



A report on the process of learning and educators influencing instructional design

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Abstract

Learning and the process of learning has been a topic of debate for social anthropologists, psychologists, sociologists and philosophers for centuries. The more commonly accepted theories include the psychoanalytic theory, cognitive-developmental theory, and the learning theory. Robert Gagne, Walter Dick, and Lou Carey made significant contributions to instructional design and education methodology. Gagne was a behaviorist and his theory, the Nine Steps of Instruction, is based on student behavioral performance. In contrast, Dick and Carey were cognitivists and their model aids the process of planning a lesson. Both theories have had a significant and lasting impact on schools and on workplace training. Both theories are essential to educating new teachers and corporate trainers today. The author presents an assessment of the various learning theories as well as shares his beliefs concerning the process of learning.

Keywords: instructional design, education methodology, learning process/theory

1. Introduction

Learning is commonly defined as the process of obtaining information. Learning involves the acquisition of knowledge of or skill in by study, instruction, or experience; to become informed of or acquainted with or to ascertain (Random House, 2016) [1]. However, learning involves further study into processes in order to reach a more educated conclusion on definition. It is necessary for an instructor to have an understanding of the process of learning in order to effectively reach the students being taught. Moreover, information obtained by studying children's development might also give the instructor insight on their own persona. Learning and the process of learning has been a topic of debate for social anthropologists, psychologists, sociologists and philosophers for centuries. The more commonly accepted theories include the psychoanalytic theory, cognitive-developmental theory, and the learning theory. An assessment of each of these theories as well as personal beliefs concerning the process of learning are points the author would like to address. Although this paper refers specifically to child learning and early childhood development, the process of learning extends from primary education to secondary and adult learning. Moreover, parallels can be made to EFL and ESL education and English language acquisition.

1.1 The Psychoanalytic Theory

Austrian psychiatrist Sigmund Freud is most credited for this theory. Sigmund Freud (1856-1939) is commonly referred to as "the father of psychoanalysis." Freud developed a theory of the human mind and human behavior. He introduced the concept of dividing the psyche into three parts entitled the ego, super-ego, and the id. According to Freud's hypothesis, personality has structure and is developed over time. The ego is the center conscious element and the superego is defined as the center for morality and the id is defined as instinct and

desire. According to Freud's theory, only the id is present at birth and the ego is developed followed by the super-ego at different stages. Beginning with his 1920 essay "Beyond the Pleasure of People" and his 1923 essay "The Ego and The Id" Freud began to expound upon these theories (AROPA, 2016) [1].

Freud is also noted for his psychosexual stage theory which hypothesizes connection between physical development and learning development. Starting at birth to adulthood individuals go through an oral stage, anal stage, and later the phallic and genital stage. American psychiatrist, Milton Hyland Erickson (1901-1980) proposed psychosocial stages which take into consideration cultural demands contributing to behavior patterns. According to Erickson, children develop according to their experiences and interactions with people and objects (Bee, 2002) [2].

1.2 Cognitive-Developmental Theories

Swiss philosopher Jean Piaget (1896-1980) is well known for his study on children and his theory of cognitive development. According to Piaget's theory, children adapt to environment by exploring and examining people and objects. The process of adaptation includes assimilation, accommodation, and equilibration (Bee, 2002) [2].

Russian psychologist Lev Vygotsky (1896-1943) also researched the origins of children's acquisition of knowledge. However, Vygotsky believes that social interaction rather than exploration were primary to cognitive development (Bee, 2002) [2].

1.3 Learning Theories

This theory focuses on learning as being a predictable process which is shaped by conditioning. Russian psychologist Ivan Petrovic Pavlov (1849-1936) is widely known for first describing the classical conditioning phenomenon with his

experiments with dogs. He noticed how dogs responded to conditional stimuli and hypothesized that humans also respond to operant conditioning. Positive and negative reinforcement are theoretically used to control and shape behavior (Bee, 2002) [2].

1.4 Author's Reflection on Learning Processes

The author believes that there are too many variables to conclude that one single system is absolute. Humans are the imperfect element that tends not to fit molds very well. Statistics and information can be manipulated to produce specific results. All theories for human development are inconclusive. However, the author agrees with many of the points in the theories presented. The author especially concurs with Pavlov's learning theory and how positive and negative reinforcement influences individual behavior. The author is in agreement that the environment has a direct influence on behavior and learning. Both negative and positive stimulation can alter the behavior of individual society members.

The author believes that it is important to have knowledge of the various theories of learning processes in order for teachers to be able to relate more effectively with their students. Learning processes can be observed and tested. Students also display changes in behavior based upon age and physical development. However, learning also involves thinking and responding to environment and information. Thoughts and theories change as people are also always in a state of change. Paradigm shifts are noted throughout all academic fields.

Nature vs. nurture and heredity vs. environment are continuing debates among the academic community. Personal values are a moral debate and that such values are manifested in the learning environment by both the instructor and the student. The learning theory is primarily "nurture" based. However, the author believes that "nature" might also have an influence on learning. The learning theory, although primarily nurture-based, is not exclusive to nurture being an influence on childhood development. Although Piaget makes a convincing assessment about how children assimilate information through inanimate objects as a central to learning, the author finds it difficult to accept the cognitive-development theory based entirely upon "built-in" strategies of assimilation. Freud's psychoanalytic theory is an effort to make an exact science of childhood development expressed by stages. Although well-presented and well known, Freud's theories accepted as an absolute would not answer for those who do not fit ascribed standards. Many modern theorists have expanded on Freud's theories while others have opposed his ideas. It is important for one to use discernment when considering theories—no theory should be taken as an absolute.

2. Details on Learning Theory

In order for an instructor to effectively reach students, an understanding of the process of learning is important. The Learning Theory is one of the more commonly accepted theories concerning learning and the process of learning. Students can connect with learning in many ways. In this paper the Learning Theory will be explained in the classroom management, practical management and instructional design, and assessment content and development. In each of these

different concepts of the Learning Theory an instructor can effectively teach a student an understanding of the ways to learn effectively in a classroom.

The Learning Theory focuses on learning as being a predictable process which is shaped by conditioning. Russian psychologist Ivan Petrovic Pavlov is widely known for first describing the classical conditioning phenomenon with his experiments with dogs. Pavlov noticed how dogs responded to conditional stimuli and hypothesized that humans also respond to operant conditioning. An assessment of the Learning Theory as well theory applications to instructional planning and delivery, classroom set-up and management are assessed as follows.

2.1 Classroom Set-Up and Application of Learning Theory

Learning theories represent a very different theoretical tradition, one in which the emphasis is much more on the way the environment shapes the student than on how the student understands his or her experiences (Bee, 2002) [2]. Because of this, the environment in which they learn can be very effective in the success of learning. It would be beneficial to include various learning tools in eye view of the students such as charts, grammar rules, or other posters that would enforce some learning technique. A list of rules should also be posted so that each student knows what is expected of them and have a sense of what is allowed and not allowed. The classroom should be arranged in an organized manner and should provide comfort to the student. Especially primary education students will be spending a large part of their day at school and should feel safe and protected. A disorderly classroom or one unorganized may make a student feel uncomfortable, therefore, imposing on their learning.

Learning may occur by watching another perform some type of action as specified in Bandera's Social Cognitive Theory. The example used dealt with behavior patterns a young learner might gain by watching television. Due to children mimicking such actions, a teacher should be careful how he or she conducts themselves in the classroom. For example, if a teacher shows frustration while trying to explain a math problem, then the student will also become frustrated. This is not a behavior pattern the teacher will want to promote. The instructor should help the child feel comfortable and not be afraid to ask questions. If a teacher promotes anxiety or frustration for having to answer a student's questions, the child may rather sit quietly and continue to lack understanding as opposed to asking for help.

As the learning theory has stated, there are ways of enforcing desired behavior. There are three basic techniques, which includes positive re-enforcement, negative re-enforcement, and punishment. When considering young learners, a teacher needs to have a well thought out system of way to enforce desired behavior. A student should be aware of all rules and regulations and there should be some set standard of how to handle misbehavior. For example, if one student cheats on a test and is punished and another student cheats and gets by, that sets a double standard. One child should receive the same punishment, as the other for the same offence so there is no difference made in either. This method should be handled carefully. For example, if a student is struggling with math and given more math problems as a way of correcting

unwanted behavior, the child may grow to resent math even more if associating it with a form of punishment. Positive re-enforcement is also an effective tool. Rewarding students for a job well done will motivate them to repeat the desired behavior. Negative re-enforcement can be used but one must be careful in using such a technique. If a student is offered extra time at break if they will not misbehave, he or she may learn to misbehave every time they want something to go their way. Teachers need to have a set standard of conducting their classroom but must remain consistent in their approach, because after all, they have a whole classroom of eyes watching them.

2.2 Learning Theory and the Practice of Instructional Design

What is the difference between the learning theories in terms of the practice of instructional design? Is one approach more easily achieved than another? To address this, one may consider that cognitive theory is the dominant theory in instructional design and many of the instructional strategies advocated and utilized by behaviorists are also used by cognitivists, but for different reasons. For example, behaviorists assess learners to determine a starting point for instruction, while cognitivists look at the learner to determine their predisposition to learning (Ertmer & Newby, 2013) ^[8]. With this in mind, the practice of instructional design can be viewed from a behaviorist/cognitivist approach as opposed to a constructivist approach.

When designing from a behaviorist/cognitivist stance, the designer analyzes the situation and sets a goal. Individual tasks are broken down and learning objectives are developed. Evaluation consists of determining whether the criteria for the objectives have been met. In this approach the designer decides what is important for the learner to know and attempts to transfer that knowledge to the learner. The learning package is somewhat of a closed system, since although it may allow for some branching and remediation, the learner is still confined to the designer's "world".

To design from a constructivist approach requires that the designer produces a product that is much more facilitative than prescriptive. The content is not prespecified, direction is determined by the learner and assessment is much more subjective because it does not depend on specific quantitative criteria, but rather the process and self-evaluation of the learner. The standard pencil-and-paper tests of mastery learning are not used in constructive design; instead, evaluation is based on notes, early drafts, final products and journals.

Because of the divergent, subjective nature of constructive learning, working from the system is easier for a designer, and thus the objective approach to instructional design. That is not to say that classical instructional design techniques are better than constructive design, but it is easier, less time consuming and most likely less expensive to design within a "closed system" rather than an "open" one. Perhaps there is some truth in the statement that "Constructivism is a *learning theory*, more than a *teaching approach*." (Wilkinson, 1995) ^[17].

2.3 Assessment of Content and Development

Pavlov developed classical conditioning after observing that

an unconditioned stimulus elicits a reflect response, he paired an unconditioned stimulus with a conditioned stimulus to elicit a conditioned response. Skinner is known for operant conditioning. Operant conditioning involves the use of positive and negative reinforcements to strengthen behavior. Classical conditioning and operant conditioning are associated with the Learning Theory. The Learning Theory emphasizes the fact that individuals perceive and process information in very different ways. The learning styles theory implies that how much individuals learn has more to do with whether the educational experience is geared toward their particular style of learning than whether or not they are "smart." In fact, educators should not ask, "Is this student smart?" but rather "How is this student smart?"

3. Author's Reflection on Learning Theory

By studying the various theories concerning the learning process, one can come to see the different perspectives on how the process is analyzed. Such knowledge helps prepare educators to have an understanding of those they instruct. Variables and stages within the theories provide a background for reference when trying to create lesson material to conform to the abilities of the class. Knowledge of learning process theories help educators understand themselves better in retrospect to their own development and experiences. Thought has a direct influence upon behavior. The standards we create for others are first based upon the standards that we have made for ourselves. How an instructor teaches therefore is based upon standards that the instructor has made for themselves. Knowledge of learning style variables concerning processes of obtaining information and environmental factors are important. Learning is a life-long event. There is no end to learning since there is no limit to what one is capable of learning.

By studying Learning Theory, one is able to see how cognitive development is perceived and how the process is analyzed. Such knowledge helps prepare educators to have an understanding of those they instruct. Knowledge of the Learning Theory provides a background for reference when trying to create lesson material to conform to the abilities of students. Knowledge of the Learning Theory helps educators understand themselves better in retrospect to their own development and experiences. Thought has a direct influence upon behavior. The standards created for others are first based upon the standards that have been made for ourselves. How an instructor teaches, therefore, is based upon standards that the instructor has made for themselves.

4. Educators Influencing Instructional Design

Student learning is heavily influenced by curriculum design. Curriculum design in turn is influenced by an educator's philosophy and instructional beliefs. Current instructional design has been developed according to revised traditional theories. As society, information and new technology continually changes classrooms, instructional design has also evolved to conform to such changes.

Educators Robert M. Gagne, Walter Dick and Lou Carey authored instructional design theories that continue to influence modern educational practices. An understanding of the instructional design models of Dick and Carey and Gagne

are important because educators need to have knowledge of the theories and their influence on education in order to support and to promote reforms in teaching practices. The role of models in instructional development is to provide conceptual and communication tools that can be used to visualize, direct, and manage processes for generating episodes of guided learning (Gustafson. & Branch, 1997) ^[10] Without knowledge of the evolution of instructional design and the influence instructional design has on teaching practices, efforts to make positive changes in education may be unsuccessful.

4.1 Summary of Robert Gagne's Model

One difficulty in learning about Robert Gagne is that his seminal theory, the Nine Steps of Instruction (1970), has become the framework for instructional design theory, educational psychology, and educational instruction theory. In the same way that concrete and rebar make every large building possible, the Nine Steps make teaching possible. The steps are:

1. Gaining attention—ensure that the learners are focused on the instructor
2. Informing the learner of the objective—this prepares the learner to receive information
3. Stimulating recall of prerequisite learning— activate prior learning
4. Presenting new material—describe and demonstrate new skills
5. Providing learning guidance—assist learners in practicing

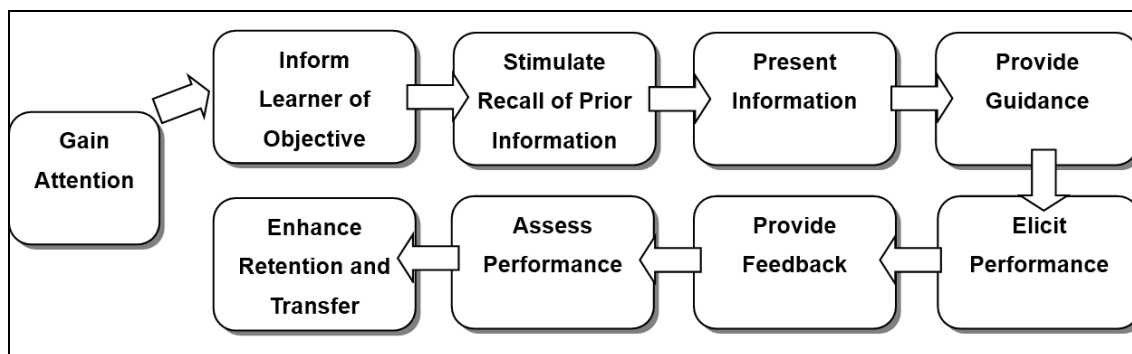
the skill

6. Eliciting performance—have learners perform the skills on their own
7. Providing feedback about correctness— refine and adjust learners' performance
8. Assessing performance—evaluate and score the skill performance
9. Enhancing retention and recall—reinforce skills and provide opportunities for practice

(Source: <http://www.nwlink.com/~donclark/hrd/learning/gagne.gif>).

Imagine any public school classroom in Japan. The teacher rises and says, "Good morning class." According to Gagne's model this is an act constituting *gaining attention*. "Today, we will continue learning about the Meiji Restoration," which is *informing the learner of the objective*. "Who can tell me what we learned about Commodore Perry yesterday?" is a question designed for *stimulating recall of prerequisite learning*. Instructors routinely stimulate students' memories with prior lessons, and in doing so they employ a portion of Gagne's theory even though the teachers probably have not heard of him. Fig 1 has a visual flow chart of the Nine Steps.

Robert Gagne and the Nine Steps of Instruction theory became the basis of modern instructional design. Gagne was a behaviorist early in his career and later he focused on memory and information processing. His theories could be applied to any learning situation, but they are especially situated to intellectual skills such as problem solving, discrimination, and conceptualization (Dempsey, 2002, pp. 365-366).



(Source: <http://www.nwlink.com/~donclark/hrd/learning/gagne.gif>).

Fig 1: Robert Gagne's Nine Steps of Instruction (1970)

4.2 Summary of Dick and Carey Model

Walter Dick and Lou Carey were students of Robert Gagne and as an obvious result Dick and Carey are familiar with the Gagne Model of Instructional Design. Dick received his PhD from Pennsylvania State University after graduating from Princeton. Carey graduated from and continues to work as an educator at Florida State University. The Dick and Carey model was introduced in 1978 (Clark, 2004) ^[4] and was later revised and publicized in 1990. The Dick and Carey model of instructional design is a goal and outcome oriented plan. The most obvious characteristic of Dick and Carey's model is that the components are self-regulating. As the system is goal-oriented, the system can be modified and refined until the desired goal is finally achieved. Dick and Carey's model is interdependent as each component in the system depends on

cooperative feedback, input and output to determine organizational flow.

Although Dick and Cary's model is not necessarily a linear model, the components of model include the following ten steps:

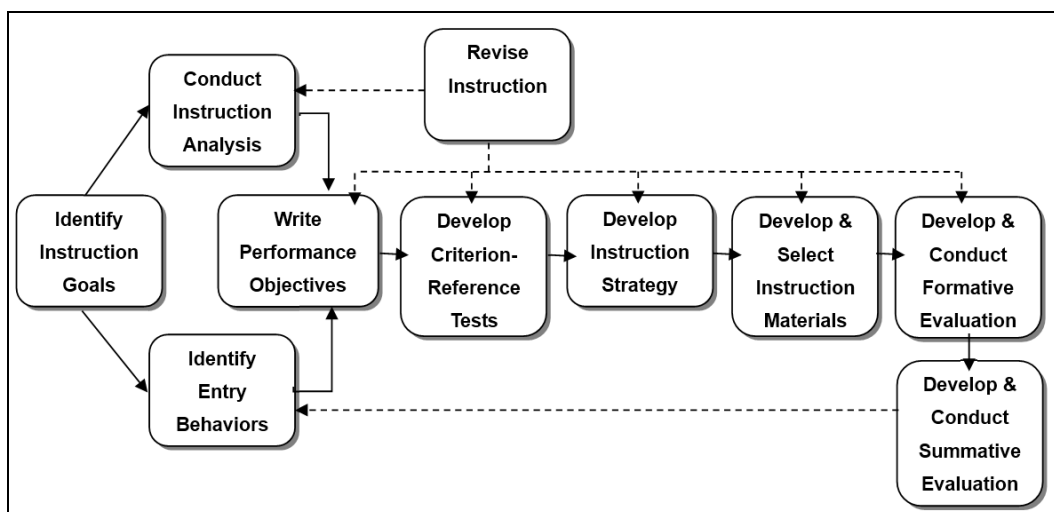
1. Determine instructional goals—decide what learners should be able to do Instructional goal may be derived from a needs assessment.
2. Analyze the instructional goal—once instructional goals are set, one must determine a step-by-step process for what learners are doing when the goal is performed
3. Analyze learners and contexts—the context in which skills are learned and used
4. Write performance objectives—the conditions and criteria of specific behavior skills to be learned

5. Develop assessment instrument— conforming to objectives
6. Develop instructional strategy—how the terminal objective is to be achieved emphasizing the presentation of data
7. Develop and select instruction—based on determined strategy, instructional materials are produced
8. Design and Conduct formative evaluation— instructional materials evaluated based on test group response
9. Revise instruction—data from formative evaluation assessed and used to formulate revisions
10. Summative evaluation—separate evaluation used to judge the worth of the instruction

(Source: http://www.personal.psu.edu/wxh139/Dick_Carey.htm)

Fig 2 depicts the flowchart of this particular model. This chart clearly explains that the first step is to identify the goals, then simultaneously analyze the instructional goal and analyze the learners. Concluding the flowchart is a summative evaluation. If the summative evaluation indicates that the original goals

have not been achieved, then the instructional designer will loop back to analyzing the learners until the goals are achieved. The beauty of the Dick and Carey model is that while keeping the goals at the forefront, all parts and sub-parts are put under the microscope. “How something is to be learned” and, more directly, the outcome of knowledge gained is the focus over “what is to be learned”. This outcome-oriented model of instruction allows for creative mental lexicons to remember specific concepts or units of information. A mental lexicon enables the students to maintain memory of certain concepts. As examples, most American high school students are familiar with the “FOIL” (First, Outer, Inner, Last) system for solving algebra problems or mental lexicon phrases such as “Mr. VEM just served us nine pizzas” to remember the order of the planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto) for science class. A skilled educator adopts and shares such mental lexicons in their instructional strategies to improve the academic performance of their students.



(Source: http://www.personal.psu.edu/wxh139/Dick_Carey.htm)

Fig 2: The Dick and Carey Design Model (1996)

5. Comparisons between and practical applications of Gagne Model and Dick and Carey Model

As one might expect, the models and theories of Robert Gagne are both similar and different from those of Dick and Carey. Their familiarity with the Gagne Model of Instructional Design has influenced their own instructional design model. Casual observation suggests that Robert Gagne’s learning outcomes were adopted into the Dick and Carey model. Moreover, Dick and Carey adapted the performance categories authored by Robert Gagne for the goal analysis. Gagne’s model appears to be relevant to actual lesson implementation whereas the Dick and Carey model is more focused on instructional strategies.

Each model is based on a learning theory, and the theory chosen has influenced the model. Gagne, as a behaviorist, said that learning must be organized into a hierarchy. This process of organization helps the instructor develop the sequence of instruction (Gagne, 1968) [9]. For example, English alphabet letter formation is not taught in order from A to Z. Letters

with similar shapes are grouped together. Lower-case letters such as *e*, *a*, and *c*, are taught together while upper-case letters such as *B*, *P*, and *D* are taught together. In order to develop the list of groups, the teacher must consider the shapes and similarities of letters. This ensures that every letter will be placed in a group and it reinforces the importance of grouping the letters. The author, as an EFL/ESL educator found value in focusing on letters such as lower case “b” and “d” that both sound and look similar. Such letters are especially confusing for young learners and can if not well-understood become an impediment to proper spelling.

Likewise, Japanese katakana characters would be grouped according to shape such as *フ, マ, ス, ル* or *シツソン* and hiragana characters such as *の, あ, め, ん* or *さ* and *き* would be grouped together. Moreover, the author found that grouping Korean hangul characters according to pronunciation aided in his studies of the Korean language. The proper pronunciation of *ㅏ* and *ㅑ* or the “o” and “yo” vowels are determined by the shape of the speaker’s mouth when pronouncing these

characters. One’s mouth should be circular when pronouncing the “horizontal vowels” \perp and $\perp\perp$. However, one’s mouth should be slightly closed in an oval shape for the proper pronunciation of the “vertical vowels” \vdash and $\vdash\vdash$. Groups of characters may be divided according to phonetics or pronunciation which would make letters such as A and K taught together while B and Z are grouped together. The following table is an example of how the English alphabet could be grouped according to the phonetic pronunciation of the characters.

Table 1: Grouping of the English alphabet based on the phonetic sounds of the characters

Sound	Characters
[ei]	A, H, J, K
[i]	B, C, D, E, G, P, T, V, Z
[e]	F, L, M, N, S, X
[ou]	O
[a]	R
[ju]	Q, U, W
[ai]	I, Y

Gagne’s theories focus on “what is to be learned” as opposed to ideas on “how it is learned.” The hierarchical analysis of a task begins with defining the terminal behavior. The instructional designer must then describe the skills required to perform the terminal behavior. The last hierarchy is the list of skills that the student must have to begin the path to the desired behavior (Gagne, 1968) [9]. For example, if a student is to write the letter A, successfully writing an “A” is the terminal behavior. The skills that leads the terminal behavior are being able to draw slanted lines, to make lines touch, and to trace correctly a copy of the letter A. The skills needed to perform the skills that lead to the terminal behavior are being able to draw straight lines, being able to hold a pencil properly, and having fine motor control to write small. The hierarchy does not necessarily command the sequence of instruction, but all skills that need instruction are listed in the hierarchy.

Using hierarchical analysis can also help an instructor to determine if the desired behavior is too broad or too narrow. For example, the desired behavior “write a quality essay” involves prerequisites for: spelling, sentence structure, paragraph organization, voice, appropriate theme, typing or writing ability, outline writing tasks, and so on. This desired behavior is suitable for an entire year’s instruction, not a one-month lesson plan. The style of teaching suited to hierarchies and Gagne’s other theories is direct instruction (Gagne, 1968) [9]. Teachers should demonstrate how to perform the prerequisite tasks, not just describe the tasks. Students need to perform the tasks, as well, not just list the tasks in a quiz.

The learning theory that Dick and Carey subscribe to is the cognitive theory. Prior to rolling out lessons, students are assessed and factored in to the lesson design. Lessons are designed based on the needs of the learners. Areas of student exploration include prior knowledge, ability levels, attitudes about the subject, and preferred learning styles (Pennsylvania State University, 2008) [14]. Impressively, the model requires student participation in designing content, “Encourage him or her to talk about the materials as he or she goes through the

instruction and to be candid about what he or she likes and does not like, what makes sense, and what does not make sense” (Brown & Green, 2006, p. 244) [3]. Approximately three students will assist in the initial testing, materials review, and assessment.

6. Conclusion: A Lasting Impact

The finely detailed research of Gagne, and the team of Dick and Carey are still employed today in instructional design that is used in schools and in the corporate world. Gagne’s model on instructional design foreshadowed later discoveries of human information processing and helped educators understand the different stages in cognitive processing and how such processes relate to instruction because students will not be able to recall and apply long-term memory unless assisted in discovering how past knowledge relates to new concepts (Wiburg, n.d.) [16]. Modern instruction continues to use the same instructional approach, which includes the cognitive needs of the learner.

Robert Gagne has also had an impact on the implementation of modern instructional technology. Gagne was a proponent of technology and his book *Instructional Technology: Foundations* is an important part of the instructional technology movement (Gagne, 1968) [9]. Technology plays an important role in the modern classroom and schools now look at technology as an integral part of instruction. Computers, Smart Boards, graphing calculators, and online learning tools have spread into classrooms throughout the world. In the foreword to *The Legacy of Robert Gagne*, the author, Rita C. Richey (2000) [15], states that:

Today we marvel at the emerging capabilities of technology and the possibility these technologies afford teaching and learning, and yet the mind of Robert Gagne has expanded the scope and contributions of this field in much the same fashion as has the computer (Richey, 2000, p. 12).

Technology now plays an incredibly important role in the modern classroom and Robert Gagne is one of the innovators that helped initiate that change.

Dick and Carey believe that students will master content by participating in structured activities. Although the big picture is explained, the activities are conducted in a series of lessons that follow a logical order. Assessments are conducted to check for mastery. Focusing on the individuals, as Dick and Carey do, will work nicely with classrooms that follow a behaviorist or constructivist learning style. Another area that easily crosses over is the instructional design portion of the model.

Dick and Carey’s model has proven to be valuable to instructors who are interested in increasing the competency of their students. The Dick and Carey model has been widely adopted not only for applications in education but also for applications in industry, manufacturing and in military services (Dick & Carey, 1996) [6]. Dick and Carey’s model is outcome-oriented and based on goals. In any environment, quality as a result of performance is the greatest benefit of application.

The instruction design models of Dick and Carey and Gagne work a foundation for addressing the instructional problems found in schools. These instructional designers contributed to education by providing and implementing new theories of

learning.

In order to ensure that learning objectives are being met, instructional design theory is important for educational settings. Knowledge of Gagne and Dick and Carey's instructional design helps educators maintain quality and improve on instruction strategies. Instruction design theories enable educators to design effective teaching programs while using knowledge of instructional design as a base to further develop formal systems of instruction.

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