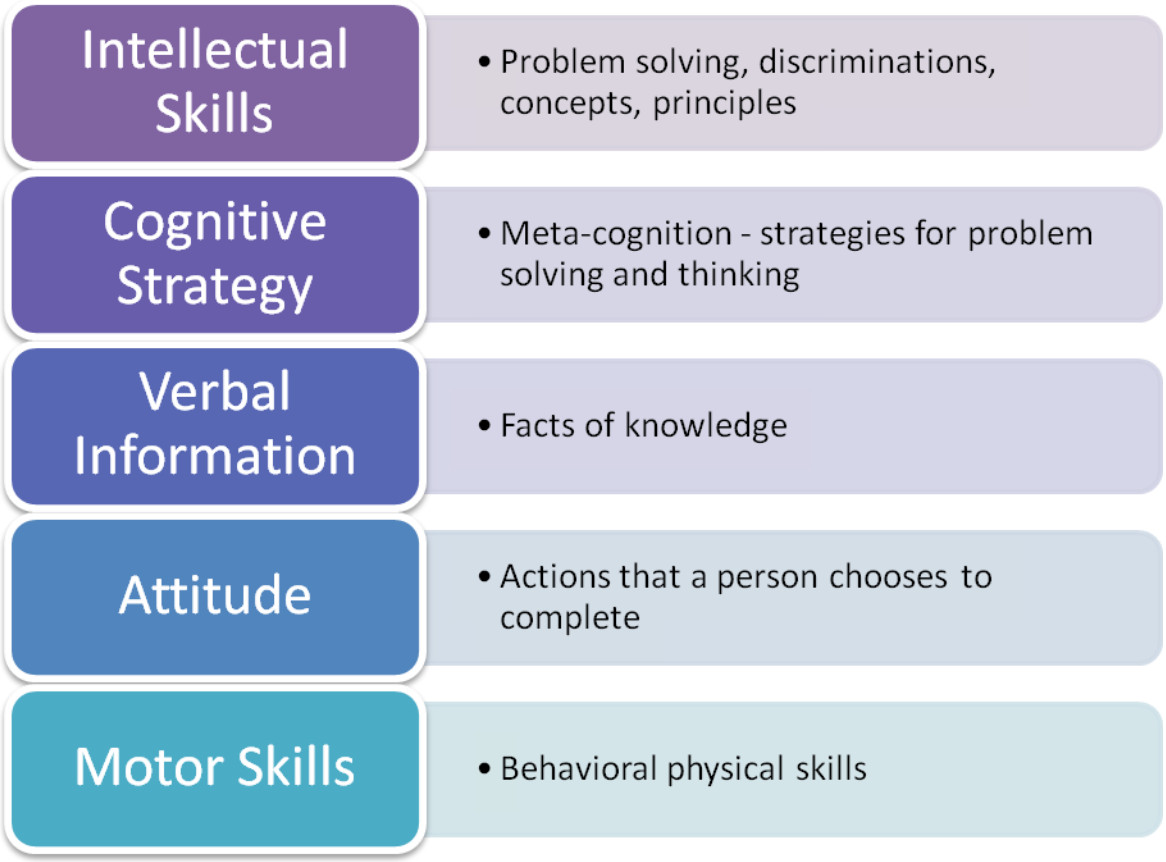
Cognitive Theory of Multimedia Learning (adapted from R. E. Mayer, 2001)

John Sweller's - Cognitive Load Theory (1988)

John Sweller builds a theory based on George Miller's research on short term memory. Sweller theorizes that the chunking or combination of elements that an individual learns during the learning process makes up that individual's knowledge base (Sweller, 1988). Sweller further explains that working (short-term) memory has a limit. When there is an overstimulation of the working memory then it is hard for learners to retain the new information and convert it to long-term memory. By chunking information into manageable parts, learners can convert information from short-term to long-term memory. Once the learner has committed the information to long-term memory, the learner can then recall the information to working memory when needed.

Robert Gagne's - Taxonomy of Learning (1985)

Robert Gagne's Taxonomy of Learning categorizes learning into five major types of learning capabilities: intellectual skills, cognitive strategies, verbal information, attitude, and motor skills. Gagne's taxonomy is utilized by instructional designers to identify prerequisite skills or knowledge that is necessary to learning. Also, Gagne's Taxonomy of Learning (1985) can assist instructional designers through the process of sequencing instruction.



Gagne's Taxonomy of Learning (adapted from R. M. Gagne, 1985)

Robert Gagne's - Conditions of Learning Theory (1985)

Robert Gagne's theory outlines a step-by-step process that involves nine steps that instructional designers must complete during the instructional design process. Gagne's nine instructional events help instructional designers prescribe appropriate instructional strategies when designing and developing instructional materials. Each instructional event that Gagne lists requires instructional designer to think about the possible internal and external conditions that have an effect on the learning process (Gagne, 1985). Internal conditions are the already established learned capabilities of the learner or prior knowledge. External conditions deal with the

presentation of stimuli to the learner (Gagne, 1985). The theory is based on information processing models that focus on the cognitive event that happen when learners are presented with a stimulus. Gagne's theory is widely used in the instructional technology field because it can be adapted for all types of learning environments as well as all types of learning.

Gagne's Conditions of Learning (adapted from R. M. Gagne, 1985)

John Keller's - ARCS Model (1983)

John Keller's ARCS model serves as a problem solving approach to designing motivational aspects to instruction. Keller's model guides instructional designers through the process of designing and developing instructional materials that gain and keep the learner's attention, make sure instruction is relevant to the learner, make sure learners are confident when completing the instructional objectives, and make sure learners are satisfied after instruction has happened (Keller, 1983).

Keller's ARCS Model ***(****adapted from J. M. Keller, 1983)*

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