CHAPTER – II

THEORETICAL BACKGROUND

➤ INTRODUCTION

➤ THE LEARNING THEORIES

➤ Description
➤ Principles
➤ Implications

➤ CONCLUSION
INTRODUCTION

The word theory has a number of distinct meanings in different fields of knowledge, depending on their methodologies and the context of discussion. In common usage, people often use the word theory to signify a conjecture, an opinion, or a speculation. In this usage, a theory is not necessarily based on facts; in other words, it is not required to be consistent with true descriptions of reality. True descriptions of reality are more reflectively understood as statements that would be true independently of what people think about them. For the layman, 'fact' ultimately displaces 'theory'; for the scientist, theory ultimately explains fact.

Theory is a way of organising knowledge and experience, so that practice can be improved through research and empirical testing of principles and the teaching of fundamentals. Theories, if accurate, fulfill the objectives of prediction (knowledge of the outcome) and understanding (knowledge of the process) regarding the relationships among the variables of interest (Wright et al., 1992). According to Swanson (2001), a good theory is something that is thorough and that has been tested both intellectually and in practice.

Although the primary goals of 'theorist-researchers' and 'practitioners' may differ (Dubin, 1976), a strong theoretical model has great value to both. Practitioners are primarily concerned with the accuracy of prediction of the theoretical model in order to guide their decision making; thus, an accurate theoretical model allows for better decision making in conditions of uncertainty. Theorist-researchers, on the other hand, have
greater concern for understanding the 'why' behind the prediction. For them, a well-developed theoretical model allows for testing of the model and, based on these tests, revision of the model to increase its accuracy.

LEARNING THEORIES

In this chapter, the researcher has made an attempt to provide a ‘thumb-nail sketch’ of 53 learning theories currently available in the learning literature. The theoretical literature pertaining to each theory is presented under three categories: ‘description’ of the theory, basic ‘principles’ underlying each theory, and the ‘implications’ for research and practice. This chapter serves as a theoretical background for analysing and interpreting the research findings given in the subsequent chapters.

(1) The Adaptive Character of Thought (ACT) (Anderson, J.)

Description

ACT is a general theory of cognition developed by John Anderson and colleagues at Carnegie Mellon University that focuses on ‘memory processes’. It is an elaboration of the original ACT theory (Anderson, 1976) and builds upon Human Associative Memory (HAM), a model of semantic memory proposed by Anderson & Bower (1973). Anderson (1983) provides a complete description of ACT. In addition, Anderson (1990) provides his own critique of ACT and Anderson (1993) provides the outline for a broader development of the theory.
ACT distinguishes between three types of memory structures: declarative, procedural and working memory. Declarative memory takes the form of a semantic net linking propositions, images and sequences by associations. Procedural memory (also long-term) represents information in the form of productions; each production has a set of conditions and actions based in declarative memory. The nodes of long-term memory, all have some degree of activation and working memory is that part of long-term memory that is most highly activated.

According to ACT, all knowledge begins as declarative information; procedural knowledge is learned by making inferences from already existing factual knowledge. ACT supports three fundamental types of learning: generalisation, in which productions become ‘broader’ in their range of application, discrimination, in which productions become ‘narrow’ in their range of application, and strengthening, in which some productions are applied ‘more often’. New productions are formed by the conjunction or disjunction of existing productions.

**Principles**

ACT is based on the following basic principles:

1. Identifies the goal structure of the problem space.
2. Provides instruction in the context of problem-solving.
3. Provides immediate feedback on errors.
4. Minimises working memory load.
5. Adjusts the “grain size” of instruction with learning to account for the knowledge compilation process.
6. Enables the learner to approach the target skill by successive approximation.
Implications

ACT can explain a wide variety of memory effects as well as account for higher order skills such as geometry proofs, programming and language learning.

(2) Adult Learning (Cross, K. P.)

Description

Cross (1981) presents the Characteristics of Adults as Learners (CAL) model in the context of her analysis of ‘lifelong learning’ programmes. The model attempts to integrate other theoretical frameworks for adult learning such as ‘andragogy’ (Knowles, 1975) ‘experiential learning’ (Rogers, 1969) and ‘lifespan psychology’. The CAL model consists of two classes of variables: personal characteristics and situational characteristics. Personal characteristics include: aging, life phases, and developmental stages. Situational characteristics consist of part-time versus full-time learning, and voluntary versus compulsory learning.

Principles

Adult learning is based on the following basic principles:

(1) Adult learning programmes should capitalise on the experience of participants.

(2) Adult learning programmes should adapt to the aging limitations of the participants.

(3) Adults should be challenged to move to increasingly advanced stages of personal development.

(4) Adults should have as much choice as possible in the availability and organisation of learning programmes.
Implications

The CAL model is intended to provide guidelines for adult education programmes. There is no known research to support the model.

(3) Algo-Heuristic Theory (Landa, L.)

Description

Landa’s theory (1974) is concerned with identifying mental processes—conscious and especially unconscious—that underlie expert learning, thinking and performance in any area. His methods represent a system of techniques for getting inside the mind of expert learners and performers which enable one to uncover the processes involved. Once uncovered, they are broken down into their relative elementary components—‘mental operations’ and ‘knowledge units’, which can be viewed as a kind of psychological “atoms” and “molecules”. Performing a task or solving a problem always requires a certain system of elementary knowledge units and operations.

Principles

Algo-Heuristic Theory is based on the following basic principles:

(1) It is more important to teach algo-heuristic processes to students than prescriptions (knowledge of processes); on the other hand, teachers need to know both.

(2) Processes can be taught through prescriptions and demonstrations of operations.

(3) Teaching students how to discover processes is more valuable than providing them already formulated prescriptions.

(4) Break processes down into elementary operations of size and length suitable for each student (individualisation of instruction).
Implications

While this is a general theory of learning, it is illustrated primarily in the context of mathematics and foreign language instruction. In recent years, Landa has applied his theory to training settings under the name “Landamatics” (Educational Technology, 1993)

(4) Andragogy (Knowles, M.)

Description

Knowles’ theory (1975) of Andragogy is an attempt to develop a theory specifically for ‘adult learning’. Knowles emphasises that adults are self-directed and expect to take responsibility for decisions. Adult learning programmes must accommodate this fundamental aspect. Andragogy makes the following assumptions about the design of learning: (1) adults need to know why they need to learn something (2) adults need to learn experientially, (3) adults approach learning as problem-solving, and (4) adults learn best when the topic is of immediate value.

Principles

Knowles’ theory of andragogy is based on the following basic principles:

(1) Adults need to be involved in the planning and evaluation of their instruction.
(2) Experience (including mistakes) provides the basis for learning activities.
(3) Adults are most interested in learning subjects that have immediate relevance to their job or personal life.
(4) Adult learning is problem-centered rather than content-oriented.
Implications

Andragogy applies to any form of adult learning and has been used extensively in the design of organisational training programmes (especially for “soft skill” domains) such as management development (Knowles, 1984).

(5) Anchored Instruction (Bransford, J. et al.)

Description

‘Anchored Instruction’ is a major paradigm for ‘technology-based learning’ that has been developed by the Cognition and Technology Group at Vanderbilt University (CTGV) under the leadership of John Bransford (1990). While many people have contributed to the theory and research of anchored instruction, Bransford is the principal spokesperson and hence the theory is attributed to him.

The initial focus of the work was on the development of ‘interactive videotool’ that encouraged students and teachers to pose and solve complex and realistic problems. The video materials serve as “anchors” (macro-contexts) for all subsequent learning and instruction. As explained by CTGV (1993, p.52): “The design of these anchors was quite different from the design of videos that were typically used in education… our goal was to create interesting, realistic contexts that encouraged the active construction of knowledge by learners. Our anchors were stories rather than lectures, and were designed to be explored by students and teachers”. The use of interactive videotool technology makes it possible for students to easily explore the content. Anchored instruction is closely related to the ‘Situated Learning’ framework (Lave, 1988) and also to the ‘Cognitive
Flexibility Theory' (Spiro et al., 1988) in its emphasis on the use of technology-based learning.

**Principles**

Anchored instruction theory is based on the following basic principles:

(1) Learning and teaching activities should be designed around a "anchor", which should be some sort of case-study or problem situation.

(2) Curriculum materials should allow exploration by the learner (e.g., interactive videodisc programmes).

**Implications**

The primary application of anchored instruction has been to elementary reading, language arts and mathematics skills. The CLGV has developed a set of interactive videodisc programmes, called the "Jasper Woodbury Problem Solving Series". These programmes involve adventures in which mathematical concepts are used to solve problems. However, the anchored instruction paradigm is based upon a general model of 'problem-solving' (Bransford & Stein 1993).

(6) **Aptitude-Treatment Interaction (Cronbach, L. & Snow, R.)**

**Description**

Aptitude-Treatment Interaction (ATI), propagated by Cronbach & Snow (1977) is the concept that some instructional strategies (treatments) are more or less effective for particular individuals depending upon their
specific abilities. As a theoretical framework, ATI suggests that ‘optimal learning’ results when the instruction is exactly matched to the aptitudes of the learner. It is consistent with theories of ‘intelligence’ (e.g., Gardner, 1983; Guilford, 1967; Sternberg, 1977) that suggest a multidimensional view of ability. According to Snow (1989), the aim of ATI research is to predict educational outcomes from combinations of aptitudes and treatments.

**Principles**

Aptitude-treatment interaction theory is based on the following basic principles:

1. Aptitudes and instructional treatments interact in complex patterns and are influenced by task and situation variables.

2. Highly structured instructional environments tend to be most successful with learners of lower ability; conversely, low structure environments may result in better learning for high ability learners.

3. Anxious or conforming learners tend to learn better in highly structured instructional environments; non-anxious or independent learners tend to prefer low structure.

**Implications**

ATI research covers a broad range of aptitudes and instructional variables. It has been used to explore new teaching strategies and curriculum design, especially in mathematics and reading.
(7) Attribution Theory (Weiner, B.)

Description

‘Attribution theory’ is concerned with ‘how individuals interpret events and how this relates to their thinking and behaviour’. Heider (1958) was the first to propose a ‘psychological theory of attribution’, but Weiner and colleagues (e.g., Jones et al., 1972; Weiner, 1974, 1986) developed a theoretical framework that has become a major research paradigm of social psychology. Attribution theory assumes that ‘people try to determine why people do what they do’, (i.e., attribute causes behaviour). A person seeking to understand why another person did something may attribute one or more causes to that behaviour. A three-stage process underlies an attribution: (1) the person must perceive or observe the behaviour, (2) then, the person must believe that the behaviour was intentionally performed, and (3) then, the person must determine if he/she believes the other person was forced to perform the behaviour (in which case the cause is attributed to the situation) or not (in which case the cause is attributed to the other person).

Principles

Attribution theory is based on the following basic principles:

1. Attribution is a three-stage process: (i) behaviour is observed, (ii) behaviour is determined to be deliberate, and (iii) behaviour is attributed to internal or external causes.

2. Achievement can be attributed to (i) effort, (ii) ability, (iii) level of task difficulty, or (iv) luck.

3. Causal dimensions of behaviour are (i) locus of control, (ii) stability, and (iii) controllability.
Implications

Weiner’s theory has been widely applied in education, law, clinical psychology, and the mental health domain. There is a strong relationship between self-concept and achievement. Learners with higher ratings of self-esteem and with higher school achievement tend to attribute success to internal, stable, uncontrollable factors such as ability, while they contribute failure to either internal, unstable, controllable factors such as effort, or external, uncontrollable factors such as task difficulty. Similarly, learners with learning disabilities seem less likely than non-disabled peers to attribute failure to effort, an unstable, controllable factor, and more likely to attribute failure to ability, a stable, uncontrollable factor.

Lewis & Daltroy (1990) discuss applications of attribution theory to health care. An interesting example of Attribution theory applied to career development is provided by Daly (1996) who examined the attributes that employees held as to why they failed to receive promotions.

(8) Cognitive Dissonance (Festinger, L.)

Description

According to cognitive dissonance theory, propagated by Festinger (1957), there is a tendency for individuals to seek consistency among their cognitions (i.e., beliefs, opinions). When there is an inconsistency between attitudes or behaviours (dissonance), something must change to eliminate the dissonance. In the case of a discrepancy between attitudes and behaviour, it is most likely that the attitude will change to accommodate the behaviour.
Two factors affect the strength of the dissonance: the number of dissonant beliefs, and the importance attached to each belief. There are three ways to eliminate dissonance: (1) reduce the importance of the dissonant beliefs, (2) add more consonant beliefs that outweigh the dissonant beliefs, or (3) change the dissonant beliefs so that they are no longer inconsistent.

**Principles**

Cognitive dissonance theory is based on the following basic principles:

1. Dissonance results when an individual must choose between attitudes and behaviours that are contradictory.
2. Dissonance can be eliminated by reducing the importance of the conflicting beliefs, acquiring new beliefs that change the balance, or removing the conflicting attitude or behaviour.

**Implications**

Dissonance theory applies to all situations involving attitude formation and change. It is especially relevant to decision-making and problem-solving. It has also got implications for attitude towards individual learning (perception, thinking, feelings, action tendencies), learning outcomes and behaviour of the individual learner (e.g., transfer of learning).

**9) Cognitive Flexibility Theory (Spiro, R. et al.)**

**Description**

'Cognitive flexibility theory' focuses on the nature of learning in complex and ill-structured domains. Spiro & Jehng (1990: 165) state: "By cognitive flexibility, we mean the ability to spontaneously restructure one’s
knowledge, in many ways, in adaptive response to radically changing situational demands... This is a function of both the way knowledge is represented (e.g., along multiple rather than single conceptual dimensions) and the processes that operate on those mental representations (e.g., processes of schema-assembly rather than intact schema-retrieval).”

**Principles**

Cognitive flexibility theory is based on the following basic principles:

(1) Learning activities must provide multiple representations of content.

(2) Instructional materials should avoid oversimplifying the content domain and support context-dependent knowledge.

(3) Instruction should be case-based and emphasise knowledge construction, not transmission of information.

(4) Knowledge sources should be highly interconnected rather than compartmentalised.

**Implications**

Cognitive flexibility theory is especially formulated to support the use of interactive technology (e.g., videodisc, hypertext). Its primary applications have been literary comprehension, history, biology and medicine.
Cognitive Load Theory (Sweller, J.)

Description

Cognitive load theory suggests that learning happens best under conditions that are aligned with human cognitive architecture. The structure of human cognitive architecture, while not known precisely, is discernible through the results of experimental research. Recognising George Miller's research (1956) showing that short term memory is limited in the number of elements it can contain simultaneously, Sweller builds a theory that treats schemas, or combinations of elements, as the cognitive structures that make up an individual’s knowledge base (Sweller, 1988).

Principles

Specific recommendations relative to the design of instructional material include:

1. Change problem solving methods to avoid means-ends approaches that impose a heavy working memory load, by using goal-free problems or worked examples.

2. Eliminate the working memory load associated with having to mentally integrate several sources of information by physically integrating those sources of information.

3. Eliminate the working memory load associated with unnecessarily processing repetitive information by reducing redundancy.

4. Increase working memory capacity by using auditory as well as visual information under conditions where both sources of information are essential (i.e. non-redundant) to understanding.
Implications

Sweller's theoretical propositions are best applied in the area of instructional design of cognitively complex or technically challenging material. His concentration is on the reasons that people have difficulty in learning material of this nature. Cognitive load theory has many implications in the design of learning materials, which must, if they are to be effective, keep cognitive load of learners at a minimum during the learning process. While in the past, the theory has been applied primarily to technical areas, it is now being applied to more language-based discursive areas.

(11) Component Display Theory (Merrill, M. D.)

Description

Component display theory (CDT), propagated by Merrill (1983) classifies learning along two dimensions: 'content' (facts, concepts, procedures, and principles) and 'performance' (remembering, using, generalities). The theory specifies four primary presentation forms: 'rules' (expository presentation of a generality), 'examples' (expository presentation of instances), 'recall' (inquisitory generality) and 'practice' (inquisitory instance). Secondary presentation forms include: prerequisites, objectives, helps, mnemonics, and feedback.

Principles

Component Display theory is based on the following basic principles: (1) Instruction will be more effective if all three primary performance forms (remember, use, generality) are present.
(2) Primary forms can be presented by either an explanatory or inquisitory learning strategy.

(3) The sequence of primary forms is not critical provided they are all present.

(4) Learners should be given control over the number of instances or practice items they receive.

Implications
CDT specifies how to design instruction for any cognitive domain. CDT provided the basis for the ‘lesson design’ in the computer–based learning system (Merrill, 1980). It also was the basis for the Instructional Quality Profile, a quality control tool for instructional materials (Merrill et al., 1979).

(12) Conditions of Learning (Gagne, R.)

Description
This theory stipulates that there are several different types or levels of learning. The significance of these classifications is that each different type requires different types of instruction. Gagne (1962) identifies five major categories of learning: verbal information, intellectual skills, cognitive strategies, motor skills, and attitudes. Different internal and external conditions are necessary for each type of learning. For example, for cognitive strategies to be learned, there must be a chance to practice developing new solutions to problems; to learn attitudes, the learner must be exposed to a ‘credible role model’ or persuasive arguments.
Principles

Conditions of learning theory is based on the following basic principles:

(1) Different instruction is required for different ‘learning outcomes’.
(2) Events of learning operate on the learner in ways that constitute the conditions of learning.
(3) The specific operations that constitute instructional events are different for each different type of learning outcome.
(4) Learning hierarchies define what intellectual skills are to be learned and a sequence of instruction.

Implications

While Gagne’s theoretical framework covers all aspects of learning, the focus of the theory is on intellectual skills. The theory has been applied to the design of instruction in all domains (Gagne & Driscoll, 1988). In its original formulation (Gagne, 1962) special attention was given to military training settings. Gagne (1987) addresses the role of instructional technology in learning.

(13) Connectionism (Thorndike, E.)

Description

The learning theory of Thorndike (1921) represents the original Stimulus-Response (S-R) framework of behavioural psychology: Learning is the result of associations forming between stimuli and responses. Such associations or “habits” become strengthened or weakened by the nature and frequency of the S-R pairings. The paradigm for S-R theory was trial and
error-learning in which certain responses come to dominate others due to rewards. The hallmark of connectionism (like all behavioural theories) was that learning could be adequately explained without referring to any unobservable internal states.

**Principles**

This learning theory is based on the following basic principles:

1. Learning requires both practice and rewards (laws of effect/exercise).
2. A series of S-R connections can be chained together if they belong to the same action sequence (law of readiness).
3. ‘Transfer of learning’ occurs because of previously encountered situations.
4. Intelligence is a function of the number of connections learned.

**Implications**

Connectionism was meant to be a general theory of learning for animals and humans. Thorndike was especially interested in the application of his theory to education, including mathematics (Thorndike, 1922) spelling and reading (Thorndike, 1921) measurement of intelligence (Thorndike et al., 1927) and adult learning (Thorndike, et al., 1928). Strong and intentional connectivity must be established among ‘willingness and capacity to learn; access to learning opportunities; purposeful learning experience; opportunities for meaningful and effective transfer of learning; timely and appropriate recognition and reward programmes in place for continuous learning, development and application of learning in organisations.
(14) Constructivist Theory (Bruner, J.)

Description

A major theme in the theoretical framework of Bruner (1960) is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structure (i.e., schema, mental models) provides meaning and organisation to experiences, and allows the individual to “go beyond the information given”.

Principles

Constructivist learning theory is based on the following basic principles:

(1) Instruction must be concerned with the experiences and contexts that make the learner willing and able to learn (readiness).

(2) Instruction must be structured so that it can be easily grasped by the learner (spiral organisation).

(3) Instruction should be designed to facilitate extrapolation and or fill in the gaps (going beyond the information given).

Implications

Bruner’s ‘constructivist theory’ is a general framework for instruction based upon the study of cognition. Much of the theory is linked to child development research (especially Piaget). The ideas outlined in Bruner (1960) originated from a conference focused on ‘science and mathematical learning’. Bruner illustrated his theory in the context of mathematics and

(15) Contiguity Theory (Guthrie, E.)

Description

Guthrie’s (1938) ‘contiguity theory’ specifies that “a combination of stimuli which has accompanied a movement will, on its recurrence, tend to be followed by that movement”. According to Guthrie, all learning was a consequence of association between a particular stimulus and response. Furthermore, Guthrie argued that ‘stimuli and responses’ affect specific sensory-motor patterns; what is learned are movements, not behaviours.

Principles

Contiguity learning theory is based on the following basic principles:

1. In order for ‘conditioning’ to occur, the organism must actively respond (i.e., do things).
2. Since learning involves the conditioning of specific movements, instruction must present very specific tasks.
3. Exposure to many variations in stimulus patterns is desirable in order to produce a generalised response.
4. The last response in a ‘learning situation’ should be correct since it is the one that will be associated.
Implications
Contiguity theory is intended to be a general theory of learning, although most of the research supporting the theory was done with animals. Guthrie did apply his framework to personality disorders (e.g., Guthrie, 1938).

(16) Conversation Theory (Pask, G.)

Description

The ‘conversation theory’ developed by Pask (1975) originated from a cybernetics framework and attempts to explain learning in both living organisms and machines. The fundamental idea of the theory was that learning occurs through conversations about a subject matter which serve to make knowledge explicit. Conversations can be conducted at a number of different levels: natural language (general discussion), object languages (for discussing the subject matter), and meta languages (for talking about learning/language).

In order to facilitate learning, Pask argued that subject matter should be represented in the form of ‘entailment structures’ which show what is to be learned. Entailment structures exist in a variety of different levels depending upon the extent of relationships displayed (e.g., super/subordinate concepts, analogies).

Principles

Conversation learning theory is based on the following basic principles:

(1) To learn a subject matter, learners must learn the relationships among the concepts.
(2) Explicit explanation or manipulation of the subject matter facilitates understanding (e.g., use of ‘teachback’ technique).

(3) Individuals differ in their preferred manner of learning relationships (serialists versus holists).

Implications

Conversation theory applies to the learning of any subject matter. Pask (1975) provides an extensive discussion of the theory applied to the learning of statistics (probability).

(17) Criterion Referenced Instruction (Mager, R.)

Description

The ‘Criterion Referenced Instruction (CRI)’ framework developed by Mager (1975) is a comprehensive set of methods for the design and delivery of training programmes. Some of the critical aspects include: (1) goal/task analysis — to identify what needs to be learned, (2) performance objectives — exact specification of the outcomes to be accomplished and how they are to be evaluated (the criterion), (3) criterion referenced testing — evaluation of learning in terms of the knowledge/skills specified in the objectives, (4) development of learning modules tied to specific objectives.

Principles

CRI framework is based on the following basic principles:

(1) Instructional objectives are derived from job performance and reflect the competencies (knowledge, skills, attitudes, values, and habits) that need to be learned.
(2) Learners study and practice only those skills not yet mastered to the level required by the objectives.

(3) Learners are given opportunities to practice each objective and obtain feedback about the quality of their performance.

(4) Learners should receive repeated practice in skills that are used often or are difficult to learn.

(5) Learners are free to sequence their own instruction within the constraints imposed by the prerequisites, and progress is controlled by their own competence (mastery of objectives).

**Implications**

Criterion referenced instruction is applicable to any form of learning; however, it has been applied most extensively in technical training, including troubleshooting. Its utility is much appreciated in the implementation of ‘systematic training and development cycle’ – training needs analysis and assessment, designing and developing training and development materials, delivery of training and training and development evaluation.

(18) **Double Loop Learning (Argyris, C.)**

**Description**

Argyris (1976) proposes ‘double loop learning theory’, which pertains to ‘learning to change underlying values and assumptions.’ The focus of the theory is on solving problems that are complex and ill-structured and which change as problem-solving advances. Double loop theory is based upon a
theory of action’ perspective outlined by Argyris & Schon (1974). This perspective examines reality from the point of view of human beings as ‘actors’. Changes in values, behaviour, leadership, and helping others, are all part of, and informed by, the actors’ theory of action. An important aspect of the theory is the distinction between individuals’ ‘espoused theory’ and their “theory-in-use” (what they actually do); bringing these two into congruence is a primary concern of ‘double loop learning’. Typically, interaction with others is necessary to identify the conflict between espoused theory and theory-in-use.

**Principles**

Double loop learning theory is based on the following basic principles:

1. Effective problem-solving about interpersonal or technical issues requires frequent ‘public testing’ of theories-in-use.
2. Double loop learning requires ‘learning situations’ in which participants can examine and experiment with their ‘theories of action’.

**Implications**

Double loop learning is a theory of ‘personal change’ that is oriented towards professional education, especially leadership in organisations. It has been applied in the context of management development in organisations.
(19) Drive Reduction Theory (Hull, C.)

Description

Hull (1933) developed a version of ‘behaviourism’, in which the stimulus (S) affects the organism (O) and the resulting response (R) depends upon characteristics of both O and S. In other words, Hull was interested in studying ‘intervening variables’ that affected behaviour, such as initial drive, incentives, inhibitors, and prior training (habit strength). Like other forms of behaviour theory, ‘reinforcement’ is the primary factor that determined learning. However, in Hull’s theory, ‘drive reduction’ or ‘need satisfaction’ plays a much more important role in behaviour than in other frameworks (i.e., Thorndike, Skinner).

Principles

Drive reduction theory is based on the following basic principles:

(1) Drive is essential in order for responses to occur (i.e., the learner must want to learn).

(2) ‘Stimuli and responses’ must be detected by the organism in order for ‘conditioning to occur’ (i.e., the learner must be attentive).

(3) Response must be made in order for conditioning to occur (i.e., the learner must be active).

(4) Conditioning only occurs if the ‘reinforcement’ satisfied a need (i.e., the learning must satisfy the learner’s wants).
Implications

Hull’s theory is meant to be a general theory of learning. Most of the research underlying the theory was done with animals, except for Hull et al., (1940) which focused on verbal learning. Miller & Dollard (1941) represent an attempt to apply the theory to a broader range of learning phenomena. It is interesting to note that, Hull began his career researching hypnosis — an area that landed him in some controversy at Yale (Hull, 1933).

(20) Dual Coding Theory (A. Paivio)

Description

The ‘Dual Coding Theory’ proposed by Paivio attempts to give equal weight to verbal and non-verbal processing. Paivio (1986:53) states: “Human cognition is unique in that it has become specialised for dealing simultaneously with language and with non-verbal objects and events. Moreover, the language system is peculiar in that it deals directly with linguistic input and output (in the form of speech or writing), while at the same time serving a symbolic function with respect to non-verbal objects, events, and behaviours. Any representational theory must accommodate this dual functionality”.

Principle

Recall/recognition is enhanced by presenting information in both visual and verbal forms.
Implications

‘Dual coding theory’ has been applied to many cognitive phenomena including: mnemonics, problem-solving, concept learning and language. Dual coding theory accounts for the significance of ‘spatial abilities’ in theories of intelligence (e.g., Guilford, 1967). Paivio (1986) provides a dual coding explanation of bilingual processing. Clark & Paivio (1991) present dual coding theory as a general framework for educational psychology.

(21) Elaboration Theory (Reigeluth, C.)

Description

According to ‘Elaboration Theory’, proposed by Reigeluth (1983) instruction should be organised in increasing order of complexity for optimal learning. For example, when teaching a procedural task, the simplest version of the task is presented first; subsequent lessons present additional versions until the full range of tasks are taught. In each lesson, the learner should be reminded of all versions taught so far (summary/synthesis). A key idea of elaboration theory is that the learner needs to develop a ‘meaningful context’ into which subsequent ideas and skills can be assimilated. Elaboration theory proposes seven major strategy components: (1) an elaborative sequence, (2) learning prerequisite sequences, (3) summary, (4) synthesis, (5) analogies, (6) cognitive strategies, and (7) learner control.

Principles

Elaboration theory is based on the following basic principles:

(1) Instruction will be more effective if it follows an elaboration strategy, i.e., the use of epitomes containing motivators, analogies, summaries, and syntheses.
(2) There are four types of relationships important in the design of instruction: conceptual, procedural, theoretical and learning prerequisites.

Implications

Elaboration theory applies to the design of instruction for the cognitive domain. The theoretical framework has been applied to a number of settings in higher education and training (English & Reigeluth, 1996; Reigeluth, 1992). Hoffman (1997) considers the relationship between elaboration theory and hypermedia.

(22) Experiential Learning (Rogers, C.)

Description

Rogers (1969) distinguished two types of learning: cognitive (meaningless) and experiential (significant). The former corresponds to ‘academic knowledge’ such as ‘learning vocabulary’ or ‘multiplication tables’, and the latter refers to ‘applied knowledge’ such as learning about engines in order to repair a car. The key to the distinction is that experiential learning addresses the needs and wants of the learner. Rogers lists these qualities of experiential learning: personal involvement, self-initiated, evaluated by learner, and pervasive effects on learner. Roger’s theory of learning evolved as part of the humanistic education movement (e.g., Patterson, 1973; Valett, 1977).
**Principles**

Experiential learning theory is based on the following basic principles:

1. Significant learning takes place when the subject matter is relevant to the personal interests of the learner.
2. Learning, which is threatening to the self (e.g., new attitudes or perspectives), is more easily assimilated when external threats are at a minimum.
3. Learning proceeds faster when the threat to the self is low.
4. Self-initiated learning is the most lasting and pervasive.

**Implications**

Roger’s theory of learning originates from his views about psychotherapy and humanistic approach to psychology. It applies primarily to ‘adult learners’ and has influenced other theories of adult learning such as Knowles (1975) and Cross (1981). Combs (1982) examines the significance of Roger’s work to education. Rogers & Frieberg (1994) discuss applications of the ‘experiential learning framework’ to the classroom.

(23) **Functional Context (Sticht, T.)**

**Description**

The ‘Functional Context’ approach to learning propagated by Sticht (1975) stresses the importance of making learning relevant to the experience of learners and their work context. The learning of new information is facilitated by making it possible for the learner to relate it to knowledge...
already possessed and transform old knowledge into new knowledge. By using material that the learner will use after training, 'transfer of learning' from the classroom to the 'real world' will be enhanced.

The model of the cognitive system underlying this approach emphasises the interaction of three components: 1) ‘a knowledge base’ (i.e., long-term memory) of what the individual knows, (2) ‘processing skills’ including language, problem-solving, and learning strategies, and (3) ‘information displays’ that present information. The performance of a task requires knowledge about what one is reading or writing, processing skills for comprehension and communication, and displays of information to be processed.

**Principles**

The ‘Functional Context’ approach to learning is based on the following basic principles:

1. Instruction should be made as meaningful as possible to the learner in terms of the learner’s prior knowledge.
2. Use material and equipment that the learner will actually use after training.
3. Literacy can be improved by improving content-knowledge, information processing skills, or the design of the learning materials.
4. Valid assessment of learning requires ‘context/content-specific’ measurement.
Implications

The functional context approach was developed specifically for adult technical and literacy training (reading/writing/mathematics) in military programmes, but it has implications for learning of basic skills in general (e.g., Sticht, 1976) and reading in particular (Sticht, 1975). Sticht’s functional context framework has been the basis for major workplace training and literacy programmes sponsored by the U.S. Department of Labor and Department of Education.

(24) Genetic Epistemology (Piaget, J.)

Description

Over a period of six decades, Piaget conducted a programme of ‘naturalistic research’ that has profoundly affected our understanding of child development. Piaget (1929) called his general theoretical framework “genetic epistemology” because he was primarily interested in ‘how knowledge was developed in human organisms’. Piaget had a background in both biology and philosophy, and concepts from both these disciplines influenced his theories and research of child development. The concept of cognitive structure is central to his theory. Cognitive structures are patterns of physical or mental action that underlie specific acts of intelligence and correspond to stages of child development.
Principles

Genetic epistemology approach is based on the following basic principles:

(1) Children will provide different explanations of reality at different stages of cognitive development.

(2) Cognitive development is facilitated by providing activities or situations that engage learners and require adaptation (i.e., assimilation and accommodation).

(3) Learning materials and activities should involve the appropriate level of motor or mental operations for a child of a given age; avoid asking learners to perform tasks that are beyond their current cognitive capabilities.

(4) Use teaching methods that actively involve learners and present challenges.

Implications

Piaget explored the implications of his theory to all aspects of cognition, intelligence and moral development. Many of Piaget’s experiments were focused on the development of mathematical and logical concepts. The theory has been applied extensively to ‘teaching practice’ and ‘curriculum design’ in elementary education (e.g., Bybee & Sund, 1982; Wadsworth, 1978).
(25) Gestalt Theory (Wertheimer, M.)

Description

Along with Kohler & Koffka, Wertheimer was one of the principal proponents of ‘Gestalt Theory’ which emphasised ‘higher-order cognitive processes’ in the midst of behaviourism. The focus of Gestalt theory was the idea of “grouping”, i.e., characteristics of stimuli cause us to structure or interpret a visual field or problem in a certain way (Wertheimer, 1923). The primary factors that determines grouping were: (1) ‘proximity’—elements tend to be grouped together according to their nearness, (2) ‘similarity—items similar in some respect tend to be grouped together, (3) ‘closure’—items are grouped together if they tend to complete some entity, and (4) ‘simplicity’—items will be organised into simple figures according to symmetry, regularity, and smoothness. These factors were called the ‘laws of organisation’ and were explained in the context of ‘perception’ and ‘problem-solving’.

Principles

Gestalt theory is based on the following basic principles:

(1) The learner should be encouraged to discover the underlying nature of a topic or problem (i.e., the relationship among the elements).

(2) Gaps, incongruities, or disturbances are an important ‘stimulus’ for learning.

(3) Instruction should be based upon the ‘laws of organisation’: proximity, closure, similarity, and simplicity.
Implications

Gestalt theory applies to all aspects of human learning, although it applies most directly to perception and problem-solving. The work of Gibson (1966) was strongly influenced by Gestalt theory.

(26) GOMS Model (Card et al.)

Description

‘GOMS’ (Goals, Operators, Methods, and Selection rules) is a theory of cognitive skills involved in ‘human-computer’ tasks. It is based upon an ‘information processing framework’ that assumes a number of different stages or types of memory (e.g., sensory store, working memory, long term memory) with separate perceptual, motor, and cognitive processing. All cognitive activities are interpreted in terms of searching a problem space, the fundamental premise of General Problem Solver (GPS) theory and Newell’s Soar (Study, Operator, Assign, Recognise) theory (1990).

According to the GOMS model (1983), cognitive structure consists of four components: (1) a set of goals, (2) a set of operators, (3) a set of methods for achieving the goals, and (4) a set of selection rules for choosing among competing methods.

Principles

GOMS model is based on the following basic principles:

(1) To improve the performance of a cognitive skill, eliminate unnecessary operators from the method used to do the task (or use other methods).
(2) The operators involved in cognitive skills are highly specific to the methods used for a given task.

(3) Task performance can be improved by providing a set of error-recovery methods.

Implications

The primary application of the GOMS model is to text editing tasks, although it has also been applied to a wide range of computer tasks (Olson & Olson, 1991). GOMS is intended as 'a system design methodology' that allows computer designers to test user-interface designs (e.g., Kieras, 1985; Oray, John & Atwood, 1993). Gong & Elkerton (1990) report the use of the GOMS model to develop computer documentation using the Minimalist model of Carroll (1990).

(27) General Problem Solver (GPS) (Newell, A. & Simon, H.)

Description

The 'General Problem Solver' (GPS) was a theory of human problem-solving stated in the form of a simulation programme (Ernst & Newell, 1969; Newell & Simon, 1972). This programme and the associated theoretical framework had a significant impact on the subsequent direction of cognitive psychology. It also introduced the use of 'productions' as a method for specifying cognitive models.

The theoretical framework was 'information processing' and attempted to explain all behaviour as a function of 'memory operations, control processes and rules'. The methodology for testing the theory involved developing a computer simulation and comparing the results of the
simulation with human behaviour in a given task. Such comparisons also made use of 'protocol analysis' (Ericsson & Simon, 1984), in which the verbal reports of a person solving a task are used as indicators of cognitive processes.

Principle

Problem-solving behaviour involves 'means-ends-analysis', i.e., breaking a problem down into subcomponents (subgoals) and solving each of those.

Implications

While GPS was intended to be a general problem-solver, it could only be applied to “well-defined” problems, such as ‘proving theorems’ in logic or geometry, word puzzles and chess. However, GPS was the basis for other theoretical works, such as SOAR (Study, Operator, Assign, Recognise) and GOMS rules. Newell (1990) provides a summary of how this work evolved.

(28) Information Pickup Theory (Gibson, J.)

Description

The ‘Theory of Information Pickup’ suggests that perception depends entirely upon information in the “stimulus array” rather than sensations that are influenced by cognition. Gibson (1966) proposes that the environment consists of affordances (such as terrain, water, vegetation, etc.) which provide the clues necessary for perception. Furthermore, the ambient array includes invariants such as shadow, texture, colour, convergence, symmetry and layout that determine what is perceived. According to Gibson,
‘perception’ is a direct consequence of the properties of the environment and does not involve any form of sensory processing.

Principles

The theory of information pickup is based on the following basic principles:

1. To facilitate perception, realistic environmental settings should be used in instructional materials.
2. Since perception is an active process, the individual should have an unconstrained learning environment.
3. Instruction should emphasise the ‘stimulus characteristics’ that provide perceptual cues.

Implications

Information pickup theory is intended as a general theory of perception, although it has been developed most completely for the visual system. Gibson (1979) discusses the implications of the theory for ‘still and motion picture research’. Neisser (1976) presents a ‘theory of cognition’ that is strongly influenced by Gibson.

(29) Information Processing Theory (Miller, G.)

Description

Miller (1956) has provided two theoretical ideas that are fundamental to cognitive psychology and the information processing framework. The first concept is “chunking” and the capacity of short-term memory. Miller (1956) presented the idea that short-term memory could only hold 5-9 chunks of information (seven plus or minus two), where a chunk is any meaningful unit.
The second concept is TOTE (Test-Operate-Test-Exit) proposed by Miller et al., (1960). Miller et al. suggested that TOTE should replace ‘stimulus-response’ as the basic unit of behaviour.

**Principles**

Information processing theory is based on the following basic principles:

1. Short-term memory (or attention span) is limited to seven chunks of information.
2. Planning (in the form of TOTE units) is a fundamental cognitive process.
3. Behaviour is hierarchically organised (e.g., chunks, TOTE units).

**Implications**

Information processing theory has become a general theory of human cognition and the phenomenon of ‘chunking’ has been verified at all levels of cognitive processing.

**(30) Lateral Thinking (DeBono, E.)**

**Description**

De Bono (1967) has written extensively about the process of lateral thinking - the generation of novel solutions to problems. The point of lateral thinking is that many problems require a different perspective to solve them successfully.
De Bono identifies four critical factors associated with lateral thinking: (1) recognising dominant ideas that polarise perception of a problem, (2) searching for different ways of looking at things, (3) relaxation of rigid control of thinking, and (4) use of chance to encourage other ideas. This last factor has to do with the fact that lateral thinking involves 'low-probability ideas', which are unlikely to occur in the normal course of events.

Although De Bono does not acknowledge any theoretical antecedents for lateral thinking, it seems closely related to the 'Gestalt Theory' of Wertheimer (1923). His work is also highly relevant to the concept of creativity (http://tip.psychology.org/create.html).

**Principle**

To get a different perspective on a problem, try breaking the elements up and recombining them in a different way (perhaps randomly).

**Implications**

Lateral thinking applies to human problem-solving. DeBono (1971a) discusses the application of lateral thinking to 'management development' (http://tip.psychology.org/manage.html), and DeBono (1971b) provides an interesting study of lateral thinking in children. Some of his recent work has focused on schools (e.g., DeBono, 1991).
Description

The ‘Levels of Processing Framework’ was presented by Craik & Lockhart (1972) as an alternative to ‘theories of memory’ that postulated separate stages for sensory, working and long-term memory. According to the levels of processing framework, ‘stimulus information’ is processed at multiple levels simultaneously depending upon its characteristics. Furthermore, the “deeper” the processing, the more that will be remembered. For example, information that involves strong visual images or many associations with existing knowledge will be processed at a deeper level. Similarly, information that is being attended receives more processing than other stimuli/events. The theory also supports the finding that we remember things that are ‘meaningful’ to us because this requires more processing than meaningless stimuli.

Processing of information at different levels is ‘unconscious’ and ‘automatic’ unless we attend to that level. For example, we are normally not aware of the sensory properties of stimuli, or what we have in working memory, unless we are asked to specifically identify such information. This suggests that the mechanism of ‘attention’ is an interruption in processing rather than a cognitive process in its own right.

Principles

Levels of processing framework is based on the following basic principles:

(1) The greater the processing of information during learning, the more it will be retained and remembered.
(2) Processing will be automatic unless attention is focused on a particular level.

Implications

The primary application of the ‘levels of processing framework’ was to verbal learning settings (i.e. memorisation of word lists); however, it has been applied to reading and language learning (e.g., Cermak & Craik, 1979).

(32) Mathematical Learning Theory (Atkinson, R. C.)

Description

‘Mathematical Learning Theory’ is an attempt to describe and explain behaviour in ‘quantitative terms’. A number of psychologists have attempted to develop such theories (e.g., Hull, 1933; Estes, 1950; Restle & Greeno, 1970). The work of R. C. Atkinson is particularly interesting because he applied mathematical learning theory to the ‘design of a language arts curriculum’.

Atkinson (1972) discusses the problem of optimising instruction. He outlined four possible strategies: (1) maximise the mean performance of the whole class, (2) minimise the variance in performance for the whole class, (3) maximise the number of students who score at grade level, or (4) maximise the mean performance for each individual. Atkinson shows that while alternative (1) produces the largest gain scores, it also produces the greatest variance since it increases the spread between the most and least successful students. Alternative (4) produces an overall gain but without increased variability. This is accomplished by giving each student ‘variable amounts of time’ depending upon performance.
**Principles**

Mathematical learning theory is based on the following basic principles:

1. It is possible to develop an optimal instructional strategy for a given individual, provided that a detailed model of the learning process is available.
2. Optimal learning performance can be achieved by giving each individual sufficient time to learn.

**Implications**

Atkinson's research has primarily focused on simple ‘language learning’ in the context of ‘computer-based instruction’. Atkinson & Shiffrin (1968) discuss a model of memory based upon quantitative principles.

(33) **Mathematical Problem Solving (Schoenfeld, A.)**

**Description**

Schoenfeld presents the view that ‘understanding and teaching mathematics’ should be approached as a ‘problem-solving domain’. According to Schoenfeld (1985) four categories of knowledge/skills are needed to be successful in mathematics: (1) ‘Resources’—proposition and procedural knowledge of mathematics, (2) ‘heuristics’—strategies and techniques for problem-solving such as working backwards, or drawing figures, (3) ‘control’—decisions about when and what resources and strategies to use, and (4) ‘beliefs’—a mathematical ‘world-view’ that determines how someone approaches a problem.
Principle

Successful solution of mathematics problems depends upon a combination of resource knowledge, heuristics, control processes and belief, all of which must be learned and taught.

Implications

Schoenfeld’s research and theory apply primarily to college level mathematics.

(34) Minimalism (Carroll, J.)

Description

The Minimalist Theory of Carroll (1990) is a framework for the design of instruction, especially training materials for computer users. The theory suggests that (1) all learning tasks should be meaningful and self-contained, (2) learners should be given realistic projects as quickly as possible, (3) instruction should permit self-directed reasoning and improvising by increasing the number of active learning activities, (4) training materials and activities should provide for error-recognition and recovery and, (5) there should be a close linkage between the training and actual system.

Minimalist theory emphasises the necessity to build upon the learner’s experience (c.f., Knowles 1975; Rogers, 1969). Carroll (1990) states: “Adult learners are not blank slates; they don’t have funnels in their heads; they have little patience for being treated as “don’t knows”… New users are always learning computer methods in the context of specific pre-existing
goals and expectations.” (p.11) Carroll also identifies the roots of minimalism in the constructivism of Bruner (1966) and Piaget (1929).

**Principles**

Minimalist theory is based on the following basic principles:

1. Allow learners to start immediately on meaningful tasks.
2. Minimise the amount of reading and other passive forms of training by allowing users to fill in the gaps themselves.
3. Include error-recognition and recovery activities in the instruction.
4. Make all learning activities self-contained and independent of sequence.

**Implications**

Minimalist theory is based upon studies of people learning to use a diverse range of computer applications including work processing, databases, and programming. It has been extensively applied to the design of computer documentation (e.g., Nowaczyk & James, 1993; Van der Meij & Carroll, 1995). Carroll (1998) includes a survey of applications as well as analysis of the framework in practice and theory.

**Model-Centered Instruction (MCI) and Design Layering (Gibbons, A. S.)**

**Description**

‘Model-Centered Instruction’ (MCI) is a set of principles to guide instructional designers in selecting and arranging design constructs, so it is
appropriately called a ‘design theory’. It favours designs that originate with and maintain the priority of models as the central design structure (Gibbons et al., 1995). Model-Centered Instruction, as any design theory, can be described in terms of the prescriptive principles it expresses for each of these layers.

**Principles**

The principles of model-centered instruction are given below:

1. **Experience**: Learners should be given maximum opportunity to interact for learning purposes with one or more system or models of systems of three types: environment, system, and/or expert performance. The terms, ‘model and simulation’, are not synonymous; models can be expressed in a variety of computer-based and non-computer-based forms.

2. **Problem solving**: Interaction with systems or models should be focused by the solution of one or more carefully selected problems, expressed in terms of the model, with solutions being performed by the learner, by a peer, or by an expert.

3. **Denaturing**: Models are necessarily denatured from the real by the medium in which they are expressed. Designers must select a level of denaturing matching the target learner’s existing knowledge and goals.

4. **Sequence**: Problems should be arranged in a carefully constructed sequence of specific instructional goals.
(5) **Goal orientation**: Problems selected should be appropriate for the attainment of specific instructional goals.

(6) **Resourcing**: The learner should be given problem-solving information resources, materials, and tools within a solution environment (which may exist only in the learner’s mind) commensurate with instructional goals and existing levels of knowledge.

(7) **Instructional augmentation**: The learner should be given support during solving in the form of dynamic, specialised, designed instructional augmentations.

**Implications**

When the designer enters design from the model/content layer, the priority of concerns follows this order:

1. What is the appropriate ‘cause-effect model’ (or system) the learner should interact with?
2. What is the appropriate level of ‘denaturing’ (reduction in fidelity and granularity) of models for a given learner?
3. What sequence or set of problems should the learner solve as a lens into or a mask on this model?
4. What resources and tools should be available to the learner solve as a lens into or a mask on this mode?
5. What additional instructional augmentations should be supplied to support the solving of the problem?
(36) Models of Learning (Rumelhart, D. & Norman, D.)

Description

Rumelhart & Norman (1978) proposed that there were three modes of learning: accretion, structuring and tuning. ‘Accretion’ is the addition of new knowledge to existing memory. ‘Structuring’ involves the formation of new conceptual structures or schema. ‘Tuning’ is the adjustment of knowledge to a specific task usually through practice. Accretion is the most common form of learning; structuring occurs much less frequently and requires considerable effort; tuning is the slowest form of learning and accounts for expert performance.

Principles

The principles of model-centered instruction are given below:

(1) Instruction must be designed to accommodate different modes of learning.

(2) ‘Practice activities’ affect the refinement of skills but not necessarily the initial acquisition of knowledge.

Implications

This is a general model for human learning, although it was originally proposed in the context of language learning (http://tip.psychology.org/language.html).
(37) Multiple Intelligences (Gardner, H.)

Description

The 'Theory of Multiple Intelligences' suggests that there are a number of distinct forms of intelligence that each individual possesses in varying degrees. Gardner (1983) proposes seven primary forms: linguistic, musical, logical-mathematical, spatial, body-kinesthetic, intrapersonal (e.g., insight, metacognition), and interpersonal (e.g., social skills). According to Gardner, the implication of the theory is that learning/teaching should focus on the 'particular intelligences' of each person. For example, if an individual has strong spatial or musical intelligences, he should be encouraged to develop these abilities. Gardner points out that the different intelligences represent not only different 'content-domains', but also learning modalities. A further implication of the theory is that assessment of abilities should measure all forms of intelligence, not just linguistic and logical-mathematical.

Principles

The principles of multiple intelligences are given below:

(1) Individuals should be encouraged to use their 'preferred intelligences' in learning.
(2) Instructional activities should appeal to different forms of intelligence.
(3) Assessment of learning should measure 'multiple forms of intelligence'.
Implications

The theory of multiple intelligences has been focused mostly on child development, although it applies to all ages. While there is no direct empirical support for the theory, Gardner (1983) presents evidence from many domains including biology, anthropology, and the creative arts, and Gardner (1993a) discusses application of the theory to school programmes. Gardner (1982, 1993b) explores the implications of the framework for creativity (Marks-Tarlow, 1995).

(38) Operant Conditioning (Skinner, B. F.)

Description

The theory of Skinner (1957) is based upon the idea that ‘learning is a function of change in overt behaviour’. Changes in behaviour are the result of an individual’s response to events (stimuli) that occur in the environment. A response produces a consequence such as defining a word, hitting a ball, or solving a mathematical problem. When a particular ‘Stimulus-Response (S-R) pattern’ is reinforced (rewarded), the individual is ‘conditioned to respond’. The distinctive characteristic of ‘operant conditioning’ relative to previous forms of behaviourism (e.g., Thorndike, 1921; Hull 1933), is that the organism can emit responses instead of only eliciting response due to an external stimulus. ‘Reinforcement’ is the key element in Skinner’s S-R theory.
Principles

Operant conditioning theory is based on the following basic principles:

(1) Behaviour that is ‘positively reinforced’ will re-occur; intermittent reinforcement is particularly effective.

(2) Information should be presented in small amounts so that responses can be reinforced (“shaping”).

(3) Reinforcements will generalise across similar stimuli (“stimulus generalisation”) producing secondary conditioning.

Implications

Operant conditioning has been widely applied in clinical settings (i.e., behaviour modification) as well as teaching (i.e., classroom management), and instructional development (e.g., programmed instruction). Parenthetically, it should be noted that Skinner rejected the idea of ‘theories of learning’ (Skinner, 1950).

(39) Originality (Maltzman, L.)

Description

Maltzman (1960) conducted a number of studies that demonstrated that originality could be increased. According to Maltzman, ‘originality’ refers to behaviour that occurs relatively infrequently, is uncommon under given conditions, and is relevant to those conditions. Maltzman distinguished originality from creativity, the latter referring to the consequences of original behaviour (including the reaction of society to the behaviour).
Maltzman (1960) describes three methods that can increase original responses: (1) present an uncommon ‘stimulus situation’ for which conventional responses may not be readily available, (2) evoke different responses to the same situation, and (3) evoke uncommon responses as textual responses. Maltzman used the latter approach. Maltzman’s research is distinctive because he was one of the few behaviourists who attempted to deal with ‘creative behaviour’. He provided a simple definition and methodology for studying originality. He also examined the relationship between originality and problem-solving.

**Principle**

Originality can be increased through instructions or practice to produce uncommon responses.

**Implications**

Maltzman conducted his studies using ‘word association’ tasks. Thus, his findings are most directly applicable to originality that involves verbalisation or language.

(40) **Phenomenography (Marton, F. & Entwistle, N.)**

**Description**

This conceptual framework focuses on the experience of learning from the learner’s perspective, and is based upon a ‘phenomenological approach’ to research. Entwistle explains: “Our task is thus to describe more clearly how learning takes place in higher education and to point out how teaching and assessment affect the quality of learning. From these descriptions, teachers should be able to draw their own lessons about how to facilitate their student’s learning” (Marton et al., 1984:1)
**Principles**

Phenomenography theory is based on the following basic principles:

1. Researchers should seek an understanding of the ‘phenomenon of learning’ by examining the students’ experiences.
2. Research about learning needs to be conducted in a ‘naturalistic setting’ involving the ‘actual content and settings’ people learn with.

**Implications**

The scope of ‘phenomenographic research’ is focused on learning in higher education. Initial studies focused on student learning experience in reading articles, attending lectures, writing essays, solving problems, and studying; more recent work has examined the cross-cultural aspects of student-learning experiences. Ramsden (1992) provides practical guidelines for teaching based upon this research approach, and Frantz *et al.* (no date) discuss an application to engineering.

**(41) Repair Theory (VanLehn, K.)**

**Description**

‘Repair Theory’ is an attempt to explain how people learn procedural skills with particular attention to ‘how and why they make mistakes’ (i.e., bugs). (Van Lehn, 1990); the theory suggests that when a procedure cannot be performed, an impasse occurs and the individual applies various strategies to overcome the impasse. These strategies (meta-actions) are called ‘repairs’. Some repairs result in correct outcomes, whereas others generate incorrect results and hence “buggy” procedures. Repair theory has been implemented in the form of a computer model called ‘Sierra’. Repair theory has been developed from extensive study of children solving arithmetic problems (Brown & VanLehn, 1980).
Principles

Repair theory is based on the following basic principles:

(1) Bugs that cause errors in 'procedural tasks' are systematic and can be identified.

(2) Once the bugs associated with a particular task are known, they can be used to improve student performance and the examples used to teach the procedure.

Implications

Repair theory applies to any procedural knowledge. However, to date, the theory has only been fully developed in the domain of children solving subtraction problems. However, elements of repair theory show up in subsequent work of VanLehn's on 'intelligent tutoring systems' and 'problem solving' (http://tip.psychology.org/problem.html).

(42) Script Theory (Schank, R.)

Description

The central focus of Schank's 'Script Theory' has been the structure of knowledge, especially in the context of language understanding. Schank (1975) outlined 'contextual dependency theory', which deals with the representation of meaning in sentences. Building upon this framework, Schank & Abelson (1977) introduced the 'concepts of scripts, plans and themes' to handle 'story-level understanding'. Later work (e.g., Schank, 1982(a), 1982(b), 1986) elaborated the theory to encompass other aspects of cognition.
Principles

Script theory is based on the following basic principles:

(1) Conceptualisation is defined as an act or doing something to an object in a direction.

(2) All conceptualisations can be analysed in terms of a small number of primative acts.

(3) All memory is 'episodic' and organised in terms of scripts.

(4) Scripts allow individuals to make inferences, and hence, understand verbal/written discourse.

(5) Higher level expectations are created by goals and plans.

Implications

Script theory is primarily intended to explain 'language processing' and 'higher thinking skills'. A variety of computer programmes have been developed to demonstrate the theory. Schank (1991) applies his theoretical framework to 'story telling' and the development of 'intelligent tutors'. Shank & Cleary (1995) describe the application of these ideas to educational software.

(43) Sign Learning (Tolman, E.)

Description

Tolman's theorising (1948) has been called 'purposive behaviourism', and is often considered the bridge between 'behaviourism' and 'cognitive theory'. According to Tolman's 'theory of sign learning', an organism learns by pursuing signs to a goal, i.e, learning is acquired through meaningful behaviour. Tolman emphasised the organised aspect of learning.
“The stimuli which are allowed in are not connected by just simple ‘one-to-one switches’ to the outgoing responses. Rather, the incoming impulses are usually worked over and elaborated in the central control room into a tentative cognitive-like map of the environment. And it is this tentative map, indicating routes and paths and environmental relationships, which finally determines what responses, if any, the animal will finally make.” (Tolman, 1948: 192). Tolman’s version of behaviourism emphasised the relationships between ‘stimuli’ rather than ‘stimulus-response’ (Tolman, 1922).

**Principles**

Sign learning theory is based on the following basic principles:

1. Learning is always purposive and goal-directed.
2. Learning often involves the use of environmental factors to achieve a goal (e.g., means-ends-analysis).
3. Organisms will select the shortest or easiest path to achieve a goal.

**Implications**

Although Tolman intended his theory to apply to human learning, almost all of his research was done with rats and mazes. Tolman (1942) examines motivation towards war, but this work is not directly related to his learning theory.
(44) Situated Learning (Lave, J.)

Description

Lave (1988) argues that learning as it normally occurs is a ‘function of the activity, context and culture in which it occurs (i.e., it is situated)’. This contrasts with most classroom learning activities which involve knowledge, which is abstract and out of context. Social interaction is a critical component of situated learning – learners become involved in a “community of practice”, which embodies certain beliefs and behaviours to be acquired. As the beginners or newcomers move from the periphery of this community to its center, they become more active and engaged within the culture, and hence, assume the role of experts or old-timers. Furthermore, situated learning is usually ‘unintentional’ rather than deliberate. These ideas are what Lave & Wenger (1991) call the process of “legitimate peripheral participation.”

Other researchers have further developed the theory of situated learning. Brown et al., (1989) emphasise the idea of ‘cognitive apprenticeship’.

Principles

Situated learning theory is based on the following basic principles:

(1) Knowledge needs to be presented in an authentic context, i.e., settings and applications that would normally involve that knowledge.

(2) Learning requires social interaction and collaboration.
Implications

‘Situated Learning’ is a general theory of knowledge acquisition. It has been applied in the context of technology-based learning activities for schools that focus on problem-solving skills (Cognition & Technology Group at Vanderbilt, 1993). McLellan (1995) provides a collection of articles that describe various perspectives on the theory.

(45) Soar (Newell, A. et al.)

Description

Soar (Study, Operator, Assign, Recognise) is architecture for human cognition expressed in the form of a production system. It involves the collaboration of a number of researchers including Allen Newell, John Laird & Paul Rosenbloom and others (1987) from different institutions. The theory builds upon earlier efforts involving Newell such as GPS (Newell & Simon, 1972) and GOMS rules (Card et al., 1983). Like the latter model, Soar is capable of simulating actual responses and response times.

The principal element in Soar is the idea of a problem space: ‘all cognitive acts are some form of search task. Memory is unitary and procedural; there is no distinction between procedural and declarative memory.'
Principles

As a theory of learning, Soar specifies (or confirms) a number of principles as listed below:

(1) All learning arises from goal-directed activities; specific knowledge is acquired in order to satisfy goals (needs).

(2) Learning occurs at a constant rate — the rate at which impasses occur while problem-solving (average of 0.5 chunk/second).

(3) Transfer occurs by identical elements and is highly specific (c.f.: Thorndike, 1921). Transfer can be general, if the productions are abstract.

(4) Rehearsal helps learning, provided it involves active processing (i.e., creation of chunks).

(5) ‘Chunking’ is the basis for the organisation of memory.

Implications

Newell (1990) has positioned Soar as the basis for a ‘unified theory of cognition’ and attempts to show how it explains a wide range of past results and phenomena. For example, he provides interpretations for ‘response time data’, ‘verbal learning tasks’, ‘reasoning tasks’, ‘mental models’, and ‘skill acquisition’. In addition, versions of Soar have been developed that perform as ‘intelligent systems’ for configuring computer systems and formulating algorithms.
Social Development Theory (Vygotsky, L.)

Description

The major theme of Vygotsky’s theoretical framework is that social interaction plays a fundamental role in the development of cognition. Vygotsky (1978: 57) states: “Every function in the child’s cultural development appears twice: first, on the ‘social level’, and later, on the ‘individual level’; first, ‘between people’ (interpsychological), and then, ‘inside the child’ (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals.”

A second aspect of Vygotsky’s theory is the idea that the potential for cognitive development depends upon the “Zone of proximal development” (ZPD): a level of development attained when children engage in social behaviour. Full development of the ZPD depends upon ‘full social interaction’. The range of skills that can be developed with ‘adult guidance’ or ‘peer collaboration’ exceeds what can be attained alone. Vygotsky’s theory was an attempt to explain ‘consciousness’ as the ‘end product’ of socialisation. For example, in the learning of language, our first utterances with peers or adults are for the purpose of communication, but once mastered, they become internalized and allow “inner speech”. Vygotsky’s theory is complementary to the work of Bandura on social learning (1977) and a key component of situated learning theory.
Principles

Social development theory is based on the following basic principles:
(1) Cognitive development is limited to a certain range at any given age.
(2) Full cognitive development requires social interaction

Implications

This is a general theory of cognitive development. Most of the original work was done in the context of ‘language learning’ in children (Vygotsky, 1962), although later applications of the framework have been broader (Wertsch, 1985).

(47) Social Learning Theory (Bandura, A.)

Description

The ‘Social Learning Theory’ of Bandura emphasises the importance of observing and modeling the behaviours, attitudes, and emotional reactions of others. Bandura (1977: 22) states: “Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behaviour is learned observationally through modeling: from observing others, one forms an idea of how new behaviours are performed, and on later occasions, this ‘coded information’ serves as a guide for action”. Social learning theory explains human behaviour in terms of continuous reciprocal interaction between cognitive, behavioural, and environmental influences. The ‘component processes’ underlying observational learning are: (1) attention, (2) retention, (3) motor reproduction, and (4) motivation. Bandura’s theory improves upon the
strictly behavioural interpretation of modeling provided by Miller & Dollard (1941). Bandura’s work is related to the theories of Vygotsky (1978) and Lave (1990), which also emphasise the central role of social learning.

Principles

Social Learning theory is based on the following basic principles:

(1) The highest level of observational learning is achieved by first organising and rehearsing the modeled behaviour symbolically, and then, enacting it overtly. Coding modeled behaviour into words, labels or images results in better ‘retention’ than simply observing.

(2) Individuals are more likely to adopt a modeled behaviour if it results in outcomes they value.

(3) Individuals are more likely to adopt a modeled behaviour if the model is similar to the observer and has admired status, and the behaviour has functional value.

Implications

Social learning theory has been applied extensively to the understanding of ‘aggression’ (Bandura, 1973) and ‘psychological disorders’, particularly in the context of behaviour modification (Bandura, 1969). It is also the theoretical foundation for the technique of ‘behaviour modeling’ which is widely used in training programmes. In recent years, Bandura has focused his work on the concept of ‘self-efficacy’ in a variety of contexts (e.g., Bandura, 1997).
(48) Stimulus Sampling Theory (Estes, W.)

Description

Stimulus Sampling Theory (SST), first proposed by Estes in 1950, was an attempt to develop a statistical explanation for learning phenomena. The theory suggested that a particular ‘stimulus (S)-response (R) association’ is learned on a single trial; however, the overall learning process is a continuous one consisting of the accumulation of ‘discrete S-R pairings’. On any given learning trial, a number of different responses can be made, but only the portions that are effective (i.e., rewarded) form associations. Thus, learned responses are a sample of all possible stimulus elements experienced. Variations (random or systematic) in ‘stimulus elements’ are due to environmental factors or changes in the organism.

Principles

Stimulus Sampling theory is based on the following basic principles:

(1) While learning of a particular instance is all or none, the overall learning process is gradual and cumulative.

(2) Fluctuations in environmental and internal factors will cause variability in learning progress.

Implications

Most of the research on SST was conducted using ‘probability or verbal learning experiments’, limiting its application to other types of learning. Furthermore, SST did not really take into account cognitive strategies used by participants in these experiments (such as hypothesis testing or the “gambler’s fallacy”) which could affect the results.
(49) Structural Learning Theory (Scandura, J.)

Description

According to ‘Structural Learning Theory’ presented by Scandura (1973), what is learned are ‘rules’ which consist of a domain, range, and procedure. There may be alternative ‘rule sets’ for any given class of tasks. Problem-solving may be facilitated when higher-order rules are used, i.e., rules that generate new rules. Higher-order rules account for creative behaviour (unanticipated outcomes) as well as the ability to solve complex problems by making it possible to generate (learn) new rules. Unlike information processing theories, which often assume more complex control mechanisms and production rules, structural learning theory postulates a single, ‘goal-switching control mechanism’ with minimal assumptions about the processor and allows more complex rule structures. Structural learning theory also assumes that “working memory” holds both rules and data (i.e., rules which do not act on other rules); the ‘memory load’ associated with a task depends upon the rule (s) used for the task at hand.

Principles

Structural learning theory is based on the following basic principles:

(1) Whenever possible, teach ‘higher-order’ rules that can be used to derive ‘lower-order’ rules.

(2) Teach the ‘simplest solution path’ first, and then, teach more complex paths or rule sets.

(3) Rules must be composed of the ‘minimum capabilities’ possessed by the learners.
Implications

Structural learning theory has been applied extensively to mathematics and also provides an interpretation of Piagetian theory (Scandura & Scandura, 1980). The primary focus of the theory is ‘problem-solving instruction’ (Scandura, 1977). Scandura has applied the theoretical framework to the development of authoring tools and software engineering.

(50) Structures of Intellect (Guilford, J. P.)

Description

In Guilford’s ‘Structures of Intellect (SI) Theory’ (1967), intelligence is viewed as comprising ‘operation, contents, and products’. There are five kinds of operations (cognition, memory, divergent production, convergent production, evaluation), six kinds of products (units, classes, relations, systems, transformations, and implications), and five kinds of contents (visual, auditory, symbolic, semantic, behavioural). Since each of these dimensions is independent, there are theoretically 150 different components of intelligence.

Principles

SI theory is based on the following basic principles:

(1) Reasoning and problem-solving skills (convergent and divergent operations) can be subdivided into 30 distinct abilities (6 products x 5 contents).

(2) Memory operations can be subdivided into 30 different skills (6 products x 5 contents).

(3) Decision-making skills (evaluation operations) can be subdivided into 30 distinct abilities (6 products x 5 contents).

(4) Language-related skills (cognitive operations) can be subdivided into 30 distinct abilities (6 products x 5 contents).
Implications

SI theory is intended to be a general theory of human intelligence. Its major application (besides educational research) has been in ‘personnel selection and placement’. Meeker (1969) examines its application to education

(51) Subsumption Theory (Ausubel, D.)

Description

Ausubel’s ‘Subsumption Theory (1963)’, is concerned with how individuals learn large amounts of meaningful material from verbal/textual presentations in a school setting (in contrast to theories developed in the context of laboratory experiments). According to Ausubel, learning is based upon the kinds of superordinate, representational, and combinatorial processes that occur during the reception of information. A primary process in learning is ‘subsumption’ in which new material is related to relevant ideas in the existing cognitive structure on a ‘substantive, no-verbatim’ basis. Cognitive structures represent the residue of all learning experiences; forgetting occurs because certain details get integrated and lose their individual identity.

Principles

Subsumption theory is based on the following basic principles:

(1) The most general ideas of subject should be presented first, and then, progressively differentiated in terms of detail and specificity.

(2) Instructional materials should attempt to integrate new material with previously presented information through comparison and cross-referencing of new and old ideas.
Implications

Ausubel clearly indicates that his theory applies only to reception (expository) learning in school settings. He distinguishes 'reception learning' from 'rote and discovery learning'; the former because it doesn't involve subsumption (i.e., meaningful materials) and the latter because the learner must discover information through problem-solving. A large number of studies have been conducted on the effects of 'advance organisers' in learning (Ausubel et al., 1978).

(52) Symbol Systems (Salomon, G.)

Description

The ‘Symbol Systems Theory’ developed by Salomon is intended to explain the effects of ‘media on learning’. Salomon (1977: 226-227) states: “To summarise, the symbol systems of media affect the acquisition of knowledge in a number of ways. First, they highlight different aspects of content. Second, they vary with respect to ease of recording. Third, specific coding elements can save the learner from difficult mental elaborations by overtly supplanting or short-circuiting specific elaboration. Fourth, symbol systems differ with respect to how much processing they demand or allow. Fifth, symbol systems differ with respect to the kinds of mental processes they call on for recoding and elaboration. Thus, symbol systems partly determine who will acquire how much knowledge from what kinds of messages.”
Principles

The symbol systems theory is based on the following basic principles:
(1) The symbolic coding elements of particular media require different mental transformations, and hence, affect the mastery of specific skills.
(2) The level of knowledge and skill that an individual possesses will affect the impact of specific media sequences.
(3) The nature of the ‘learning/information processing’ tasks can affect the impact of specific, media sequences.
(4) The social context of media presentations can influence what message is perceived.
(5) There is a reciprocal relationship between ‘media and learner’; each can influence the other.

Implications

Salomon’s theory is supported primarily by research conducted with film and television (especially “Sesame Street”). More recent work has extended the framework to computers (e.g., Salomon et al., 1991).

(53) Triarchic Theory of Intelligence (Sternberg, R.)

Description

The ‘Triarchic Theory of Intelligence’ presented by Sternberg (1977) consists of three sub-theories: (i) the ‘componential sub-theory’ which outlines the structures and mechanisms that underlie intelligent behaviour categorised as metacognitive, performance, or knowledge acquisition components, (ii) the ‘experiential sub-theory’ that proposes intelligent behaviour be interpreted along a continuum of experience from novel to
highly familiar tasks/situations, (iii) the ‘contextual sub-theory’ which specifies that intelligent behaviour is defined by the sociocultural context in which it takes place and involves adaptation to the environment, selection of better environments, and shaping of the present environment.

**Principles**

The ‘Triarchic Theory of Intelligence’ is based on the following basic principles:

1. Training of intellectual performance must be socioculturally relevant to the individual.
2. A training programme should provide links between the ‘training and real-world behaviour.’
3. A training programme should provide explicit instruction in strategies for coping with novel tasks/situations.
4. A training programme should provide explicit instruction in both ‘executive and non-executive information processing and interactions’ between the two.
5. Training programmes should actively encourage individuals to manifest their differences in ‘strategies and styles.’

**Implications**

The ‘Triarchic Theory’ is a general theory of human intelligence. Much of Sternberg’s early research focused on analogies and syllogistic reasoning. Sternberg has used the theory to explain ‘exceptional intelligence’ (gifted and retardation) in children, and also to critique existing intelligence tests. Sternberg (1983) outlines the implications of the theory for skill training. Later work examines topics such as learning styles (Sternberg, 1997) and creativity (Sternberg, 1999).
### Table – 2.1(a): Learning Theories (Summary Table)

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Behavioural</th>
<th>Information Processing</th>
<th>Constructivist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background</strong></td>
<td>• Early 20th century&lt;br&gt;• B.F. Skinner—his ideas on Operant Conditioning largely contributed this perspective&lt;br&gt;• Development as a reaction to the study of mental phenomena</td>
<td>• Mid 20th century&lt;br&gt;• George Miller—Provided two ideas that are fundamental to this perspective: 1. Short-term memory can only hold 5-9 chunks of meaningful information. 2. The human mind function like a computer—taking in information, processes it, stores and locates it and generates responses to it.&lt;br&gt;• Developed as a reaction to behaviourism.</td>
<td>• Later 20th century (although ideas of constructivism have existed prior to the 20th century—Dewey, Piaget, Bruner &amp; Vygotsky)&lt;br&gt;• Represents a collection of theories including generative learning, discovery learning and situated learning.&lt;br&gt;• Ideas of constructivism come from cognitive psychology, developmental psychology and anthropology.</td>
</tr>
<tr>
<td><strong>Definition</strong></td>
<td>• Learning occurs when new behaviours or changes in behaviours are acquired as the result of an individual’s response to stimuli.</td>
<td>• Learning is a change in knowledge stored in memory.</td>
<td>• Learning is the process where individuals construct new ideas or concepts based on prior knowledge and or experience.</td>
</tr>
<tr>
<td><strong>Principles</strong></td>
<td>• The influence of the external environment contributes to the shaping of the individual’s behaviour.&lt;br&gt;• The environment presents an antecedent that prompts a behaviour&lt;br&gt;• Whether the behaviour occurs again is dependent on the consequence that follows it.</td>
<td>• Governed by internal process rather than by external circumstances (behaviourism).&lt;br&gt;• Process of selecting information (Attention), translating information (Encoding), and recalling that information when appropriate (Retrieval).</td>
<td>• Individuals construct knowledge by working to solve realistic problems, usually in collaboration with others.&lt;br&gt;• Learning as a change meaning constructed from experience.&lt;br&gt;• Individual interpretation of experience vs. Objective representation (information processing perspective).</td>
</tr>
<tr>
<td><strong>Applications for Instruction</strong></td>
<td>(1) State objectives and break them down into steps.&lt;br&gt;(2) Provide hints or cues that guide learners or desired behaviour.&lt;br&gt;(3) Use consequences to reinforce the desired behaviour.</td>
<td>(1) Organize new information.&lt;br&gt;(2) Link new information to existing knowledge&lt;br&gt;(3) Use techniques to guide and support ‘learners’ attention, Encoding and Retrieval processes.</td>
<td>(1) Pose “good” problems—realistically complex and personally meaningful.&lt;br&gt;(2) Create group learning activities.&lt;br&gt;(3) Model and guide the knowledge construction process.</td>
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</table>

Source: [http://funderstanding.com/aboutlearning.cfm](http://funderstanding.com/aboutlearning.cfm)
Table-2.1(b): Learning Theories and Instructional Strategies Matrix (Summary Table)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Behaviourism</th>
<th>Cognitivism</th>
<th>Constructivism</th>
</tr>
</thead>
</table>
| Representation of the Learning Process | • Stimulus-Response  
• Reinforced Behaviour  
• Antecedent Behaviour  
• Sequenced knowledge and skills presented in logical limited steps | • Cognitivist Learning Perspective  
• Information Processing  
• Schema  
• Mental Models | • Inquiry - based  
• Discovery learning |
| Relevant Frameworks                | • Programmed instruction (logical presentation of content, overt responses, immediate knowledge of correctness) | • Events of Instruction (Conditions of Learning) | • Cognitive Apprenticeship  
• Cognitive Flexibility  
• Situated Learning  
• Zone of Proximal Development |
| Key Principles                     | • Learning happens when a correct response is demonstrated following the presentation of a specific environmental stimulus.  
• Emphasis is on observable and measurable behaviours | • Learning is a change of knowledge state.  
• Knowledge acquisition is described as a mental activity that entails internal coding and structuring by the learner.  
• Learner is viewed as an active participant in the learning process  
• Emphasis is on the building blocks of knowledge (e.g. identifying prerequisite relationships of content).  
• Emphasis on structuring, organizing and sequencing information to facilitate optimal processing | • Learners build personal interpretation of the world based on experiences and interactions.  
• Knowledge is embedded in the context in which it is used (authentic tasks in meaningful realistic settings).  
• Create novel and 'situation-specific' understandings by "assembling" knowledge from diverse sources appropriate to the problem at hand (flexible use of knowledge) |
| Goal of instruction                | • Communicate or transfer behaviours representing knowledge ans skills to the learner (does not consider mental processing).  
• Instruction is to elicit the desired response from the learner who is presented with a target stimulus.  
• Learner must know how to execute the proper response as well as the conditions under which the responses is made. | • Communicate or transfer knowledge in the most efficient, effective manner (mind-independent, can be mapped onto learners).  
• Focus of instruction is to create learning or change by encouraging the learner to use appropriate learning strategies.  
• Learning results when information is stored in memory in an organized, meaningful way. | • Build personal interpretations of the world based on individual experiences and interactions (constantly open to change, cannot achieve a predetermined, "correct" meaning, knowledge emerges in relevant contexts).  
• Learning is an active process of constructing rather than acquiring knowledge.  
• Instructions is a process of supporting knowledge construction rather than communicating knowledge. |
### Table 2.1(b) (Contd.)

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<thead>
<tr>
<th>Parameter</th>
<th>Behaviourism</th>
<th>Cognitivism</th>
<th>Constructivism</th>
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</thead>
<tbody>
<tr>
<td><strong>Instructional/Learning Strategies</strong></td>
<td></td>
<td><strong>Information Processing Model</strong></td>
<td></td>
</tr>
<tr>
<td>Behaviourism</td>
<td>• Instruction utilizes consequences and reinforcement of learned behaviours.</td>
<td>• Teachers/designers are responsible for assisting learners in organizing information in an optimal way so that it can be readily assimilated.</td>
<td>• Do not structure learning for the task, but engage learners in the actual use of the tools in real world situations.</td>
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<tr>
<td></td>
<td>• Instructional cues to elicit correct response</td>
<td>• Explanations</td>
<td>• Modeling</td>
</tr>
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<td></td>
<td>• Practice paired with target stimuli</td>
<td>• Demonstrations</td>
<td>• Collaborative Learning</td>
</tr>
<tr>
<td></td>
<td>• Reinforcement for correct responses</td>
<td>• Illustrative examples</td>
<td>• Coaching</td>
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<tr>
<td></td>
<td>• Building fluency (get responses closer and closer to correct response)</td>
<td><strong>Gestalt Theory</strong></td>
<td>• Scaffold</td>
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<tr>
<td></td>
<td>• Multiple opportunities / trials (Drill and practice)</td>
<td>• Matched non examples</td>
<td>• Fading</td>
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<tr>
<td></td>
<td>• Discrimination (recalling facts)</td>
<td>• Corrective feedback</td>
<td><strong>Problem-Based Learning</strong></td>
</tr>
<tr>
<td></td>
<td>• Generalization (defining and illustrating concepts)</td>
<td>• Outlining</td>
<td>• Authentic Learning</td>
</tr>
<tr>
<td></td>
<td>• Associations (applying explanations)</td>
<td>• Repetition</td>
<td>• REALs</td>
</tr>
<tr>
<td></td>
<td>• Chaining (automatically performing a specified procedure)</td>
<td>• Concept Mapping</td>
<td>• Anchored Instruction</td>
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<td></td>
<td></td>
<td>• Advanced Organizers</td>
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<td></td>
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<td>• Analogies</td>
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<td>• Summaries</td>
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<tr>
<td>Theorists</td>
<td>• Skinner</td>
<td>• Keller’s ARCS Model of Motivation</td>
<td>• Vygotsky</td>
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<td></td>
<td>• Bandura</td>
<td>• Interactivity</td>
<td>• Lave &amp; Wenger</td>
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<td></td>
<td>• Thorndike</td>
<td>• Synthesis</td>
<td>• Piaget</td>
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<td></td>
<td>• Pavlov</td>
<td>• Scheme Theory</td>
<td>• Bransford, Hasselbring, etc. (CTGV)</td>
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<td></td>
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<td>• Metaphor</td>
<td>• Grabinger</td>
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<td>• Generative Learning</td>
<td>• Spiro and Colleagues</td>
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<td>• Organisational strategies</td>
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<td>• Elaboration Theory</td>
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<td>• Links to prior knowledge</td>
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</table>

CONCLUSION

A theory helps make sense of the observable world by ordering relationships among observed elements (Klimoski, 1991). A theory specifies relationships among constructs (i.e., unobservable units) and variables (i.e., observable units) in the empirical world (Bacharach, 1989; Heneman, 1969). The two primary criteria upon which any theory may be evaluated are its falsibility and utility (Bacharach, 1989). ‘Falsibility’ allows empirical refutation; ‘utility’ refers to the ability of a theory to explain the substantive meaning of constructs, variables, and their linkages, while prediction empirically tests the explanation of that meaning (Bacharach, 1989).

Researchers have specified the components that a good theory needs to include. First, it should provide a delineation of major constructs and independent and dependent variables (Thompson, 1991). Second, it should define major relationships among the variables, which can generate hypotheses that can be tested (Wallace, 1983, Heneman, 1969). Third, a good theory should be generalisable, have clear implications for practice, and should direct future research (Miner, 1984). Fourth, it should be parsimonious and provide the simplest explanation to account for the phenomena observed (Landy & Vasey, 1984). Fifth, a good theory should be value added and contribute to what is currently known (Whetten, 1989).

An additional consideration is a theory’s scope. Attempts at grand or very broad theory development in HRM have resulted in theories stated at high levels of abstraction at which it has not been possible to deduce hypotheses that could be tested (Meltz, 1991). An alternative to theories that are so general that they provide little predictive accuracy and are cannot be
tested are "middle range theories" (Bobko & Russell, 1991). Middle range theories are concerned with one or a few phenomena, tend to be a link to each other, and are concrete enough to generate testable hypotheses which can be tested (Moore, et al, 1980, 1-2).

Finally, researchers have emphasised that value orientation is a significant influence in perceptions of what constitutes a good theory (Klimoski, 1991; Boehm, 1980; Dubin, 1976). The separation that often exists between the science and practice of HRM contributes to different perceptions held by HRM scholars and practitioners. Whereas the objective of HRM practice is to devise rules and models for administering organisations, the objective of the science of HRM is to describe and predict phenomena at a very general level (Tullar, 1991). 'Academic research, and theories behind the research, is often viewed by HRM practitioners as being inapplicable to the real world or organisational environment' (Klimoski, 1991). This is understandable since the tendency of scientific research, based on the traditional model, is controlled observation which often results in research that does not fit the real world of the practitioner (Boehm, 1980).

A description of the characteristics of good theories for HRM needs to include the components discussed above as well as take into account the applied nature of the field. The applied nature of HRM signifies the crucial importance of HRM research in organisations. It also suggests that productive research is dependent on cooperation between science and practice of HRM. HRM academicians need to be able and also willing to incorporate their research into organisations (Boehm, 1980), and practitioners need to expand their perception and definition of research to include the systematic examination of organisational problems, and thereby view it as a process from which they can benefit.
It is essential to examine the distinction between the science and the practice of HRM. The underlying issue is that the science and practice of HRM can be brought closer together, in an effort to effectively integrate theory, research, and practice. Some optimism for this effort comes from recent work on theory building. Wright & McMahon (1992) suggested that theory is important whether one's orientation is toward research or practice. In fact, Bacharach (1989) recently discussed the similarity of interest between researchers and practitioners in the development of good theory. He suggested that consultants serve to clarify and reduce the ambiguity of the world for clients. As good theory intends to diminish the complexity of the world through prediction and explanation, sound theoretical development should benefit both researchers and practitioners. ‘Theorising’ and ‘practising’ – is not a pair of antonyms, but parallel and separate activities in which one engages. At times, the focus is more on one than the other; other times, one is highly engaged in both; yet other times, perhaps, neither activity is pronounced.

In summary, 53 learning theories presented in this chapter addressed various complexities associated with the process of ‘theorising’ learning. By and large, these learning theories focused on the concepts, principles and process of ‘individual learning’ encompassing general learning, psychology of learning, adult learning, language learning, learning culture and environment as a precondition for effective learning, learning context, learning styles and preferences, and learning outcomes. Learning theories, individually and collectively, provide an integrated and a holistic context for promoting individual, team and organisational learning on the one hand, and the meaningful application of learning at all levels for enhancing organisational effectiveness on the other.
References


152


155


**Website:**
(http://tip.psychology.org/index.html)