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Introduction

This course, *Theories of Learning and Teaching*, is part of the English program in the canvas adopted for the Masters Degree syllabus. It introduces five major currents that deal with learning/teaching theorizing:

1) Behaviorism
2) Cognitivism
3) Constructivism (both cognitive and social constructivism)
4) Social Learning
5) Multiple Intelligences

In what follows, students will be presented with theoretical backgrounds preceding the emergence of each of the currents, along with the prominent scholars who brought breakthroughs in the schools and currents they belonged to. Moreover, any possible differences among theorists sharing the same current will be tackled in ways to sweep any confusion that might result from the profusion of concepts pertaining to learning and teaching.

As seen in 1 through 5 above, a historical perspective is adopted in order to streamline the emergence of every current; this order is likely to map the different schools and currents on a timeline, easily graspable by students. It also shows how research has been wrestling with learning and teaching over a fairly long period of time before managing to come up with theories that seem at times to conflict, converge, or diverge. Although tackling the same object of research, these schools and currents concurrently supply the students with the knowledge that learning, being closely linked to humans, is so complex that no theory could be exclusively singled out as the best. The notion of the relative value of each theory is supposed to insert into the students' minds the idea that research in learning and teaching theories is an endless enterprise.

This course is made up of three parts. Part One deals with behaviorism; Part Two contains, as an introductory view, cognitivism by way of introducing Constructivism. As to Part Three, two chapters are inserted therein, Social

Learning and Multiple Intelligences. Social Learning, championed by Albert Bandura, comes right after Social Constructivism. This is to allow students smoothly move from Vygotsky's theory to Bandura's, to hopefully come out with a view that both theories could be complementary. Another objective, relative to Bandura's theory, is to recall once again Behaviorism in Bandura's scientific and research background. This would have a usefully informative looping effect where students will see in Bandura's theory a slight development of Behaviorism and cognitivism, as it draws as well on cognition in learning.

The last section in part will be devoted to Howard Gardner's Multiple Intelligences. Here the focus will be on the potential benefit of drawing on the innate capacities individuals are born with. Individual intelligences are useful means through which educators could help students exploit their potential inborn intelligences to learn better. This sheds light on aligning the teaching methods along the peculiarities of the learners' intelligence-oriented preferences. Gardner lines up nine types of intelligences, each of which is suitable for specific types of contents.

Preliminary Definitions

Lecture N° One

I. The Concept of Learning

Learning outcome: To grasp the meaning made of the concept of learning that the public at large entertain as well as the one that the different educational psychologists put forth within their respective theories.

Here are some definitions of what learning is; select which one(s) seem(s) closer to what you personally believe is appropriate, then share with the class the arguments that encourage you to make this selection.

- I think that learning is acquiring any skill that enriches your life. It doesn't have to be taught out of a book or by a teacher, rather you may acquire it through your own exploration, through sharing or by in struction from an one, not necessarily a "teacher"
- The acquisition of new responses to various stimuli.
- Learning is the accumulation of experinces and the consequential growth and new understanding of the world around us.
- Learning is the individual growth of a person as a result of cooperative interaction with others. It is the advancement of understanding that enables the learner to function better in their environment, improve and adapt behavior, create and maintain healthy relationships, and achieve personal success.
- Learning is the expression of what one may already know or perceive. It is the accumulation of knowledge but more importantly the application of this knowledge. If one cannot use newly acquired information for his/her own practical use or benefit, then it is doubtful that he/she is engaged in the learning process.
- Learning is a change in behavior.

- Learning is a process. It is not static. A person never stops acquiring new information. It keeps a person's mind active and aware but also conscious to the world around them.
- Learning is a lifelong process of gaining and using information presented to us. The ability to learn is endless, as long as the desire is present. Learning is only successful when the information gained is used and understood.
- Learning is the accruing of knowledge that collectively drives behavior development and external interaction.
- Learning is reflection upon experience. It is making connections and finding patterns. It is the consequences of being involved in some valued activity in a culture, and as such it is a byproduct of participation in cultural activity, not the direct product of some study of facts about the world. So I always think in terms of activities in which the participant will value the use of language, and in which literacy abilities will increase as a consequence of being involved in the activity. We have traditions of learning, one of which is called school. But the main consequence of school activities is learning.

Observation

You have certainly been at a loss how to make the most appropriate selection among these ten definitions. Your indecision is due to the fact that you felt that all ten definitions contain a part of what learning is. This is because each one reflects one, two or more schools of educational psychology. In the following section, you will be able to review some or many of these definitions as they are adopted by the different theories of learning and teaching. To begin with, Behaviorism as a school of psychology, will be represented by three psychologists, namely Pavlov, Thorndike, and Skinner.

Lecture N° Two

I.1 What is the concept of learning?

It is a permanent change in behavior as a result of experience. That's why learning should not be equated to rote memorization. Why? Because from birth and throughout our lifespan, we do not only learn by heart **facts** and **competence** in skilled activities; we learn more than that: we learn **attitudes**, **ideals**, **mannerisms**, **prejudices**, **roles** and **social skills**.

1) **What is imprinting**?

A behavior-pattern which has been **built-in from birth** or is innately programmed is said to have been **imprinted**.

Example: the use of the eyes for seeing and following moving objects being imprinted, a child goes through a **critical period** before being able to develop a liking to them, mainly if they are colorful. After this critical period comes learning. The act of seeing and following moving objects has been programmed. The act of developing a liking for them is learned. The critical period for a child kept in darkness for a long time would be longer than that of another one who has not experienced the same dark isolation.

Observation

You have noticed that, while learning is defined as a change in behavior covering not only memorization of facts and competences but also attitudes, ideals, mannerisms, prejudices, roles and social skills, imprinting is an innately programmed behavior.

PART ONE

I.1.1 Behaviorism

Learning Outcome:

By the end of this chapter, students will be able to:

- Explain how behaviors are learned according to connectionism theory.
- Discuss some of Pavlov, Skinner and Thorndike's contributions to educational practice.
- Explain how responses become conditioned, extinguished, and generalized, according to classical conditioning theory.
- Describe a process whereby an emotional response might become conditioned to an initially neutral object.
- Explain, using contiguous conditioning principles, how movements are combined to become an act.
- Describe Skinner's three-term contingency model of operant conditioning, and provide examples.
- Define and exemplify key operant conditioning concepts: positive and negative reinforcement, punishment, generalization, discrimination, shaping, and Premack Principle.
- Provide a brief overview of a behaviorist model of self-regulation.
- Explain some key educational applications of operant principles to education: behavioral objectives, learning time, mastery learning, programmed instruction, and contingency contracts.

Lecture N° Three

I.1.2 Historical overview

The term ‘behaviorism’ is attached to a trend of psychological schools that give precedence of behavior over mind, or cognitive processing, taking the former as its main subject of research and study in as far as it supplies evidence to formulate any theory of what learning is. Behaviorism views learning as a ‘cause and effect’ mechanism, in which external factors lead to a response. Over time, behaviorists believe this response becomes a learnt behavior. For example, when a student is rewarded for success in the classroom, behaviorist would say that this increases the likelihood that the behaviors leading to this success will be repeated, and they refer to this as learning. In this behaviorist approach, learning is said to occur when observable and permanent changes in behavior result from the influence of the external factors such as instruction and experience. The behaviorist approaches are much concerned with measurable and observable changes in behavior

At the beginning of the twentieth century, psychology was at its very first steps. There emerged two schools of thought that developed into becoming prominent: structuralism and functionalism. Both schools had to face challenges due to the epistemological and methodological lines that they were famous for. Structuralism used the introspection method, which placed it out of touch with important developments in science and did not incorporate Darwin’s work on adaptation and evolution. Functionalism’s focus, however, was so wide that it touched a large array of research directions.

This historical backdrop led to the emergence of Behaviorism as a leading school in psychology with the fore-grounded scientific name of John B. Watson (1878–1958). This psychologist, considered as the founder of behaviorism, reacted against the then research methods in psychology, labeling them as unscientific. He believed that, in order for psychology to be scientific,

it needed to align itself along the same research methods of physical sciences, which limits its field of research within observable and measurable phenomena. For Watson, the corresponding measurable and observable phenomenon in psychology is behavior, seen as the proper material for psychologists to study. This defining statement of what psychology needs to be was a way to stress that introspection and conscious experience were unreliable bases because they were neither observable nor measurable.

Watson thought that Pavlov's conditioning model was appropriate for building a science of human behavior. For him, Pavlov's precise measurement of observable behaviors brought psychology very close to scientific methods; he then contended that Pavlov's model could be extended to account for diverse forms of learning and personality characteristics. He observed, for example, that newborn babies are capable of displaying three emotions: ***love***, ***fear***, and ***rage***. Through Pavlovian conditioning, these emotions could become attached to stimuli to produce a complex adult life. Watson expressed his belief in the power of conditioning in this famous pronouncement:

> *Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—a doctor, lawyer, artist, merchant-chief and, yes, even into beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors. (Watson, p. 10)*[1]

Although Watson's research has little relevance for academic learning, his views had a steady influence on the subsequent development of behaviorism during the period between 1920 until the early 1960s. His emphasis on the importance of the environment became solid grounds for behaviorism to highlight external inputs (environment) in developing the behaviorist learning/teaching theories.

[1] *What The Nursery Has To Say About Instincts.* In C. Murchinson (Ed.) *Psychologies of 1925*, Worcester, MA: Clark University Press, 1926.

The distinctive feature of Behaviorism is generally linked to its conditioning theories that it put forth. Again, conditioning is closely related to the effect the environment in terms of the events it provides for learning or behavior change and adaptation. Although Behaviorism does not deny the existence of the inner working of the mind, yet it considers it as irrelevant to explaining what learning is like.

The best-known *conditioning theory* is B. F. Skinner's *operant conditioning*. Before discussing this theory, some historical work in the conditioning tradition is presented to set the backdrop for Skinner's work; specifically, Thorndike's connectionism, Pavlov's classical conditioning.

Lecture N° Four

I.1.3 Psychological Behaviorism

Early in the 20th century, James Watson wove together three 19th-century ideas –

- Darwin's evolutionary theory emphasizing the physical as well as psychological continuity between animals and humans,
- Wundt's experimental method in psychology, and
- James's functionalist psychology – into both a method and theoretical overview for animal and human psychology.

In **1913**, he published '*Psychology as the behaviorist views it*,' which contained a number of distinct but related doctrines, three of which are of particular interest for the student of language:

(1) The rejection of introspection as an experimental method,

(2) The shunning of internal events, and

(3) The emphasis on learning.

The rejection of introspection as an experimental method

In the late 19th century, Wundt convinced psychologists that scientific work in their discipline must be experimental and quantitative, but like all 19th-century psychologists, he continued to work on psychology's traditional object – consciousness – and to access it by the traditional route of introspection. Watson, trained as an animal experimenter, argued that consciousness and introspection were not a proper basis upon which to establish an experimental scientific psychology. According to Watson, experimentation in psychology begins and ends with observable behavior.

The shunning of internal events

If all internal events are characterized by the fact that they are conscious and accessible only through introspection, then Watson's rejection of conscious experience as the object of psychology amounts to a rejection of all internal events from the scope of psychology.

Emphasis on Learning

Watson turned to the work of the Russian physiologist Ivan Pavlov (1927), who had just won the Nobel Prize in medicine for his work on a type of learning called **classical conditioning**. Since so many of human behavioral dispositions are not innate, Watson hoped that classical conditioning would offer a means to account for what is typically human in human psychology.

Lecture N° Five

I.1.4 Pavlov's Contribution to the Theories of Learning and Teaching

In this lecture, a theory of learning of one the representatives of behaviorism will be presented.

Classical Conditioning

While Watson was developing his pioneering ideas of behaviorism, there was another scientist, Ivan Pavlov (1849—1936), who carried out experiments on dogs in the Russian Experimental Institute of Medicine. Pavlov was a physiologist working on strictly physiological topics; his theories on behaviorism were incidental but were extended to human behavior

Pavlov's first formalizing statement of his learning theory is commonly known as classical conditioning. During the experiments that he carried out in the Institute of Experimental Medicine, Pavlov noticed that the dogs (experimental guinea pigs) salivated just at the sight of food, served at fixed times. He also noticed that this salivation was caused even by the sound of the worker's footsteps. This observation led Pavlov to conclude that the worker, serving the food to the dogs, became associated with the primary cause of salivation.

Basic Processes

Based upon the observations presented above, Pavlov attempted a structured image of the phenomenon. He labeled food (meat in this case) ***unconditioned stimulus*** (hence **US**) that elicits an ***unconditioned response*** (hence **UR**). The experiments that followed were focused on how the US could be manipulatively used by the experimenter in order to condition the dog at will. To do so, he repeatedly associated neutral stimuli with the US (ex: a timer that ticks prior to food being served); the timer did not cause any salivation during the first steps of the experiment, but over some trials, the dog started salivating. The conclusion that Pavlov reached was that the dog started to be conditioned to the timer because it stood (symbolically announced food) for food. The timer then became a ***conditioned stimulus*** (**CS**) that produced a ***conditioned response***, which was similar to the original **UCR**. However, Pavlov realized that extending the use of the makeshift **CS** resulted in the latter losing its effect. This phenomenon is called **extinction**.

Out of this experiment, three concepts[2] (D. H. Schunk, P.79) were adopted to characterize some phenomena accompanying the move from US—UR to CS—CR couples:

- ***Spontaneous recovery*** occurs after a time lapse in which the **CS** is not presented and the **CR** presumably extinguishes. If the **CS** then is presented and the **CR** returns, we say that the **CR** spontaneously recovered from extinction. A **CR** that recovers will not endure unless the **CS** is presented again. Pairings of the **CS** with the **UCS** restore the **CR** to full strength. The fact that **CS**–**CR** pairings can be instated without great difficulty suggests that extinction does not involve unlearning of the associations.
- ***Generalization*** means that the **CR** occurs to stimuli similar to the **CS**. Once a dog is conditioned to salivate in response to a metronome ticking at 70 beats per minute, it also may salivate in response to a metronome ticking faster or slower, as well as to ticking clocks or timers. The more dissimilar the new stimulus is to the **CS** or the fewer elements that they share, the less generalization occurs.
- ***Discrimination*** is the complementary process that occurs when the dog learns to respond to the **CS** but not to other, similar stimuli. To train discrimination, an experimenter might pair the **CS** with the **UCS** and also present other, similar stimuli without the **UCS**. If the **CS** is a metronome ticking at 70 beats per minute, it is presented with the **UCS**, whereas other cadences (e.g., 50 and 90 beats per minute) are presented but not paired with the **UCS**.

Higher-Order Conditioning

Once a stimulus becomes conditioned, it can function as a **UCS** and ***higher-order conditioning*** can occur. If a dog has been conditioned to salivate at the sound of a timer ticking at 70 beats per minute, the ticking metronome

[2] *Learning Theories, An Educational Perspective*, by Dale H. Schunk,the University of North Carolina, USA, Sixth Edition, 2012.

can function as a **UCS** for higher-order conditioning. A new neutral stimulus (such as a buzzer) can be sounded for a few seconds, followed by the ticking timer. If, after a few trials, the dog begins to salivate at the sound of the buzzer, the buzzer has become a second- order **CS**. Conditioning of the third order involves the second-order **CS** serving as the **UCS** and a new neutral stimulus being paired with it. Pavlov (1927) **reported that conditioning beyond the third order is difficult. CSs** capable of producing **CRs** are called *primary signals.*

Implications on Human Behavior

Unlike animals, people have the capacity for speech, which greatly expands the potential for conditioning. Language constitutes the ***second signal system***. Words or thoughts are labels denoting events or objects and can become **CSs**. Thus, thinking about a test or listening to the teacher discuss a forthcoming test may cause anxiety. It is not the test that makes students anxious but rather words or thoughts about the test, that is, its linguistic representation or meaning.

Biological Influences

Pavlov believed that any perceived stimulus can be conditioned to any response that can be made. Subsequent research has shown that the generality of conditioning is limited. Within any species, responses can be conditioned to some stimuli but not to others. Conditioning depends on the compatibility of the stimulus and response with species-specific reactions (Hollis, 1997). All organisms inherently possess the basic behavioral patterns that enable them to survive in their niches, but learning provides the fine-tuning necessary for successful adaptation (Garcia & Garcia y Robertson)[3] , 1985, p. 197).

[3] *Evolution of learning mechanisms.* By Garcia, J., & Garcia y Robertson, R. (In B. L. Hammonds (Ed.), *Psychologyand learning: Master lecture series* (Vol. 4, pp. 191–243). Washington, DC: American Psychological Association. 1985.

Habit Formation and Change

Habits are learned dispositions to repeat past responses. Being formed through repetition, these habits are established as behaviors. In an educational setting, teachers could link these habits/behaviors to cues closely related to the immediate environment of school. For example, the idea of "showing respect and tolerance to others" is to be provided with the school context, in the classroom, the laboratory, the material to be handled by students during instruction, the cafeteria, the playground. It is through this school medium that students will apply "respect and tolerance" with others. Their behaviors will be ready to observation and measurement.

Applying this procedure to EFL classes needs only substituting the language that needs to be learned for the "idea", taken as an example above, i.e. [showing respect and tolerance to others]. The key to changing a habit in, say, pronouncing, the /p/ sound consists in framing this habit change within a three-phase method. According to Guthrie[4], three phases could establish this habit change (1) **threshold**, (2) **fatigue**, and (3) **incompatible response**, which could profitably be made use of to establish language use habits, change or reinforce them. Although Guthrie's contribution does not include cognitive processes and thus is not considered to be a viable learning theory today, an attempt to make use of it in order to change undesired habits into desired ones seems profitable. Nonetheless, its emphasis on contiguity is timely because current theories stress contiguity. Guthrie's ideas about changing habits also are thought provoking and provide good general guidance for anyone wishing to develop better habits.

In the *threshold* method, the cue (stimulus) for the habit to be changed (the undesired response) is introduced at such a weak level that it does not elicit the response; it is below the threshold level of the response. Gradually the stimulus is introduced at greater intensity until it is presented at full strength. Were the stimulus introduced at its greatest intensity, the response would be the behavior that is to be changed (the habit). For example, a learner may react

[4] *A new look at habits and the habit-goal interface*, by Wood, W., & Neal, D. T. in *Psychological Review, 114*, 843–863. 2007

to the sound /p/ by producing a /b/ sound, due to the phonological system he's been reared in. To alter this habit, teachers could gradually introduce the sound /p/ individually or within words that the learner's ear gets accustomed to until the sound becomes discrete and readily distinguishable. Over time, the chances to pronounce it correctly will increase.

In the *fatigue* method, the cue for engaging in the behavior is transformed into a cue for avoiding it. Here the stimulus is introduced at full strength and the individual performs the undesired response until he or she becomes exhausted. The stimulus becomes a cue for not performing the response. For example, to alter a learner's behavior of repeatedly mispronouncing the sound /p/, teachers might present the learner with diverse examples containing both sounds, that is, /p/ and /b/, and make the learner pronounce the examples until it is no longer fun (some limits are needed!).

In the *incompatible response* method, the cue for the undesired behavior is paired with a response incompatible with the undesired response; that is, the two responses cannot be performed simultaneously. The response to be paired with the cue must be more attractive to the individual than the undesired response. The stimulus becomes a cue for performing the alternate response. For example, to stop mispronouncing the sound /p/, teachers could rely on mnemonics that graphically represent the desired pronunciation. Over time, seeing the mnemonics becomes a cue for correctly pronouncing the sound /p/.

According to Guthrie, punishment is ineffective in altering habits. Punishment following a response cannot affect the stimulus–response association. Punishment given while a behavior is being performed may disrupt or suppress the habit but not change it. Punishment does not establish an alternate response to the stimulus. The threat of punishment even can prove to be exciting and bolster the habit. It is better to alter negative habits by replacing them with desirable ones (i.e., incompatible responses).

Lecture N° Six

I.1.5 Summarized Illustration of Pavlov's Experiment

A hungry dog normally secretes saliva at the sight and taste of food such as meat. In this straightforward situation, the food is called an **Unconditioned Stimulus (US)** and the salivation is an **Unconditioned Response (UR)**. Perform some distinctive actions such as:

a) Ringing a bell or switching on a bright light when the dog is next given food and it will again secrete saliva.
b) Repeat this procedure on a number of occasions.
c) Later, either ring the bell or switch on the bright light **but** do not give food to the dog: it will continue to respond by secreting saliva.

From this experiment, one concludes that the bell or the light is now a **Conditioned Stimulus** and the salivation by the dog a **Conditioned Response**

A whole school of psychology could not have been constructed from the result of one relatively simple experiment with limited implications for human behavior. By what is known as **higher order conditioning**, the whole process is capable of being extended. This is illustrated by:

a) Show some arbitrary stimulus such as a large black square to the dog and it is unlikely to respond to it and it certainly will not produce saliva.
b) Next, present the black square without food **but** ring the bell and the dog will respond by secreting saliva.
c) Then finally present the square **alone** without either food or ringing the bell, and the dog will continue to secrete saliva.

As a result of this process, the dog has now become conditioned not only to the sound of the bell but also to the sight of the large black square.

If one takes the experiment too far beyond the original stimulus in too many steps, conditioning will be inefficient.

Activities around Pavlov's Classical Conditioning

The **Higher Order Conditioning** (the second experiment) contains a principle that underlies other phenomena observed not only in animals but in children and adults as well: an organism can be conditioned to respond to stimuli which are similar in character, and this is termed "stimulus generalization": a baby severely frightened by a cat suddenly jumping on the pram coverlet could easily develop a fear not only of small animals but also of their inanimate counterparts.

Question: Given the data so far gathered, is Pavlov's contribution to educational thought and learning theory too limited to be of value to the practicing teacher?...WHAT DOES IT MISS?

Food for thought and comment:

If memorization is important, so is emotional growth and personal development because all three are inextricably interlocked.

Alternative to Pavlov's theory:

Freud, Piaget and Hebb adopt an **integrative** approach to the study of children, including **physical**, **intellectual** and **emotional** development both in individual cases and in membership of a group in a social environment. How different is this from Pavlov's theory?

Activity: Say whether the following statements are "true" or "false".

a) Pavlov stresses learning as an association by contiguity.
b) Pavlov reveals something of the physiological basis of learning.
c) Pavlov explains concepts such as generalization and inhibition.

Activity: How true is the following?

a) Brainwashing is a form of conditioning to an idea, commonly of a political nature.
b) Advertising techniques, particularly those appealing to the emotions or an individual's status, are example of conditioning by repetition and suggestion. **Justify**

CHAPTER TWO

Lecture N° Seven

I.2 OPERANT CONDITIONING

I.2.1 Skinner's Contribution to Theories of Learning

A well-known behavioral theory is *operant conditioning*, formulated by B. F. Skinner (1904–1990). Beginning in the 1930s, Skinner published a series of papers reporting results of laboratory studies with animals in which he identified the various components of **operant conditioning**. He summarized much of this early work in his influential book, *The Behavior of Organisms*.

Skinner's ideas lent themselves to being applied to the field of education. The early interest of Skinner in education led him to envisage creating teaching machines and programmed instruction.

Early in his career, he became interested in education and developed teaching machines and programmed instruction. Pavlov's *Conditioned Reflexes* in 1972 and Watson's *Behaviorism* influenced him greatly and could be considered as the seminal seeds that triggered his interest to psychology. History will record him as one of the leading figures in the field of the psychology of learning.

Although his theory has been discredited by current learning theorists because it cannot adequately explain higher-order and complex forms of learning (Bargh & Ferguson)[5], his influence continues as **operant conditioning principles** are commonly applied to enhance student learning and behavior.

Scientific Assumptions.

[5] *Beyond behaviorism*: *On the automaticity of higher mental processes*, by Bargh, J. A., & Ferguson, M. J. In *Psychological Bulletin, 126*, 925–945. 2000.

Due to the nature of his basic training in physiology, Pavlov located learning within the network of the nervous system, and behavior was for him the product of neurological functioning. Skinner, however, believed that a psychology of behavior should be separated from any neurological consideration, although he did not deny a possible neurological basis to behavior.

Moreover, Skinner also objected to the too much importance given to the unseen, unobservable processes of learning that the cognitivists took into consideration while theorizing about what learning is. What the cognitivists label as internal working of the mind, Skinner set a condition in order to believe in it: no access is possible to this internal process, there must be a visible behavioral sign. As well as Skinner admitted the existence of certain links between the neurological network and the process of learning, he also did not deny the existence of attitudes, beliefs, desires.

In an article contributed to *American Psychologist*[6], *Skinner* wrote that people do not experience consciousness or emotions but rather their bodies and that internal reactions are responses to internal stimuli, which meant that both internal stimuli and internal responses are not observable, therefore not accessible to scientific investigation or study. He then gave the example of *pain*, i.e. an internal phenomenon, is not linguistically expressible in ways that show its entire dimensions.

Functional Analysis of Behavior.

In order to show the primacy of behavior over the 'mental, unobserved world', Skinner thought of a means to examine behavior through analyzing it functionally. Learning being conditioned, it is, for Skinner, the re-assortment of responses in a complex situation. The responses are signs of learning having taken place, and conditioning's role is to strengthen that learning through reinforcing it. Three terms that go together: condition, learning, and reinforcing.

[6] *Whatever happened to psychology as the science of behavior*? by B. F. Skinner. In *American Psychologist, 42*, 780–786. 1987

However, for Skinner, there are two types of conditioning:

1) Type S, introduced by Pavlov, and which is characterized by the pairing of the reinforcing stimulus (unconditioned) with another (conditioned) stimulus.
2) Type R, which is described by Skinner as a type of responses which are controlled by the consequences of their actions, not by the antecedent stimuli. Here Skinner emphasizes the "agency" of the response's consequences, and he termed this type OPERANT behavior, because it operates on the environment to produce an effect.

In his seminal work entitled *The Behavior of Organisms*[7], he wrote

If the occurrence of an operant is followed by presentation of a reinforcing stimulus, the strength is increased. . . . If the occurrence of an operant already strengthened through conditioning is not followed by the reinforcing stimulus, the strength is decreased. (p. 21)

One may liken operant behavior to learning through doing.

Basic Processes

This section examines the basic processes in operant conditioning: **reinforcement**, **extinction**, **primary** and **secondary reinforcers**, the **Premack Principle**, **punishment**, **schedules** of **reinforcement**, **generalization**, and **discrimination**.

Reinforcement.

Reinforcement is a means to strengthen the response and increase its rate of recurrence. The instrument through which this reinforcement is made possible is called reinforcer (or reinforcing stimulus). As indicated by the meaning imbedded in the very phrase 'reinforcing stimulus', a reinforcer could be any stimulus likely to strengthen the response in order for a desired change to take place. By way characterizing still more the nature of a reinforcer, Skinner, in his *Science and Human Behavior* (1953), wrote:

[7] *The behavior of organisms*. By B. F. Skinner, New York: Appleton-Century-Crofts. 1938

> *The only way to tell whether or not a given event is reinforcing to a given organism under given conditions is to make a direct test. We observe the frequency of a selected response, then make an event contingent upon it and observe any change in frequency. If there is a change, we classify the event as reinforcing to the organism under the existing conditions.* (pp. 72–73)

This is to highlight the fact that a reinforcer is defined by its change-oriented effect. Still more, Skinner's definition includes a variable relative to the effectiveness of a reinforcer being dependent on given circumstances. What is reinforcing to a particular student during a reading session may not be so during a mathematics session or even a reading session on a later occasion. Students find reinforcing such events as teacher praise, free time, privileges, stickers, and extra marks.

Positive reinforcement

This involves presenting a stimulus, or adding something to a situation, following a response, which increases the future likelihood of that response occurring in that situation. A *positive reinforcer* is a stimulus that, when presented following a response, increases the future likelihood of the response occurring in that situation. In the opening scenario, Leo uses points as positive reinforcers for good behavior.

Negative reinforcement

This involves removing a stimulus, or taking something away from a situation following a response, which increases the future likelihood that the response will occur in that situation. A *negative reinforcer* is a stimulus that, when removed by a response, increases the future likelihood of the response occurring in that situation. Some stimuli that often function as negative reinforcers are bright lights, loud noises, criticism, annoying people, and low grades, because behaviors that remove them tend to be reinforcing. Positive

and negative reinforcement have the same effect: They increase the likelihood that the response will be made in the future in the presence of the stimulus.

Extinction.

Non-reinforcement leads necessarily to a decrease of occurrence of the response. This decrease may incrementally add up to a total extinction of the response. Such cases happen in classes, when a student notices that, although he raises his hand for participation in the lesson, he is never given such an opportunity will certainly tend to decrease his participation.

The speed at which extinction takes place is dependent on the recurrence of the negative reinforcement or non-reinforcement to the response or only a little number of responses has previously been reinforced.

Primary and Secondary Reinforcers.

Reinforcement proceeds through the effect of two types of reinforcers: Primary and secondary reinforcers. In *Learning Theories* (1991), Dale H Schunk, exemplifying these reinforcers, writes:

> *Stimuli such as food, water, and shelter are called primary reinforcers because they are necessary for survival. Secondary reinforcers are stimuli that become conditioned through their association with primary reinforcers. A child's favorite milk glass becomes secondarily reinforcing through its association with milk (a primary reinforcer). A secondary reinforcer that becomes paired with more than one primary reinforcer is a generalized reinforcer. People work long hours to earn money (a generalized reinforcer), which they use to buy many reinforcers (e.g., food, housing, TVs, vacations).* (p.93)

Educational reinforcers may be teachers' praise, good marks, parents' approvals and/or money.

Selecting suitable reinforcers.

Another trend within behaviorism suggests useful ways and means to invest in reinforcers. In order to profitably exploit reinforcement for the learner's advancement, a principle, called the Premarck Principle, is put forth. This principle states that "*the opportunity to engage in a more valued activity reinforces engaging in a less valued activity, where "value" is defined in terms of the amount of responding or time spent on the activity in the absence of reinforcement*." (Dale H. Schunk, p.93) To support this principle, an example is thus supplied:

> "*Suppose that a child is allowed to choose between working on an art project, going to the media center, reading a book in the classroom, or working at the computer. Over the course of 10 such choices the child goes to the media center 6 times, works at the computer 3 times, works on an art project 1 time, and never reads a book in the classroom. For this child, the opportunity to go to the media center is valued the most. To apply the Premack Principle, a teacher might say to the child, "After you finish reading this book, you can go to the media center.*" (ibid, p. 93)

Punishment.

Based on the Premarck principle, it is likely that punishment will be unnecessary. In order for the teacher to reduce the likelihood of recurrence of a negative response (behavior), the teacher may suggest to the learner positive response (behavior), thus making the proposed behavior dependent on abandoning the negative one. If, on the other hand, the teacher regularly adopts punishment, he may reduce the future likelihood of responding to a stimulus on the part of the learner. Punishment represses a negative response (behavior) but does not eliminate it; once the threat of punishment is removed, the same negative response (behavior) re-emerges.

Scheduling Reinforcement.

Regular reinforcement refers to regular feed-back. When the teacher sets short, mid and long-term feed-back delivery for correct responses, he is likely to lead his learner to voluntarily drop the incorrect responses; they, consequently, chances that they will learn them will decrease. However, excessive positive reinforcement might lead the learners to be conditioned to it, because there are instances where they don't need reinforcement for every single correct response.

Generalization.

Skinner suggests the contagious effect of scheduled reinforcement (short, mid, and long-term reinforcement) that results in the learner generalizing a correct response's reinforcement to other similar responses. The learner will generalize the positive reinforcement over the other responses that share similitude with one another. The result of this generalization will have the effect of chain covering many similar responses.

An example here may illustrate the idea more:

> *Students with good academic habits typically come to class, attend to and participate in the activities, take notes, do the required reading, and keep up with the assignments. These component behaviors produce high achievement and grades. When such students begin a new class, it is not necessary that the content be similar to previous classes in which they have been enrolled. Rather, the component behaviors have received repeated reinforcement and thus are likely to generalize to the new setting.* (ibid, p. 97)

Through generalization, the learner will imperceptibly collaborate with the teacher to reach behavioral change.

Discrimination.

As stated above, scheduled reinforcement leads students to get rid of the threat of punishment and move ahead to benefit from previously reinforced good responses and then generalize over other similar responses. Likewise, non-reinforcement, (although generally not advised) may help when made use of to

set the incorrect responses in contrast with the correct responses. This seems useful in as far as the teacher avoids negative reinforcement and learners will acquire certain skills to discriminate between correct and incorrect responses.

Discrimination stands here as a safeguard against too much generalization, thus avoiding errors that are generally made due to generalization, or over-generalization. As errors (incorrect responses) disrupt learning, they are better eliminated through discrimination than negative reinforcement (punishment).

Successive Approximations of Shaping the Desired Response.

The successive steps of (1) suitable selection of reinforcers, (2) scheduled reinforcement, (3) generalization, and (4) discrimination all lead the learner to change his/her behavior. This change remains in need of still other 'fine-tuning' operations that result in shaping of the learner's correct response. The learner gradually precedes by approximation to finally hone his/her response to the desired response. Of course, during this phase, the teacher will accompany his learners through five steps:

1) Identify what the student can do now (initial behavior)
2) Identify the desired behavior
3) Identify potential reinforcers in the student's environment
4) Break the desired behavior into small sub-steps to be mastered sequentially
5) Move the student from the initial behavior to the desired behavior by successively reinforcing each approximation to the desired behavior

Note that these steps occur during instruction, i.e. learning through doing. This may be reminiscent of formative assessment. It could be applied on students having difficulty using the right tense in a narrative text type. The teacher will assess what the learner knows and can do now, then he will set the desired behavior as a goal to be reached by the learner. A third step consists in identifying the mid-way reinforcers to employ and lead the learner to smoothly approximate the desired behavior by assigning small sub-steps making up the task.

As concerns the activity that consists in the learner being able to use the right tense in writing a narrative text type, suggested earlier, the teacher builds on the learner's mastery of regular/irregular verbs to assign, for example, an activity consisting of 'telling a joke', 'reporting yesterday's activities at home' or 'any event that took place in the past'. The learner will certainly commit errors, which the teacher should expect. He then has to select the appropriate mid-reinforcers to cope with them in ways that the activity should be split into small tasks that would cumulatively hone the learners fitting into the desired behavior.

Self-Regulation

Self-regulation is closely linked and partially dependent on the learner having successfully reached the level of discriminating between responses. There is, however, a slight difference holding between 'discriminating between responses' and self-regulation in that the latter establishes future reinforcers in order to respond to and avoid responding to those imposed on him, ex: the learner consciously imposes on himself/herself other reinforcers than those he/she is facing in the present moment).

This way of doing could be labeled 'differing' the reward to a later date. How? The learner, although driven by a pressing will to accomplish a task, yet he/she is tempted to join his/her colleagues holding a noisy party some blocks away. This situation puts the learner mid-way between deciding which response to opt for. In order to self-regulate, the learner should postpone the immediate reward for a later time and keep himself busy working on his task. But he should set a time limit for his/her task to be finished before joining his/her colleagues. Such a situation not being a one-off event, the learner should impose on himself/herself a 'code of conduct' for future similar occasions. He/she should decide to disconnect his phone, cut off the internet, and close himself/herself inside his/her room with no possibility of being reached. He/she should also set a schedule with time limit sign-posts.

Proceeding this way will allow the learner to decide when to respond to which stimulus; he/she will also have some control of his behavior, managing the way he/she responds and how he/she is rewarded.

I.2.2 INSTRUCTIONAL APPLICATIONS

As a concluding teaching recommendation, here is a seven-paragraph text[8] that summarizes Skinner's view on how his theory should put into practice in the classroom.

"Skinner wrote extensively on how his ideas can be applied to solve educational problems. He believed that there is too much aversive control. Although students rarely receive corporal punishment, they often work on assignments not because they want to learn or because they enjoy them but rather to avoid punishments such as teacher criticism, loss of privileges, and a trip to the principal's office.

A second concern is that reinforcement occurs infrequently and often not at the proper time. Teachers attend to each student for only a few minutes each day. While students are engaged in seat work, several minutes can elapse between when they finish an assignment and when they receive teacher feedback. Consequently, students may learn incorrectly, which means that teachers must spend additional time giving corrective feedback.

A third point is that the scope and sequence of curricula do not ensure that all students acquire skills. Students do not learn at the same pace. To cover all the material, teachers may move to the next lesson before all students have mastered the previous one.

Skinner contended that these and other problems cannot be solved by paying teachers more money, lengthening the school day and year, raising standards, or toughening teacher certification requirements. Rather, he recommended better use of instructional time. Since it is unrealistic to expect students to move through the curriculum at the same rate, individualizing

[8] *Learning Theories, An Educational Perspective*, by Dale H. Schunk,the University of North Carolina, USA, Sixth Edition, 2012. p.102/103

instruction would improve efficiency. Skinner believed that teaching required properly arranging reinforcement contingencies. No new principles were needed in applying operant conditioning to education. Instruction is more effective when:

(1) Teachers present the material in small steps;

(2) Learners actively respond rather than passively listen;

(3) Teachers give feedback immediately following learners' responses;

(4) Learners move through the material at their own pace.

The basic process of instruction involves shaping. The goal of instruction (desired behavior) and the students' initial behavior are identified. Sub-steps (behaviors) leading from the initial behavior to the desired behavior are formulated. Each sub-step represents a small modification of the preceding one. Students are moved through the sequence using various approaches including demonstrations, small-group work, and individual seat work. Students actively respond to the material and receive immediate feedback.

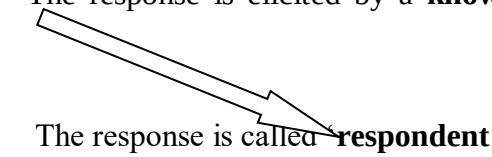
This instructional approach involves specifying learners' present knowledge and desired objectives in terms of what learners do. Desired behaviors often are specified as behavioral objectives, to be discussed shortly. Individual differences are taken into account by beginning instruction at learners' present performance levels and allowing them to progress at their own rates. Given the prevailing teaching methods in our educational system, these goals seem impractical: Teachers would have to begin instruction at different points and cover material at different rates for individual students. Programmed instruction circumvents these problems: Learners begin at the point in the material corresponding to their performance levels, and they progress at their own rates."

Lecture N° Eight

I.2.3 Discussion of and activities around Skinner's Theory

Skinner's Operant Conditioning

In **Classical Conditioning** (Pavlov) The response is elicited by a **known** stimulus.



The response is called '**respondent behavior**'

A) **Classical Conditioning** is different from Skinner's Operant Behavior in that the stimulus is **unknown** or **unrecognizable**.

B) **Skinner's Experiment**

a specific Skinner's apparatus consists of a puzzle box with a disc at which a bird pecks and is rewarded with grain. The lever mechanism which releases the grain is linked to record the number of pecks made and also regulated to give complex variations in the time intervals between rewards. In an operant behavior experiment, the strength of the stimulus is not measured directly and is irrelevant, therefore it is the rate of response which is significant. The strength of the operant is determined by the total number of responses over period.

Take these three definitions and relate them to the experiment above

- The acquisition of new responses to various stimuli
- Learning is the accumulation of experiences and the consequential growth and new understanding of the world around us
- Learning is a change in behavior

In Skinner's experiment, you have noticed that the bird is made to "realize" that the pecking it does is actually the reason for the reward with grain. The problem that the bird faces, however, is about the number of times it has to peck before being rewarded with grain; it keeps pecking anyway, thus engaging its "agency" into the act of "learning". This is why Skinner's theory

is called Operant Conditioning. The notion of Conditioning is certainly at the heart of Skinner's theory, but there is a margin of freedom allowed the organism (here, the bird) where a certain act of doing is expected of the bird.

Discussion

How operant is Skinner's conditioning?

Does that mean that operant conditioning **leads** to operant behavior?

How?

Does that mean to follow a successful performance with an immediate reward?

Questions:

- Where is the stimulus in this experiment?
- Is the stimulus **known** or **unknown**? Discuss
- What difference is there between the bird in this experiment and Pavlov's dog?

Answer by 'true' or 'false'

- In Pavlovian conditioning, the organism responds passively to the stimulus.
- In operant conditioning, the animal actively brings about its own reward.
- In operant conditioning, the organism reacts positively and exerts some measure of control over its environment.

Hints: The technical term used by Skinner to describe a reward is 'reinforcement'; positive reinforcement includes rewards such as food, a prize, praise and success; negative reinforcement includes punishment, rebuke and dissatisfaction caused by an unsuccessful performance.

Text to explore:

Skinner made the interesting observation that if a pigeon happens to be behaving in a certain way or adopts a specific posture, such as standing on one leg when it makes a successful action and is rewarded, it will continue to behave in that manner on subsequent occasions when seeking a reward. This is known as "superstitious" behavior, it is common in adults and children alike, such as putting on a favorite piece of clothing before attending an important event.

Lecture N° Nine

CHAPTER THREE

I.3 Connectionism

I.3.1 Thorndike's Contribution to Learning Theories

Edward L. Thorndike (1874–1949) was a prominent U.S. psychologist. He is famous for a theory of learning related to what is commonly known as *connectionism* that dominated the field of educational psychology in the United States during the first half of the twentieth century. His work was essentially focused on education, particularly on learning, transfer, individual differences, and intelligence.

Trial-and-Error Learning

Basically, Thorndike's *Educational Psychology*[9]contains the bulkiest part of his work wherein 'establishing connections' between sensory experiences and the neural impulses stands as the bedrock of what it is to learn. The sensory experiences represent the stimuli that the environment provides, while the neural impulses are the responses that the actual behavior reveals. This description, of what learning is, is reminiscent of what Pavlov and Skinner put forth, but Thorndike brought some novelties that made his theory different from both.

While Pavlov's theory keeps the learner in a strictly passive posture during the learning process, Skinner ascribed some agency to the learner through his Operant Conditioning. Thorndike, on the other hand, views learning as process involving trial and error on the part of the learner, thus allowing the latter to be much more active than he is seen through Pavlov and Skinner's theories.

[9] Educational Psychology, Vol.1. *The Original Nature Of Man*; Educational Psychology, Vol.2. *The Psychology of Learning*; Educational Psychology, Vol.3. *Mental Work and Fatigue and Individual Differences and their Causes.* [Teachers College Press, US]

Similar to Pavlov and Skinner, the early experiments that Thorndike carried out were on animals, during which he repeatedly noticed how the animals under observation behaved by means of trial-error procedure to solve problems the experimenter (Thorndike) previously put them in. He noticed that these animals tried many ways to solve their problems but always ended up selecting, from those problem-solving ways, only those that they noticed were successful. Put in the words used by Thorndike describing the behavior of the animals, the 'ways' to solve the problems are termed 'responses' and the 'problem' is termed 'stimulus.

Thorndike conclusively decided that the animals under observation will establish a connection between the response they perform and the consequence that ensues. The more successful the response is the more connected it becomes to its consequences. This knowledge will be stored in the memory of the animal to be applied in later occasions. This is how, according to Thorndike, learning takes place: through trial-error process and the connection that is established between successful responses and their rewarding consequences, and also between the unsuccessful responses and their unrewarding consequences. Put succinctly, trial-error process that leads to selection of rewarding consequences and elimination of unsuccessful responses.

Establishing the connection between successful responses and their rewarding consequences is what it is to learn, and is not monitored by the experimenter. This observation allows us to set Thorndike's theory apart from Pavlov's or Skinner's. Again, the fact that trial-and-error learning does not happen instantly but requires time, it involves the notion of 'repetition'. This repetition will incrementally provide the animal with a stock of 'knowledge', or 'learning' of how similar situations require similar behaviors that were previously performed, or abandoned.

However, applying this procedure to human learning should be critically viewed, as humans enjoy richer ways to respond to problem situations. To this objection, Thorndike responds by suggesting three laws that could easily applied to human learning, thus reducing the disparity between

human and animal learning. The difference between both takes to the degree, not the nature of the problems (stimuli) or of the behavior (response)

I.3.2 Laws of Exercise and Effect

Thorndike's theory of learning essentially revolves around three laws that frame the interplay of try-and-error in response to given stimuli and the connections that come as a result. The first law is labeled the Law of Exercise, which in turn subdivided into two parts:

a) The Law of Use, and
b) The Law of Disuse

The first part, the Law of Use, could be defined as 'the more responses accumulate to stimuli, the more strengthened is the connection holding between them'. As for the second part, the Law of Disuse, one can summarize it this way: the less responses are addressed to stimuli, the weaker the bonds linking them become. In the first instance, where the connections are strengthened, the organism tends to learn more; but in the second instance, the organism tends to forget what it is supposed to have leaned.

The second law, the Law of Effect, casts light on the consequence of the response, which determines the increase or decline of the connections. If a given response to a given stimulus is satisfying (reward), then the organism is encouraged to keep trying (i.e. learning) similar or same type of responses; if, however, the responses bring about dissatisfaction, annoyance or negative consequences (punishment), then the connections will decrease. The decrease of the connections means the organism is no more learning. It could be safely contended that the decreasing or increasing levels of the strength of the connections are means to train the organism to adapt to the unexpectedness (environment) imbedded in problem situations.

The following study illustrates application of the Law of Effect (Thorndike, 1927)[10].

> *Participants were shown 50 strips of paper, ranging in length from 3 to 27 centimeters (cm), one at a time. Next to each strip was a second strip that participants knew was 10 cm long. They initially estimated the length of each strip without feedback. Following this pretest, the 50 strips were presented again, one at a time. After each estimate, they were told "right" or "wrong" by the experimenter. After the 50 strips were presented repeatedly over several days, they again were presented without feedback about accuracy of length judgments. Following training, participants' length estimates more closely approximated the actual lengths of the strips than had their prior estimates. Thorndike concluded that these results, which were similar to those from experiments in which animals were rewarded with food or freedom, support the idea that satisfying (correct) stimulus–response connections are strengthened and annoying (incorrect) ones are weakened.*

In addition to the Law of Exercise and the Law of Effect, Thorndike suggests another law that he named the Law of Readiness. It refers to the state of preparation that organisms (individuals in general, and learners as well) are in before acting. If an individual is prepared (ready) to perform any task, he feels rewarded while doing it; if, however, he does not feel like doing it (not prepared, not ready), he will feel what could be labeled self-punishment.

When applied in learning, this Law of Readiness may help teachers to take into account the boosting effect on learners when they feel they are in a state of readiness, along with the frustrating effect of not being prepared (ready). In the former case (learners ready), the behavior learners display to learn will take the form of a self-reward, whereas in the latter case, learners will fell punishment. Both cases highlight the importance of analyzing the reasons why readiness-based behaviors are rewarding while unpreparedness-

[10] The law of effect. in *American Journal of Psychology, 39*, 212–222. Thorndike, E. L. (1927). Quoted by Dale H. Schunk in *Learning Theories, An Educational Perspective*, by Dale H. Schunk, the University of North Carolina, USA, Sixth Edition, 2012. pp.74/75

based behaviors are punishing. Readiness might be due to prior knowledge, prerequisite skills or merely a favorable development level. Unpreparedness, on the other hand, might be due lack of the elements that the prepared learner enjoys, as seen earlier.

I.3.3 Other Principles

By way of fine-tuning learning through generalization, Thorndike suggests two principles:

1) Associative Shifting.

This principle refers to the gradual procedure in teaching new skills. The stimulus that the teacher intends his learners to respond to should be conceived in ways that it (a) must be applicable to other situations (shifting by association), (b) contains some elements (hints) likely to help the learners to apply them to different situations. For example, to teach the learners the passive voice, teachers should have previously taught the present perfect, in order for the learners to enjoy readiness based on their prior knowledge and skills relative to the use of the past participle.

Moreover, moving from the use of the passive voice in a present tense sentence should rely on the learners having become aware that the selection of the auxiliary *to be* depends on the tense of the main verb imbedded in the sentence to be turned into the passive voice. Here the learners will be encouraged to learn the principle, not the rule. Moving from considering much more the principle than the grammatical rule will empower the learners to safely step into the area of generalization.

2) Identical Elements Affect Transfer (Generalization)

This principle stipulates that a transfer of skills occurs when situations have identical elements and call for similar responses. We may contend that this principle's effectiveness is dependent on the previous one (Principle 1 above). How? If teaching the passive voice is exclusively dependent on examples of present tense sentences, the learners will not necessary be able to

turn a past tense sentence into the passive voice. This is due to the learners having clung to the grammatical rule, instead of learning the principle likely to allow them to transfer, i.e. generalize.

I.3.4 Revisions of Thorndike's Theory[11]

Thorndike revised the Laws of Exercise and Effect after other research evidence did not support them. Thorndike discarded the **Law of Exercise** when he found that simple repetition of a situation does not necessarily "stamp in" responses. In one experiment, for example, participants closed their eyes and drew lines they thought were 2, 4, 6, and 8 inches long, hundreds of times over several days, without feedback on accuracy of the lengths. If the **Law of Exercise** were correct, then the response performed most often during the first 100 or so drawings ought to become more frequent afterward; but Thorndike found no support for this idea. Rather, mean lengths changed over time; people apparently experimented with different lengths because they were unsure of the correct length. Thus, repetition of a situation may not increase the future likelihood of the same response occurring.

With respect to the **Law of Effect**, Thorndike originally thought that the effects of satisfiers (rewards) and annoyers (punishments) were opposite but comparable, but research showed this was not the case. Rather, rewards strengthened connections, but punishment did not necessarily weaken them. Instead, connections are weakened when alternative connections are strengthened. In one study (1932), participants were presented with uncommon English words (e.g., *edacious, eidolon*). Each word was followed by five common English words, one of which was a correct synonym. On each trial, participants chose a synonym and underlined it, after which the experimenter said "right" (reward) or "wrong" (punishment). Reward improved learning, but punishment did not diminish the probability of that response occurring to that stimulus word.

[11] *Learning Theories, An Educational Perspective*, by Dale H. Schunk, the University of North Carolina, USA, Sixth Edition, 2012. pp.75/76

Punishment suppresses responses, but they are not forgotten. Punishment is not an effective means of altering behavior because it does not teach students correct behaviors but rather informs them of what not to do. This also is true with cognitive skills. Brown and Burton (1978) found that students learn *buggy algorithms* (incorrect rules) for solving problems (e.g., subtract the smaller number from the larger, column by column, 4371— 2748 =2437). When students are informed that this method is incorrect and are given corrective feedback and practice in solving problems correctly, they learn the correct method but do not forget the old way.

I.3.5 Educational Implications of Thorndike's theory

Thorndike's theory and works have had many implications on education, covering topics that range from educational goals, learning processes, teaching methods, curricular sequences, to techniques for assessing educational outcomes. Some of Thorndike's many contributions to education are the following.

Moreover, his theories have had enduring effects in education in Algeria, namely, teaching English as a Foreign Language (EFL). Prior to the Competency-Based Approach (CBA), presently implemented in Algeria, another approach, the Approach by Objectives, had been adopted in teaching foreign languages in the primary, middle and secondary education. English, as a foreign language, used to be taught along the lines of behaviorism where objectives were assigned by the end of teaching/learning cycle, be it a session, a semester, or a whole term. These objectives were expressed in terms of "operational objectives" through which the learners' behavior had to be observed and measured. In the process of learning, the students went through some steps expected to lead them to apply what they were taught. The steps in question are:

1) Drilling and repetition
2) Transformation
3) Manipulation

These frames kept the students in a state of passive receivers, under the overarching control of the teacher, in a learning/teaching situation reminiscent of Pavlov's and Skinner's experiments. The student was controlled in such a way that the learning outcome was much a sign of the teacher having done his job than the student having learnt. The lesson plan of an English session used to be mapped upon a Presentation-Practice-Production general framework. By the end of the session the student was led to practice what he had been presented with, and then in the final phase, i.e. Production, he just repeated what he had already practiced. This way of doing deprived the learning—teaching process of an important element: the information gap-filling. The idea of filling an information gap is a criterion upon which any language behavior, on the part of the student, is valued to be either a communicative activity or a language practice. What has been repeatedly observed (within the previous Approach by Objectives) is that in Production phase, the students 'produce' language that the teacher already knew the content of, thus leaving next to no chance for the students to filling the information gap holding between the sender (the student, producer of the piece of written and/or oral language) and the receiver(s) (the teacher and the peers). This situation turns Production similar to Practice. As no free use of language was provided for, the classroom practice faithfully used to abide by the basic principles of behaviorism.

Principles of Teaching.

Teachers should help students form good habits. As Thorndike noted:

- Form habits. Do not expect them to create themselves.
- Beware of forming a habit which must be broken later.
- Do not form two or more habits when one will do as well.
- Other things being equal, have a habit formed in the way in which it is to be used.

The last principle cautions against teaching content that is removed from its applications: For example "*Since the forms of adjectives in German or Latin are always to be used with nouns, they should be learned with nouns*". Students

need to understand how to apply knowledge and skills they acquire. Uses should be learned in conjunction with the content.

Sequence of Curricula.

A skill should be introduced (Thorndike & Gates, 1929)[12]:

- At the time or just before the time when it can be used in some serviceable way
- At the time when the learner is conscious of the need for it as a means of satisfying some useful purpose
- When it is most suited in difficulty to the ability of the learner
- When it will harmonize most fully with the level and type of emotions, tastes, instinctive and volitional dispositions most active at the time
- When it is most fully facilitated by immediately preceding learnings and when it will most fully facilitate learnings which are to follow shortly. (pp. 209–210)

These principles conflict with typical content placement in schools, where content is segregated by subject (e.g., social studies, mathematics, science). But Thorndike and Gates urged that knowledge and skills be taught with different subjects. For example, forms of government are appropriate topics not only in civics and history, but also in English (how governments are reflected in literature) and foreign language (government structure in other countries).

Mental Discipline.

Mental discipline is the view that learning certain subjects (e.g., the classics, mathematics) enhances general mental functioning better than learning other subjects. Mental discipline was a popular view among educators during Thorndike's time. He tested this idea with 8,500 students in grades 9 to 11 (Thorndike)[13]. Students were given intelligence tests a year apart, and their programs of study that year were compared to determine whether certain courses were associated with greater intellectual gains. The results provided no

[12] *Elementary Principles of Education*, Thorndike & Gates, New York, US, Macmillan, 1929.
[13] *Mental Discipline in High School Studies*. In JOURNAL OF EDUCATIONAL PSYCHOLOGY. Vol. 15

support for mental discipline. Students who had greater ability to begin with made the best progress regardless of what they studied.

> *If our inquiry had been carried out by a psychologist from Mars, who knew nothing of theories of mental discipline, and simply tried to answer the question, "What are the amounts of influence of sex, race, age, amounts of ability, and studies taken, upon the gain made during the year in power to think, or intellect, or whatever our stock intelligence tests measure," he might even dismiss "studies taken" with the comment, "The differences are so small and the unreliabilities are relatively so large that this factor seems unimportant." The one causal factor which he would be sure was at work would be the intellect already existent. Those who have the most to begin with gain the most during the year.* (p. 95)[14]

So rather than assuming that some subject areas improve students' mental abilities better than others, we should assess how different subject areas affect students' ability to think, as well as other outcomes (e.g., interests, goals). Thorndike's influential research led educators to redesign curricula away from the mental discipline idea.

Lecture N° Ten

I.3.6 Summary of Thorndike's Contribution

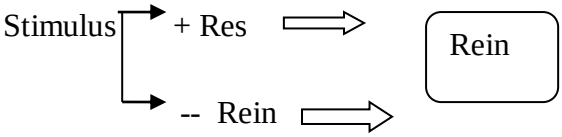
Thorndike's structure of S-R bonds.

Old assumptions, some dating back to Classical Times which thought that learning and memorizing resulted from the formation of simple associations of words, ideas, and concepts "in the mind" → pleasurable experiences are likely to be kept longest.

→ Painful experiences are likely to be forgotten.

[14] Ibid

In its simplest form, this theory is named "association by contiguity". From "association by contiguity" emerged "rewarded association" of Thorndike.



In 1949, Thorndike developed a narrowly mechanical **theory of learning**

For each S, there is an associated R. S and R become welded. The welded S and R form a connection or bond. In the process of learning, S-R bonds are constructed, strengthened and organized.

4) Thorndike supplied 3 laws that explain behavior.

1) **The Law of Effect** 2) **The Law of Exercise** 3) **The Law of Readiness**

1) **The Law of Effect**:

An S-R connection or bond is strengthened if its consequence proves satisfying or is rewarded, and a bond is weakened if its consequence proves annoying or punished. This Law is an explanation of trial- and-error learning. Thorndike later concluded that reward is far more effective in modifying behavior than punishment is.

Punishment

Wrong

Frown

approval

A mild expression of disapproval

Unsuccessful action itself

Reward

material reward

sign or comment of

2) **The Law of Exercise**:

With practice or repetition, a bond or connection is strengthened or conversely is weakened through disuse: Learning is by doing and repetition.

A SERIOUS WEAKNESS: Practice without knowledge of results is quite worthless [rote learning].

3) **The Law of Readiness**:

Satisfaction and reward as opposed to frustration and annoyance depend on whether the learner is actively prepared for learning or not. A bond is strengthened or weakened according to whether the learner's mental adjustment, preparation or readiness.

Thorndike is known by these **three Laws**. He also proposed **five subordinate Laws**.

a) The learner must be flexible and vary his approach in attempting to solve a problem until by trial and error he is successful.
b) The attitude of the learner is significant in determining his behavior and success in learning.
c) The learner picks out the fundamental and essential points of an argument or problem and discards irrelevant details.
d) The learner responds to new situations by drawing analogies with past experience or identifying elements common to both.
e) The learner responds to a given stimulus, then by associative shifting transfers it to a totally different stimulus.

Lecture N° Eleven

I.3.7 Thorndike's three Laws of Learning exemplified

A) The Law of Effect

An S-R connection or bond is strengthened if its consequence proves **satisfying** or is **rewarded**; a bond is weakened if its consequence proves

annoying or is punished. This Law is an explanation of **trial and error** learning.

Ex: A person might make many attempts to solve a problem or perform a skilled action until a correct solution is obtained, subsequent repetition will stamp it. Conversely, unsuccessful solutions or actions are inhibited and extinguished.

Satisfying+rewarded consequence= bond strengthened

Annoying+punishmed consequence= bond weakened

Activity: Supply similar instances in EFL classes.

Thorndike later concluded that the relative effectiveness of reward and punishment are not equal; reward is far more effective in modifying behavior than is punishment. His conclusions on the effects of punishment are of considerable significance for parents, teachers and criminologists.

B) The Law of Exercise

It suggests that with **practice** or **repetition**, a bond or connection is strengthened or conversely a bond is weakened through disuse:

1) More frequently and more recently performed actions tend to be repeated and strengthened.
2) Learning by doing.
3) Practice makes perfect.

Practiced and more frequently repeated actions= bond strengthened

Less frequently practiced/repeated actions= bond weakened

Activity: How successful is this Law in

1) Memorizing the arithmetical tables by heart
2) Verbal memory
3) Repeating physical activities in order to acquire a physical skill

C) The Law of Readiness

Satisfaction and reward as opposed to frustration and annoyance depend on whether the learner is actively prepared or not. A bond is strengthened or weakened according to the learner's mental adjustment, preparation or readiness.

Observation: In These three laws, one can notice that, building upon Pavlov and Skinner's theories, Thorndike opens up new aspects to consider in the organism's reaction to the conditioning dyadic, i.e. stimulus-response. The organism's engagement will be more felt if its action is more rewarded (positive reinforcement) than punished (negative reinforcement), it is made to repeat the action, and is put in an annoyance-free situation. Moreover, these three laws share much of Pavlov and Skinner's theories but differ a little from them in that it foregrounds the organism's role in learning.

PART TWO

Cognitivism

Learning outcome:

By the end of this chapter, students will be able to:

1) Notice the 'cognitive turn', which came as a reaction against Behaviorism.
2) Notice the contribution of Chomsky in the theory of learning through the involvement of his linguistic paradigm.
3) Be aware of the relations holding between Cognitivism and Constructivism.
4) Study and understand Jean Piaget's cognitive constructivist theory along with Lev Vygotsky's social constructivist theory.
5) Discover the centrality of the learner's cognition in Piaget's theory.
6) Discover the centrality of the learner's involvement in the social/environmental milieu.
7) Compare Piaget's theory with Vygotsky's.
8) Discover how both psychologists' theories are complementary in leading the learner to construct his learning and be responsible of.
9) Learn about the educational implications of both theories.

Lecture N° Twelve

CHAPTER ONE

Cognitivism

II Historical overview and links between cognitivism and constructivism

II.1 Cognitive Learning Theories.

Cognitive learning theories focus on the role played by internal mental processes in learning. This educational psychology trend posits that during the learning process, knowledge is constructed by the learner in ways that new knowledge is added to and modified to old types of knowledge or experiences. This view stresses the fact that there must be in the human mind a mental mechanism that processes information. By this idea, cognitivism frontally opposed the behaviorist view which, as seen earlier, which stipulates that learning occurs when the learner's responses are reinforced (conditioned) by external factors.

Cognitivism came to give pride of place to the mental process in the attempt to explain what is involved in the learning process. During the 1950s and 1960s, there emerged a couple of voices that expressed their dissatisfaction with the behaviorist views as to how learning occurs. The diverging views opposing the behaviorists to the cognitivists have widened the scope as concerns what it is to learn in general, and the first and/or the second language(s) in particular.

As any linguistic theory seeks support from diverse domains to sustain its claims about what language is, it also relies on the findings of psychology to explain how language is learnt/acquired. One of the prominent linguists during the 1950s and 1960s was Noam Chomsky who, although he was not psychologist, managed to bring some insights related to the inner working of the mental structures put forth by the cognitivists. He then sided with

cognitivism, thus joining his linguistic paradigm (generative-transformational grammar) to the cognitive school of psychology. He introduced new concepts by way pinning down his claims within the field of cognitivism. Such concepts are 'the mental lexicon', 'the language organ', 'universal grammar', 'the LAD' with which he unmistakably favored the cognitivist view on how learning occurs, with more focus being put on the mother tongue.

Contrary to the three behaviorist theories seen earlier, Chomsky's contribution is limited to the acquisition/learning of the first/second language. His new linguistic paradigm (generativism in linguistics and innatism in psychology) was pitted against the American Structuralism in linguistics, and this opposition was extended to Distributionnalism, then led by Leonard Bloomfield. As Bloomfield's psychological background was behaviorism, he contended that language learning/acquisition was a mere habit formation, discarding any mention of the inner working of the learner's mind/brain. Chomsky's philosophical back-up being rationalism, his view of how language is learnt/acquired frontally opposed Bloomfield's empiricism.

Although Chomsky's general position in *Syntactic Structures* is, as far as he reveals it, indistinguishable from that of the Bloomfieldians and other empiricists, there is one point on which he disagreed with Bloomfield and many of his followers from very early on. Bloomfield was a behaviorist (at the time he wrote *Language*), and many of his followers shared his belief that a 'mechanistic' account of language in terms of stimulus—and—response was more objective and more scientific than the traditional 'mentalistic' description of language as a vehicle for the 'expression of thought.' In the year that *Syntactic Structures* was published, B F Skinner's *verbal Behavior* also appeared and it was reviewed in due course by Chomsky. Skinner is one of the most eminent and most influential advocates of behaviorist psychology alive at the present time; and his book constitutes the most detailed attempt that had as yet been made to account for the acquisition of language within the framework of behavioristic 'learning theory.' Chomsky's review is now a classic, in which he not only subjects Skinner's book to a penetrating examination, but at the same time reveals his own mastery of the relevant psychological literature.

Chomsky has since repeated his arguments against behaviorism on many occasions. Briefly, they amount to the following. One of the most striking facts about language is its 'creativity'—the fact that by the age of five or six children are able to produce and understand an indefinitely large number of utterances that they have not previously encountered—and the behaviorist's 'learning theory', however successful it might be in accounting for the way in which certain networks of 'habits' and 'associations' are built up in the 'behavior—patterns' of animals and human beings, is totally incapable of explaining 'creativity'—an aspect of human 'behavior' manifest most clearly in language.

Chomsky further claims that the terminology of behaviorism (stimulus, response, habit, conditioning, reinforcement, etc), though it can be made precise (and has been made precise in its application to more restricted domains), is so loose as actually applied to language, that it could cover anything and is thus completely devoid of empirical content. In the absence of any overt 'response', the behaviorist takes refuge in an unobserved and unobservable 'disposition to respond'; and having accounted, in principle, for the association of words (as 'responses') with objects (as 'stimuli') and for the learning of a limited set of sentences in the same way, he either says nothing at all about formation of new sentences or at this point appeals to some undefined notion of 'analogy'. Chomsky's criticisms of behaviorism in undoubtedly valid. It does not follow, of course (and as far as I know Chomsky has never claimed that it does), that no aspects of language, or the use of language, can be reasonably described in terms of a 'stimulus—and—response' model.

From the late 1950s to the present, the American linguist has inspired thousands of articles and hundreds of books exploring what is referred to as the 'language-acquisition device'. This is the idea that there is something unique in human biology dedicated to language. The principal evidence marshaled on behalf of this idea is that children know more than they could possibly have learned from the evidence available to them. This difference between what they know and the linguistic examples they are exposed to is known as the 'poverty of the stimulus'. There are plenty of examples (and counterexamples) of this in

the literature. Cognitive scientists are divided as to whether there is any such poverty, some even referring to it deprecatingly as the ‘poverty of imagination’ (on the part of Chomskyans). While that debate rages, however, its focal point has come to be how much, if any, of human grammar is innate.

Again, Chomsky put forth a notion that would sustain his claim that learning/acquiring language does not happen by a mere formation of habits after the learner is exposed to the stimulus of the environment (the parents, the care-takers…). This notion is Universal Grammar. Universal grammar can be simply defined as a set of universal innate principles of grammar shared by all languages. That a child will not be able to learn its mother tongue without a set of innate principles, because the linguistic data it is exposed to are too poor is the central point of the UG. The theory given by the American linguist Chomsky, attempts to explain language acquisition in general, not describe specific languages. The key features of the UG are given below.

UG consists of different kinds of universals. Chomsky identifies two types: **substantive** and **formal**. Substantive universals consist of fixed features such as the distinctive phonetic features of which sounds are made or syntactic categories such as noun, verb, and object. **Formal** universals are more abstract. They are statements about what grammatical rules are possible in languages.

Formal and substantive universals are constrains and therefore delimit the options by setting parameters which must then be fixed according to the particular input data that the child obtains.

So, the principles and parameters which can be defined as a framework in human brain make UG possible. UG holds a set of principles and parameters arranged into modules such as Binding Theory and it is a computation system that ranges from the component of Phonological Form to the component of Logical Form ,that is ,from ’sound’ to ’meaning’. The rules the child learns can be **unmarked** or **marked**. The universals that the child learns form the core grammar and the distinctive features are termed as **peripheral**.

To sum up, there are some innate universal principles without which a child cannot master his mother tongue. But the input data are also a must as the input triggers the LAD.

Observation:

Note that, in theorizing what learning consists of, Chomsky's contribution rests on rational reasoning that leads to the assumption that there must be a mental device (LAD) between the input (stimulus) and the output (response). This middle area (the black box, for the behaviorists) is the device which is operated in order for the child to learn any language. To sustain his belief, Chomsky calls in examples of monkeys being submitted to learning human languages but none brought any scientifically defensible results. Moreover, Chomsky posited the existence of what he dubbed Universal Grammar (UG) that innately allows any child to selectively learn the most recursively repeated chunks of language while being exposed to them. These 'recursively repeated chunks of language' become the principles of the language; those that are less received cannot be lumped under one heading, because of their elusiveness, and consequently become parameters, specific to individual languages. These parameters, for Chomsky, are taught; the principles are acquired. Chomsky does not deny the importance of children being exposed to language from the environment; all he opposed was the exclusive learning effect of the environment, and the neglect of the working of the LAD and UG. The recent discoveries made in the neurosciences credited Chomsky's assumption relative to the existence of a language organ on the left side of the brain**.**

It should be noted, however, that cognitivism is not limited to the Chomskyan paradigm; other cognition-oriented trends emerged as reactions against the behaviorist views on learning. Among the other alternative views of learning is constructivism, represented by the famous psychologist, Jean Piaget.

Lecture N° Thirteen

II.1.1 Constructivism

Due to Jean Piaget's work focusing on cognition to theorize learning, constructivism comes to be known as Cognitive Constructivism. Another psychologist, Lev Vygotsky, initiated another conception about constructivism that relies of society, taken as the most important agent in individuals constructing their learning. This view is known by the name of Social Constructivism.

In *Ways of Learning*[15], Alan Pritchard defines constructivist view of learning in these terms:

> *Constructivists view learning as the result of mental construction. That is, learning takes place when new information is built into and added onto an individual's current structure of knowledge, understanding and skills. We learn best when we actively construct our own understanding.* (p. 17)

This definition of learning is in stark contrast with the behaviorist's in that it presents learning as a cumulative process through which information goes before becoming a modified version of knowledge, understanding and skills. The agent responsible for this assumed processing is presented as a mental computation supplied by the mind-brain.

II.1.2 Assumptions and perspectives of Constructivism:

Constructivism assumes that thinking takes place in situations and that cognition is largely constructed by individuals as a function of their experiences in these situations. In this view, individuals are said to be involved in what they learn due to the inner working of their cognition and also due to the social interactions that society provides circumstances for. Both pathways

[15] *Ways of Learning Learning theories and learning styles in the classroom*, by Alan Pritchard. Routledge Second edition. 2009.

(cognition and social interactions) pave the way for individuals to acquire skills and knowledge.

Constructivism posits that learning principles do not exist outside individuals; rather, it is the individuals' cognition and engagement in society that allow for learning to be constructed. This conception of learning highlights the individualized type of learning: every individual reaches a type of learning that is particular to him. For constructivism, there is no such statement that scientific truth pre-exists human's investigation: it is the role of man to construct it, to make it through cognition and social involvement. The making and construction of scientific truth is made possible through a gradual fact checking that hypothesizing serves so that every construction of scientific truth is true only for the one who constructs it.. This individualized construction is based on the assumption that individuals produce knowledge that is the product of their personal beliefs and social lived experiences. The diversified human social experiences and cognition cast on knowledge a veil of subjectivity.

The individualized process of learning (knowledge construction), seen earlier, is built on another assumption relative to the learners being active, in ways that they are likened to 'lone scientists'. These lone scientists construct their knowledge through hypotheses that their innate mental structures allow to make. This assumption is so deep rooted that mental structures reflect reality.

In broad terms, constructivism covers three views that underlie three different assumptions as concerns knowledge construction and learning processes.

1) View One:

   Acquiring knowledge involves reconstructing external reality and reflecting it. The accuracy of knowledge is evaluated according to whether it reflects the external world or not. One can notice that the external world is the prime source of mental structures to be activated in order to construct knowledge. This view gives precedence of the external world over the inner working of the mental structures. The senses and experiences are favorably given pride of place.

2) View Two

This view assumes that knowledge is cumulatively built upon previous one(s); the external environment is in no way source for knowledge construction. Rather, it is through cognitive abstractions that knowledge is obtained/attained. This view used to be Piaget's in his early theorizing about constructivism-based learning.

3) View Three

This view reconciles both of the previous ones. It stands at equal distance between both in acknowledging the environment's effect and the mental structures agency in constructing knowledge and attaining learning of that knowledge. Piaget adhered to it by way reducing his early extreme views, thus joining Vygotsky's theory of learning, which mainly focuses on dialogue in social setting as catalyst for activating the mental structures of the learners.

II.1.3 Principles of Constructivism[16] :

- Learners are active participants in their learning. Learning by doing is central to constructivism in practice
- Learners are self-regulated. They construct and monitor their own learning, and metacognition plays an important role in facilitating this self-regulation.
- Social interaction is necessary for effective learning. Both Piaget and Vygotsky acknowledged the role of social interaction with peers and significant others (such as parents and teachers) in cognitive development.
- Constructivism encourages individuals to make sense of information for themselves. This means that knowledge may be relative and may differ for each learner. And just as individuals construct their own meaning within social and cultural context, knowledge and understanding may differ across learners and contexts. (pp. 219/220)

[16] *Educational psychology for learning and teaching* by Sue Duchesne and Anne McMaugh, Fifth Edition, Cengage Learning, 2016

Lecture N° Fourteen

CHAPTER TWO

II.2.1 Piaget's Theory Of Learning

Learning outcome:

After going through Piaget's Theory of Cognitive Development, the students will be able to:

1 Understand what is meant by development;

2 Identify Piaget's four cognitive processes and, using these processes, outline how development occurs;

3 List and describe the key features of each of Piaget's four stages of cognitive development.

Piaget's theory inception is located in his interest in how humans come to understand the world. He qualifies the advanced stage of understanding as a sign of intelligence that rests on continuous interactions with the environment. He posits that there must be some cognitive 'recipients' that house the skills, knowledge and learning, acquired through repeated interactions with the world and that are revealed in the intelligent behavior.

The cognitive recipients that contain the accumulated experience-based knowledge are given the name of schemata (plural of the singular form 'schema'). These schemata are "the basic building blocks of intelligent behavior – which become increasingly complex as the child grows"[17]. How do these schemata grow in complexity? Piaget suggests that schemata grow in complexity thanks to the interplay of two other mental processes that he names as (1) assimilation, and (2) accommodation. Receiving experience-based knowledge/learning through these processes, schemata acquire more knowledge that results in the child becoming adapted to the environment; hence equilibrium is established with regard to the environment.

To understand more the relation holding between schema, assimilation and accommodation, the following sections will explore the pathway that humans cross before reaching equilibration and, consequently, adaptation.

[17] *30-second psychology*, edited by Christian Jarrett, Ivy Press Limited, 2011, p.40

Schema

Due to his biological training background, Piaget was inspired by the way biological organisms adapt to the environment in their growth and survival. His observations of the animals biological acts conclusively made him to believe that they attempt to organize the environment in order to adapt to it. Consequently, he embarked on conceiving similar processes likely to characterize and explain intellectual development in humans, contending that the "intellectual acts are acts of organization of and adaptation to the environment"[18] (p.13). This view assimilates the basic principles of cognitive development to those of biological development.

Similar to biological structures, the mind is assumed by Piaget to possess structures as well. As much as the lungs are biological structures made use of to adapt the organism to the environment so are mind structures used to allow humans adapt to the world in their intellectual development. One of these mind structures is the schema that Piaget described as being one of the processes within the nervous system. He acknowledges that they are not observable because they are only concepts or categories which perform tasks similar to a computer file that store information, experiences, or knowledge that build, in the long run, into a set of learning patterns.

Schemata's role is not limited to storing information; it processes, identifies and classifies the incoming information (stimuli) that the environment provides. Some inner mechanisms inside schemata are hypothetically said to allow humans to reach a plateau where they become able to differentiate between stimuli and generalize the knowledge they accumulate. This ability to differentiate and generalize, however, does not emerge instantly but is the end product of a relatively long process of reception of environmental stimuli. Infants, for example, can not differentiate or generalize until they have acquired enough amount of information to 'fill' their files (schemata) with.

[18] *Piaget's Theory of Cognitive and Affective Development,* by Barry J. Wadsworth, Fifth edition. Longman Publishers, USA. 1996

As illustration, imagine that a father, talking to his 4-year old son while on a trip in the countryside, would ask the toddler what a flying object is (in this case, a plane he notices flying overhead). The child, based on his prior experience of naming birds in his picture book at home, would naturally reply 'it's an eagle, dad'. This boy's answer is based on a previous 'birdness' schema obtained after the birds' general characteristics and attributes were classified and generalized. Now the father naturally corrects his son's answer by means of 'No sonny, that's a plane'. The father's intervention here introduces a new element into the 'birdness schema', thus leading the initial schema to fine-tune the notion of 'winged flying objects'. A grow/development in the schema is operated.

This example is one of many other instances where the child's schema classifies and reclassifies, categorizes and re-categorizes the previous incoming stimuli, until a full-blown schema is established around one field of knowledge. The process of continuous classifications and categorizations is a life-long one; the more images (concepts), the bigger the file containing them becomes. The more files, the more developed (complex) the schema is. In the example above, all the child does is to fit the new information (relative to "birdness", that his father supplies) into his partially filled schema, thus adjusting his previous knowledge to this new knowledge of similar-flying-objects-which-are-not-birds.

However, if the example supplied above refers to schemata as intellectual structures, this does not imply that they start with an intellectual status from birth. During the early months after birth, schemata are very limited in umber are what Piaget calls 'reflexive schemata'. Wadsworth[19] writes that:

> *At birth, schemata are reflexive in nature. That is, they can be inferred from simple reflex motor activities such as sucking and grasping. The sucking reflex illustrates a reflexive schema. At birth, infants typically suck on whatever is put in their mouths—a nipple, a finger—suggesting that there is no differentiation that only a single, global sucking schema exists. Shortly after birth, infants learn to differentiate; when the infant is hungry,*

[19] Ibid

> *milk-producing stimuli are accepted and non-milk-producing stimuli are rejected. A differentiation exists at this point.* (p.15)

Through differentiating between the two sucking stimuli, i.e. milk-producing and non-milk-producing stimuli, the child's schema has integrated a broad and a specified image. The broad one is relative to the act of sucking and the narrow one is a refined one that carries the information whether the stimulus is milk-producing or non-milk-producing.

As reflexive schemata operate upon information brought in by the sensori-motor inlets, they develop in more complex forms as they stretch over other activities that involve using the body parts. The broad schema, for instance, of catching objects that are thrown to the boy/girl are similarly developed. An infant fits into his old schema of object-catching some reflexes appropriate to the size of the object, the distance and speed at which it is sent; the clenching of the infants' hand is regulated according to these variables. These reflexes, based on the environmental stimuli, appear on the body level but are not limited to it. They evolve into becoming feeders of the intellectual development of adults through mental construction and reconstruction of schemata.

As human existence is based on experiential modes of living, adults develop an array of schemata containing diverse constructed and reconstructed knowledge. There emerges an interconnected network of schemata which communicate through nodes, exchanging fine-tuned information highly useful to humans to cope with the multiple aspects of life. Some psychologists assume that the node-based, instant, and smooth communication between schemata is a sign of what intelligence is all about. The changing forms of schemata (construction and reconstruction) stress the idea that learning is a life-long process highly dependent on this change. But how does this change occur? The answer to this question is offered by Piaget through the other two components of his theory: Assimilation and Accommodation.

Assimilation

Going back to the previous example of the father asking his son what a flying object was, we notice how the child's answer was wrong that the father's reply corrected. This instance illustrates how assimilation occurs: the child takes in his father's correct answer, inserting it into his old schema of 'flying-creatures' (general schema) in order to refine the old misconception about flying-birds

and flying-non-birds. Seen through this example, assimilation, as Wadsworth[20] put it, becomes

> A *cognitive process by which a person integrates new perceptual, motor, or conceptual matter into existing schemata or patterns of behavior.* (p. 17)

The stimulus, the plane seen flying overhead, was assimilated into the old schema and understood as an eagle. Interpreting the environment stimulus represents how the new information is classified within the old schema of 'flying-bird' as category: new information comes to be placed already existing schema. The addition of the new information does not in itself bring a change to the existing schema but needs to be adjusted, adapted to the old one. This adjustment is necessary because the old and new information present an incoherence that needs correction. The process of correcting this incoherence is labeled accommodation.

Accommodation

After taking in the new stimulus, individuals' cognitive structures notice the incoherence between the new and old information. Two options will be available: either a modification within the existing schema is operated in order to correct the old information by means of the new one, or a new schema is created. In both cases, we can say that accommodation comes into play here. It creates a wholly new schema to fit the new information or only modifies the incorrect conception imbedded in the old one.

The correcting effect of accommodation will lead the individual to engage in assimilation anew; the accommodated stimulus (the new one that is placed in a new schema or modified within the same schema) is assimilated in its modified form. Viewed through this angle, the assimilation-accommodation-assimilation process looks like machinery constantly classifying, reclassifying, organizing, re-organizing, constructing and reconstructing new stimuli within already existing schemata or inside new ones. All this process is a mental one, which signals the individual's current

[20] Ibid

level of understanding. However, if this current level of knowledge is indicative of how developed the schema is, it also means that, because of the constant construction and reconstruction, schemata are always approximate copies of reality, a relative representation of the environment. This is reason enough to say that learning is a life-long process.

Because of the idiosyncratic aspect of experiences, schemata differ from one individual to the other. Moreover, infants' schemata are primitive and global, i.e. not refined, whereas those of adults tend to be fine-tuned, rich of final information that successfully stand accommodation filtering. Adults' schemata are interconnected by means of nodes that establish smooth communication. The more interconnected the schemata are, the more cognitive development is assumed to have occurred.

Equilibration

Given that assimilation and accommodation jointly contribute to endow the schema with the ability to refine stimulus-generated information and, at the same time, to generalize upon the fine-tuned information, they (the two processes) reach a level where cognitive development attains stability, balance or what is commonly known as equilibration, or, as Piaget put it, equilibrium. How does this final stage occur? The assimilation—accommodation interplay looks like, so to say, a device that ensures self-regulation to take place in ways that stimuli are taken in, classified, corrected, and fine-tuned. The classification phase results in creating a generic image; correction is meant to re-classify it; the fine-tuning step gives still another detailed image of the stimulus, where differences and similarities emerge.

As much as assimilation and accommodation never stop operating, so does equilibrium. Equilibrium is dependent on the working of these two processes, which are inherent to human development and intellectual growth. Irregularities in either of the two processes would result in abnormalities in the intellectual growth. Equilibrium is revealed in the qualitative change that occurs in schemata, because it is the internal mechanism responsible for cumulatively coordinating, differentiating, integrating, constantly constructing knowledge, and developing the intellectual structures, as a consequence.

Lecture N° Fifteen

II.2.2 Piaget's developmental stages theory

Given Piaget's conception about learning being the outcome of a constructive process whose aim is to bring modification, change and development of the schema by means of assimilation—accommodation—equilibration interplay, the developmental stages suggested play the role of displaying a time-line along which these three process operate. The developmental stages theory is a means through which one could see how learning is articulated through the different periods (stages) humans cross from infancy to adulthood. Piaget regards the schemata development to be proportionate to the degree of intelligence humans attain at given stages of life.

The time frame suggested by Piaget starts from age zero after birth and stretches over periods the last of which displays a full-blown intellectual maturity. The following table[21] shows the different stages that humans go through:

Table.1 Developmental Stages

Period	*Age*	*Characteristics of the stage*
Sensori-motor	0–2 years	Simple reflexive behavior gives way to ability to form schemas and to create patterns and chains of behavior. Over time children come to realize that objects exist even if they cannot be seen.
Pre-operational	2–7 years	Children are essentially egocentric and unable to consider events from another's point of view. The use of symbolic thought begins and the imagination also begins to develop.
Concrete operational	7–11 years	Children begin to use logical thought about physical operations; they are able to conserve – that is, they realize that two equal physical quantities remain equal even if the appearance of one changes.

[21] *Ways of Learning. Learning theories and learning styles in the classroom*, by Alan Pritchard. Routledge Second edition. 2009.

Formal operations	11+ years	Children are able to think hypothetically and abstractly, although this is limited by lack of depth and breadth in knowledge.

It is worthwhile to note that, whereas these developmental stages focus on broadly delineated periods that humans go through in developing their intellectual growth, the schema-assimilation-accommodation-equilibration interplay is not confined to them. These processes accompany humans all through life. However, the merit of the developmental stages lies in shedding light on how these four processes could possibly be mapped on the different periods of infancy, early childhood, and youth. This model, though in miniature size, might be helpful to understand cognitive processes common to humans at large. It could also be helpful to teachers in order for them to structure their teaching according to the developmental stages their learners are at.

As shown in Table 1 above, the first stage might correspond to the reflexive status of schemata. It could also refer to the absence of displacement in infants whose age is comprised between zero and two years, a stage at which infants adhere to the 'out-of-sight-out-of-mind' frame. It is only by the end of this period that infants start to 'think' that absent objects could be found somewhere around. They will reach a level of understanding that if something is not available here and now, this does not mean that it could not be somewhere else.

During the second stage, i.e. Pre-operational stage, between the age of two and seven, children are said not to possess a theory of mind, because they are centered on their ego and unable to conceive of events to be understood (or even happen) from a different viewpoint, other than theirs. However, children are said to start making use of symbols; language being a system of signs symbolizing thought, behavior, and experience, it stands in central position in the child's cognitive/intellectual development. Once they reach the age between seven and eleven, children are said to leave this stage and step into the concrete operational period.

The concrete operational period is comprised between the age of seven and eleven. The ego-centeredness that characterizes children in the previous age now steps aside to leave space for less self-centeredness where children start thinking logically based on the manipulation of concrete objects to do so. This ability to use rationality (the logical thinking) and manipulation of concrete, visible, observable objects is a sort of prelude to the next, and last, period that Piaget names the formal operational stage.

The formal operational stage, comprised between eleven and fifteen years of age, is the period at which children are able to engage in abstract thinking, where they deal with ideas and reason in hypothetical manners. This ability reminds us of the famous statement of Piaget about children being 'lone scientists': noticing puzzling situations, children attempt answers which they check through testing.

These four stages could not mark children's intellectual development without positively impacting their schemata. The positive impact of schemata results in the latter growing in complexity and connectivity with the other schemata that form a network of interconnections through a multitude of nodes. According to Piaget's theory, it is this interconnectedness which reveals the level of intelligence in the last stage and beyond, later on in adult life.

II.2.3 Instructional Implications of Piaget's Theory

Classroom practice that is aligned along Piaget's theory may be labeled as both constructivist and interactionist. Being characterized by both tendencies, instruction in language teaching/learning is said to derive from approaches that favor the learner's active construction of his/her own knowledge. Viewed from this perspective, the learner stops being considered as a passive recipient of whatever knowledge the instructor provides him with.

In the previous Chapter, Behaviorism could be exemplified by the Grammar-translation and Audio-lingual methods, where the teacher is vested with the authority to lead the lesson, leaving a next-to-zero active involvement of the learner. As to the method inspired by Chomskyian Innatism, the learner

is expected to invest in his ability for induction to sort out the principles; the learner here does not rely on any of the instructor's roles in direct intervention. However, researches conclusively proved that such ambitious expectations were helplessly unfruitful.

The Natural Approach has as well shown its weaknesses. Relying heavily on meaning, it missed to emphasize the important part of the syntactic mechanisms that the learners should equally focus on. The interactionist—constructivist perspective could be viewed as a means to bridge the gap between the two extremes (Behaviorism and Innatism) as much as it allows for the inclusion of both form and meaning. Expressed in the vey terms of Martin East, interactionist—constructivist "perspective on learning allows for a classroom balance between teacher-led moments and learner-centered exploration and experimentation. Interactionism recognizes that each learner is unique and that the relative balances between teacher-led and learner-centered might vary according to students' perceived and actual needs"[22] (p. 170).

Defined as such, the interactionist—constructivist perspective could be represented by Task-Based Language Teaching (TBLT, for short). This approach highlights the learner's agency alongside the teacher's supportive and facilitative roles. Within thin view, the learners are given enough chance to build their own meanings either individually or in a pair of group-work setting. According to Piaget's view, the construction of knowledge must be individual, where the learner is led through an instructional path that crosses Assimilation, Accommodation, and Equilibration trajectory. The learner will be put in learning situations that allow him re-adjust his schemata according to the novelty-challenge that he/she faces, thus contributing in developing his schema, hence intellectual growth, or intelligence.

The concrete realization of the Assimilation, Accommodation, and Equilibration process may be through experiential learning where the learner will behave just like a "lone scientist", drawing his innate propensity to hypothesize that is triggered by the equally tendency to questioning. In so doing, the interactionist—constructivist perspective may satisfy the

[22] *Foundational Principles of Task-Based Language Teaching*, by Martin East, First published 2021 by Taylor & Francis, Routledge

requirement of learner-centeredness pedagogy which, in its turn will encourage a form of unguided learning. This apparently smooth transition from the large frame of Assimilation, Accommodation, and Equilibration interplay, through hypothesis making and ending with discovery-based unguided learning is expected to endow the learner with the capacity to make his own knowledge and turn instruction a sort of learner-centered classroom practice.

TBLT tasks seem to perfectly serve Piaget's theory of learning in that they are characterized by the following features[23], reached during experiments carried out throughout the world:

- The form focus in TBLT takes place "in context, embedded in meaning-based activities, not in separate drill-and-kill sessions"
- In TBLT the teacher's role is purely supportive and never directive,
- During-task teacher intervention and feedback might not only be reactive (……) but also proactive, utilizing both implicit and explicit feedback strategies and, on occasions, directly teaching about an aspect of language. Furthermore (…..) opportunities arise in TBLT for the explicit teaching of language not only post-task, but also pre-task.
- TBLT tasks are seen as to promote student engagement and risk-taking, with evaluations revealing "that students like tasks," and course results indicating "that students learn from tasks" (courses for Slavic languages)
- They are perceived as "a tool that helps [students] carry out specific real-life activities" , contributing to a course that was seen by students as "engaging and informative,""really fun," and "very interesting" (courses for Spanish)
- They are regarded as "an excellent choice to motivate students and promote higher levels of proficiency," creating "a low-anxiety learning environment where students can try out their ideas and practice their language to develop confidence" (courses for Japanese).

Below is offered an activity related to schema, the Piagetian construct that is pivotal in understanding cognitive development and intelligence in children. Work in groups or pairs to work out the possible connections that were born out of the child's lived experience. You should bear in mind that those balls

[23] Ibid (pp.178/179)

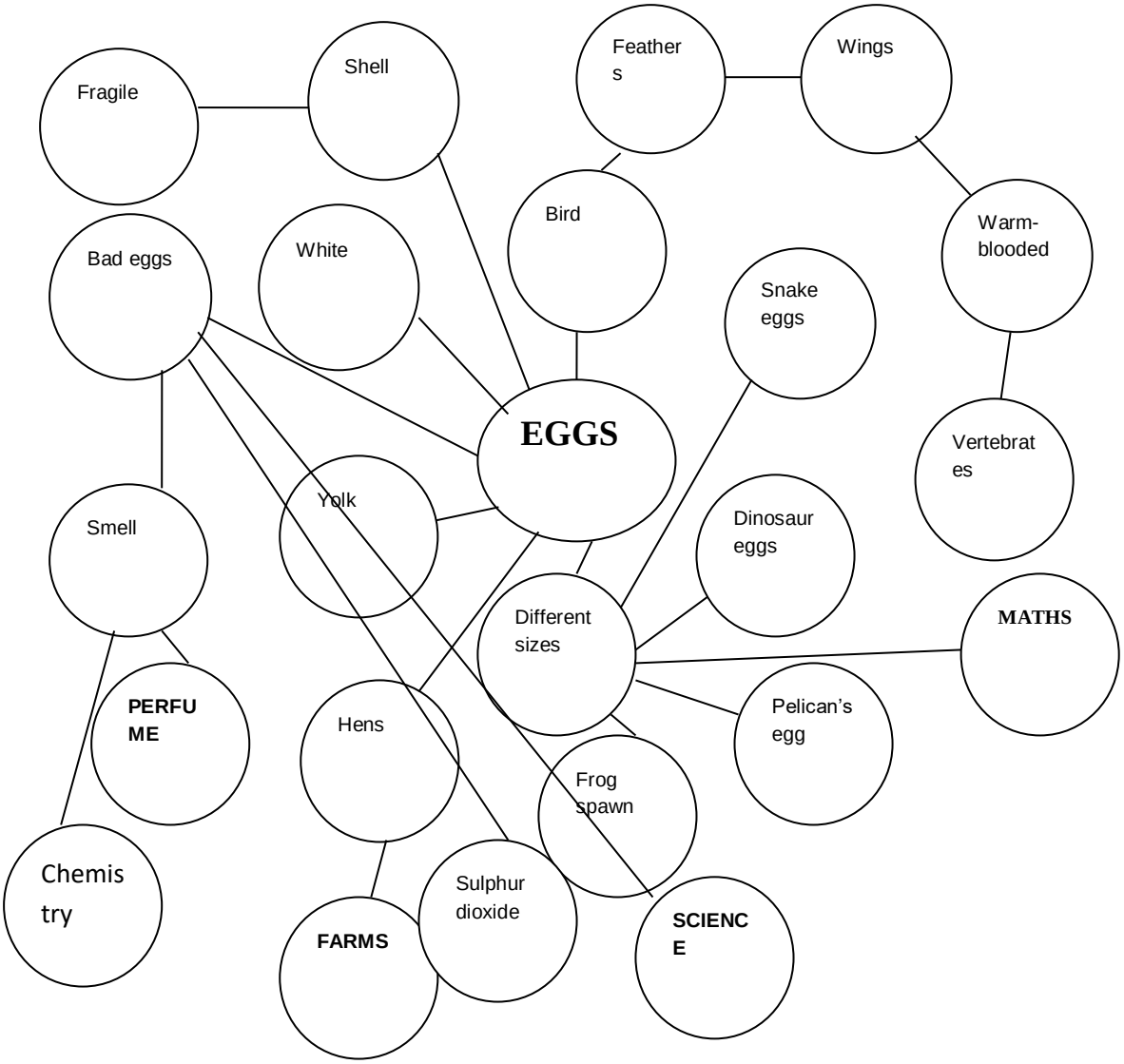
represent nodal points that connect with each other to shape up a network that keeps growing the more the child engages in life/learning activities. This phenomenon is differently perceived and theorized by schools of psychology, but in Piaget's paradigm, it seems to reveal how intelligence grows.

Activities around Piaget's Schemata

Given that schemata are known to be characterized by the following features:

1) **General**: a schema may be used in a wide variety of situations as a framework for understanding incoming information.
2) **Knowledge***:* a schema exists in memory as something that a person knows.
3) **Structure***:* a schema is organised around some theme.
4) **Comprehension***:* a schema contains slots which are filled in by specific information.

Comment on the following chart that contains schemata intertwined with other sub-schemata around the word EGG.



CHAPTER THREE

II.3 Social Constructivism

Learning outcome:

- Grasp the major concepts that pin down Vygotsky's Learning Theory.
- Understand Vygotsky's Social Constructivist Theory of Learning.
- Compare and contrast Vygotsky's theory with Piaget's with regard to how cognitive development occurs.

Lecture N° Sixteen

II.3.1 Vygotsky's Theory of Learning

Vygotsky's whole work rests on a number of notions and concepts that frame his theory within social contexts. The following notions are his major novelties:

1) Mediated learning
2) The role of the sign as a mediatory element in learning
3) The Zone of Proximal Development (ZPD)
4) Scaffolding

As much as Piaget characterized intelligence as being the resulting product of the schematic development due to the assimilation-accommodation-equilibration interplay, so does Vygotsky as he criticized the psychometric measures in identifying intelligence. He considers that socio-cultural contexts are necessary for learners to develop their intelligences and be evaluated accordingly.

Vygotsky, relying on human development through history, supplies examples of the mediatory tools that man has used in order to master his environment. He says that although man is not the strongest creature on earth, yet he has been able to create the crane by means of which he has become able to lift the heaviest creature such as the elephant; the degree of strength was reached because of the mediatory role of the crane. Likewise, learning should

depend on the mediatory role of the sign, represented by the token, the cultural artifacts. Language, for Vygotsky, being a system of signs, stands good chances to be an effective cultural mediatory artifact. The use that should be made of this mediatory sign, i.e. language, is through dialogue.

Based on the mediatory role of the language as a system of signs, along with other mediatory signs, Vygotsky suggests his famous Zone of Proximal Development (ZPD). This zone is metaphorically termed as a given moment of the learner's development where he/she is not able to accomplish a task that a little bit harder. He then needs accompaniment of an elder person or a more knowledgeable individual to help him/her cross his present moment zone to an upper one. This Vygotskyan construct is thus described by Richard D. Parsons *et al.*[24] :

> *Vygotsky believed that children are often at a cognitive level where they can solve problems independently. He termed this level as the zone of actual development. In contrast, he believed that there are times when a child can solve problems with support, and this he identified as the zone of proximal development. From this perspective, he posited that learning takes place when the child is working in her zone of proximal development. Tasks within this zone are ones that the child is not yet capable of doing herself, but can be accomplished if she is given assistance by a peer or teacher.(…) reading words with single vowels is too easy. However, reading words with multiple syllables and consonant blends is too hard. Following Vygotsky's lead, the area in which learning will take place, the child's zone of proximal development, is somewhere in between these two. That is, learning is most likely to take place if the child is given the opportunity to read words with two vowels together and at the same time have access to peer or teacher assistance.* (pp. 54/57)

This quotation reveals how Vygotsky's theory of learning is permeated with socio-cultural concerns. Language being a cultural system of signs that is fraught with socio-cultural elements, it is made use of through dialogue to help

[24] Educational Psychology : a practioner-research model of teaching, by Richard D. Parsons, Stephanie Lewis Hinson, and Deborah Sardo-Brown, Ruth Doyle, Casper College, 2000

the learner cross his/her present-moment zone to access a higher, more demanding zone.

Noticing how learners, at an early age, self-talk while busy solving learning tasks, Vygotsky suggests to exploit this private talk in order to turn shared knowledge into a personal one. This should take place through dialogue between peers, the teacher, the parents or any grown-up individual likely to help the child cross his/her present-moment zone to move to the upper one. Still, Vygotsky argues that during the dialogue, learners will incorporate their interlocutors' speech into their own, thus developing their cognitive capacities. According to this view, dialogue and discussion become highly important means by which learners access more demanding learning tasks.

The facilitating role of care-takers, teachers, peers or any grown-up person during ZPD is seen as a means to pave the way to the other Vygotskyan construct: scaffolding. This construct consists in supplying the learner with support at the appropriate time and according to the level of sophistication the task requires. The frame within which this support is brought should be through discussion, hints and prompts (list of words, images, signs, graphs, or any realia likely to suggest solutions). Moreover, learners, according to Vygotskyan theory, would do better if they work in groups or pair-work setting.

However, the more the learners show capacities to do well, the less the current scaffolding elements are used or relied on. The process of relying on supportive scaffolding is of a changing character, that is, the elements that constitute scaffolding are selectively chosen according to the level of performance the learners attain. It is worthy of notice that Vygotsky is deeply concerned with the socio-cultural perspective through which he seems to perceive learning. This is visible in the stress that he puts on group and pair-work, dialogue, the use of mediatory signs, among which language is given pride of place. All this wealth of means contribute in boosting the learners cognitive growth and development.

Going through the ZPD, assisted by the scaffolding process, learners are expected to pass through various stages, each requiring specifically appropriate means of support. These various stages conclusively contribute to the

development of the cognitive capacities of learners. But the cognitive development of learners is highly dependent on the latter socio-cultural stock, in ways that the activities assigned should allow for the prevailing social context and culture.

Socio-cultural theories, including Vygotsky's socio-constructivist theory of learning, believe in the co-evolutionary history of thinking and speaking. This is why Vygotsky contends that discussion and dialogue help learners internalize the interlocutors' language into theirs and, consequently, manage to gain control over their mental processes. This situation allows also the learners to co-construct their knowledge in collaboration with the other members of the group. This control of the mental process leads also to the learners being able to organize their knowledge.

As students in Master Degree applied linguistics studies [at Yahia Fares University, Medea], you need to focus more on the application of Vygotsky's theory of learning specifically on learning English. In light of Vygotsky's theory of learning, English as a foreign/ second language is learned along the lines advocated by the larger frame of socio-cultural perspective. In *How Languages are Learned* [25] is introduced the concept of 'collaborative dialogue', borrowed from Swain and Lap Kin's experiments carried out on learning a foreign language (French) in an immersion context. They concluded that the learners "co-construct linguistic knowledge while engaging in production tasks (i.e. speaking and writing) that simultaneously draw their attention to form meaning." (p.48) They also noticed that learners engaged in hypotheses testing about the linguistic forms they were using, thus organizing their knowledge.

Collaborative dialogue as it is applied here leads to combine both language learning and language use; this is due to the process being focused on "language output" (i.e. speaking and writing), rather than on "language input" that is provided by the teacher and/or the program sources. What is noticeable here is how language use mediates language learning within a socio-cultural context immediately recognizable by the learners and appealing to them. This

[25] *How Languages **are Learned***, by Patsy M Lightbown and Nina Spada, Third Edition, OXFORD UNIVERSITY PRESS. 2009.

way of doing activates the learners' cognitive processes due to the linguistic activities are mediated by the immediate social and cultural context.

PART THREE

CHAPTER ONE

III.Social Cognitive Learning Theory

Learning outcome:

1) Acquiring the basic concepts specific to Bandura's SCLT
2) Linking Bandura's theory to Behaviorism and cognitivism
3) Positioning learning in social settings, thus making a link between Bandura's theory and Vygotsky's

Lecture N° Seventeen

III.1 Bandura's Social Cognitive Learning Theory

Albert Bandura was born December 4, 1925. He received his bachelor degree in Psychology from the University of British Columbia in 1949. He went on to the University of Iowa, where he received his Ph.D. in 1952. It was there that he came under the influence of the behaviorist tradition and learning theory. Noticing the irreconcilable conflict opposing those theories advocating exclusively inner drives for learning and those that championed external environment which, for them, were the only means by which science could account for learning, Bandura chose to adopt, so to say, a third way. Having a behaviorist background, he shifts the focus onto the inner drives of humans as they are exposed to the external environment.

The very name of Bandura's theory (i.e. social and cognitive) is indicative of how cognition is developed within social environments. The social context then is viewed as a catalyst that both inhibits and promote learning. However, Bandura pins down his theory by means of some assumptions, which are:

III.1.1 Some basic assumptions of Bandura's SCLT.

- People can learn by observing others;
- Learning is an internal process that may or may not result in a behavior change;

- Learning can occur without a change in behavior (Observation without imitation).

Regarding behavior, Bandura's basic assumptions of SCLT are thus presented:

- ✓ Behavior is directed toward particular goals;
- ✓ Behavior eventually becomes self-regulated;
- ✓ Cognition plays a role in learning.

These assumptions cover both cognition and behavior, thus bridging the gap between behaviorist views on behavior and the cognitivists' views on cognition.

As is the case with all paradigms, SCLT contains some principles which clarify the scope of Bandura as concerns how learning occurs. SCLT's principles are:

III.1.2. SCLT's Principles

In order for learning to occur, there should be a reciprocal interaction between three elements:

- Personal Factors;
- Behavior;
- The environment

Named ***triadic reciprocality***, this principle holds that individuals tend to create their favorable environments in order to have control over them. This tendency to create and control the environment is dependent on how these individuals perceive themselves; how these individuals value their capacities. One can easily view how the interplay of the triadic reciprocality's elements interact, giving off a holistic conception of learning in Bandura's SCLT.

Assuming that SCLT's assumptions and principles are valid, Bandura contends that individuals are naturally driven to attain self efficacy. The self efficacy notion is said to be central to SCLT theory as it highlights the human tendency to have control over their environment, thus reaching awareness of how they are efficacious. Through self

efficacy individuals self regulate their learning process. This is reminiscent of Piaget's notion of children being 'lone scientists'.

Within this view, framed by the assumptions and principles of SCLT, human learning occurs in social contexts, be they represented by the school microcosms or in society at large. Francesca Bin[26], in her Master Thesis, drawing on Bandura's theory, describes learning in these terms:

• Learning can occur by observing others' behaviors and the resulting outcomes;

• Learning can occur cognitively without a corresponding change in behavior;

• Modeled behavior is reinforced by producing desirable outcomes (for both the observed party and the learner);

• Three variables in the social learning context, the learner, the behavior, and the environment, can influence each other.

These four characteristic features of learning occur in society. This is reminiscent of Vygotsky's socio-constructivist theory where learning is said to be more effective in social environment through dialogue (language) and the assistance of the supporting effect of mediation and ZPD. Within the scope of SCLT, individuals learn new behaviors by observing others' behaviors and imitating them. They could also learn by direct experience without going through the often tiring maze of memorizing. This is named the observational learning.

Observational learning is often based on the famous five-ape experience. Based on this experiment human behavior in social contexts is said to parallel the following experiment:

> *A researcher puts five monkeys in a cage. There's a bunch of bananas hanging from a string, with a ladder leading to the*

[26] Bin, Francesca, Master's Degree Programme – Second Cycle (D-M. 270/2004) in Economia e Gestione delle Aziende, Curriculum International Management Final Thesis Digital Learning within an Organization: the case of MARKETERs Club. 2014/2015

bananas. When the first monkey goes for the bananas, the researcher sprays all five monkeys with freezing water for five minutes. Some time later, when a second monkey inevitably tries to go for the bananas, the researcher once again sprays all five monkeys with the cold water for five minutes. The researcher then puts the hose away and never touches it again. But, when a third monkey tries to go for the bananas, the other four attack him to prevent him from climbing that ladder. They are afraid of the punishment that may come. Then, the researcher replaces one of the monkeys with a new monkey who wasn't part of the original experiment and was never sprayed with water. And, as soon as he touches the ladder to go for the bananas, the other four monkeys attack him to keep him from doing so. If he tries again, they attack him again. Thus, the new monkey learns not to go after the bananas because he'll get attacked if he does. The researcher replaces a second monkey with another new monkey. When this monkey goes for the bananas, the other four attack him, including the new monkey who was never sprayed with water. *The researcher then continues to replace all the monkeys one at a time, until all five of the original monkeys are removed from the cage. Each time the newcomer goes for the bananas, the others attack, even when they, as new monkeys, have never received punishment for going after the bananas. And thus, the new monkeys, who have never been sprayed with cold water, learn not to go after the temptation of the bananas. The researchers hypothesize that, if they were to ask the monkeys why they don't go for the bananas, they'd answer "because that's the way it's always been done".*

This experiment illustrates the views of Bandura about social learning is all about. He contends that we can learn from our **interactions** with others in a social context. By observing the behaviors of others, individuals develop similar behaviors. This learning is accompanied by **assimilating** others' behavior then **imitating** them. According to

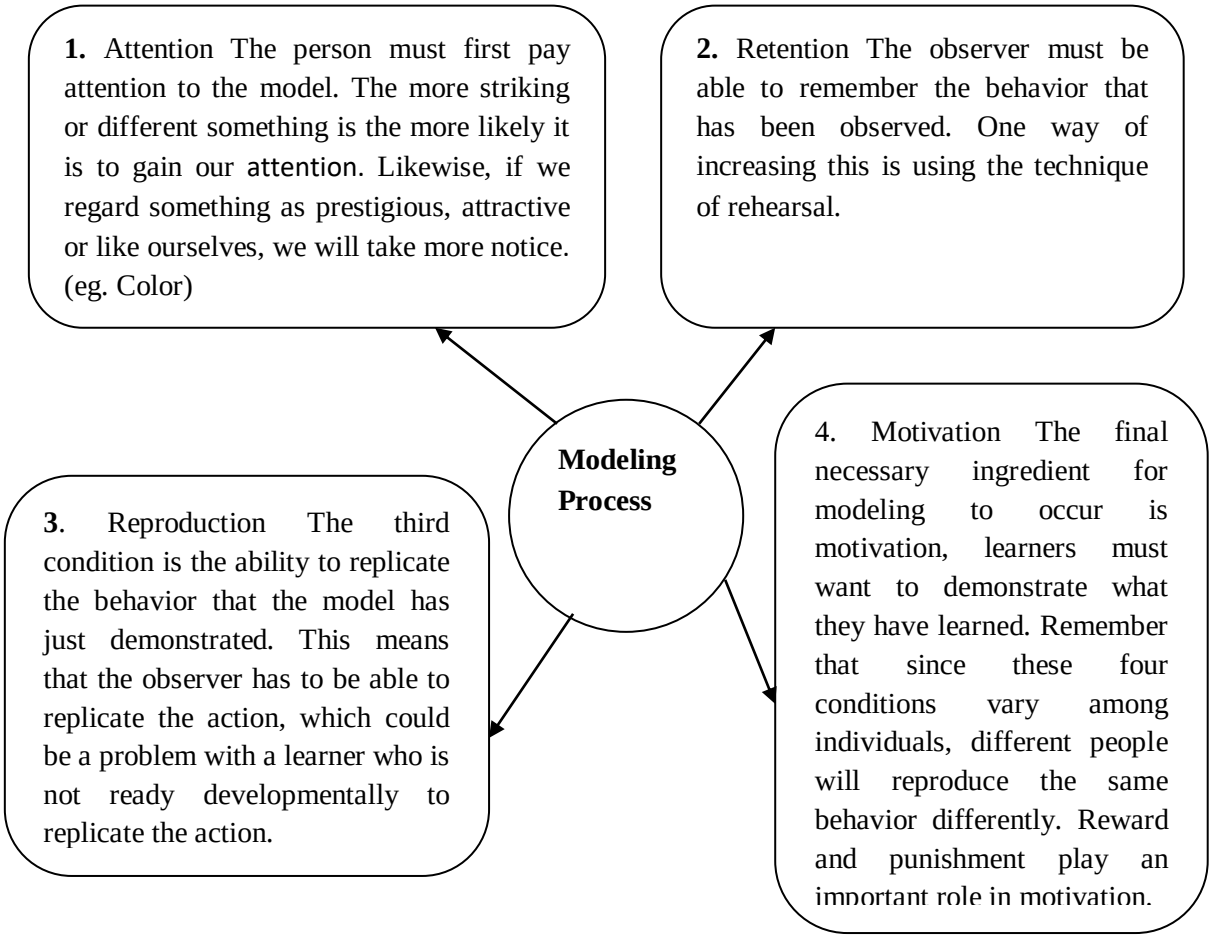
Bandura, imitation involves the actual reproduction of observed motor activities, especially if their observational experiences are positive ones or include rewards related to the observed behavior. It needs to be underlined that Bandura believes that direct reinforcement could not account for all types of learning, thus parting ways with Thorndikes's theory, and consequently with behaviorism altogether. Again, assimilation and imitation are not limited to learning motor behaviors only but are extended to knowledge in general.

Lecture N° Eighteen

In addition to **assimilation** and **imitation**, a third element comes into play in learning: **modeling**. Modeling process is thus depicted:

Modeling Process

The modeling process consists of **four** conditions, i.e., **attention**, **retention**, **reciprocation** and **motivation**.



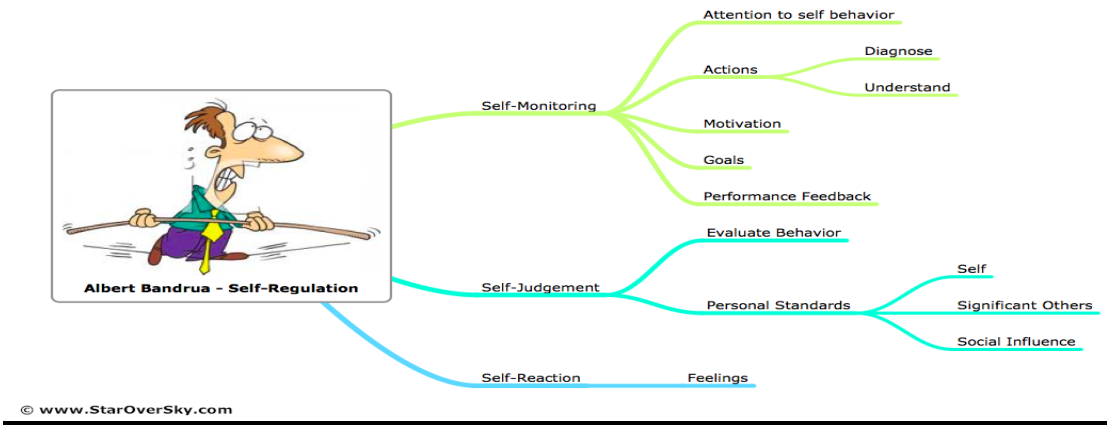
III.1.3. Self-efficacy and SCLT

rather than something to be avoided while the people with ***weak efficacy*** more likely **What is Self-efficacy?** It refers to **an individual's belief in his or her capacity to execute behaviors necessary to produce specific performance attainments.**

Self-efficacy beliefs exert their diverse effects through **cognitive**, **motivational**, **emotional**, and **decisional** processes. Efficacy beliefs affect whether individuals think optimistically or pessimistically, in self-enhancing or self-debilitating ways. They play a central role in the self-regulation of motivation through goal challenges and outcome expectations. (Mark & Campbell, 2011). On this regard self efficacy lies at the center of SCLT and shows that beliefs about one's ability or capacity influence the way one executes a behavior successfully. Moreover, it clarifies that people tend to engage in activities based on their sense of competence &/or past success.

Researches concluded that people with ***high efficacy*** are more likely to view difficult tasks as something to be mastered to avoid challenging tasks and finally they focus on personal failings and negative outcomes.

Self-regulation and SCLT



Lecture N° Nineteen

III.1.4. Educational Implication

As the SCL Theory emphasizes social environment, assimilation, imitation, and modeling, educators need to provide in their classroom practice three types of models:

1) A live model, which involves an actual individual demonstrating or acting out a behavior.

2) A verbal instructional model, which involves descriptions and explanations of a behavior.

3) A symbolic model, which involves real or fictional characters displaying behaviors in books, films, television programs, or online media.

Authentic material, group work, and full involvement in the learning/teaching process are key means to working within the framework of SCL Theory.

As this theory focuses on (1) assimilation, (2) imitation and (3) modeling, instructors need to diligently prepare the instructional input in order for the learners to safely cross the three phases. These founding principles, if respected, will lead the learners reach that plane of self-efficacy where (1) cognition, (2) motivation, (3) emotion, and (4) decision making will interact in a balanced way, leading to self-regulation.

To do so, instructors are called upon to selectively include in their classroom practice authentic material, covering both oral/aural and written resources. This kind of material should be pragmatic-oriented so as to present the learners with models that appeal to the learners in ways likely to allow them assimilate, imitate and be modeled along them. It would also help the instructors distance their practice from traditional, tedious ways of teaching by the old methods. CBA, it seems, stands good chances in this respect as it encourages authenticity, life-like classroom situations, and life-like problem-solving situations.

CHAPTER TWO

III.Multiple Intelligences Theory

Learning outcome:

1) Acquiring the basic concepts specific to Multiple Intelligences Theory
2) Comparing Howard Gardner's MI theory to Vygotsky's and Bandura's theories.
3) Positioning learning within Gardner's paradigm.

Lecture N° Twenty.

III.1. Multiple Intelligences Theory, by Howard Gardner

To grasp what Multiple Intelligences Theory consists of, it would be more informative to refer to its founder's writing. Below is a three-page section extracted from Howard Gardner's *Multiple Intelligences New Horizons* [27], (pp.3/6). Under the section's title IN A NUTSHEL, Gardner presents us with a historical view of how Intelligence used to be perceived and dealt with by psychologists prior to his groundbreaking paradigm. Binet, a French psychologist used to treat intelligence in a way that Gardner disapproved of, thus suggesting a new view and conception.

In a Nutshell

'The original scene: Paris, 1900—La Belle Epoque. The city fathers approached a talented psychologist named Alfred Binet with an unusual request. Families were flocking to the capital city from the provinces, and a good many of their children were having trouble with their schoolwork. Could Binet devise some kind of a measure that would predict which youngsters would succeed and which would fail in the primary grades of Paris schools?

As almost everybody knows, Binet succeeded. In short order, his discovery came to be called the "intelligence test"; his measure, the IQ, for "intelligence quotient" (mental age divided by chronological age and multiplied by 100). Like other Parisian fashions, the IQ soon made its way to the United States, where it enjoyed a modest success until World War I, when

[27] *Multiple Intelligences New Horizons*, Howard Gardner, Published by Basic Books A Member of the Perseus Books Group

it was used to test over one million American military recruits. With its use by the U.S. armed forces, and with America's victory in the conflict, Binet's invention had truly arrived. Ever since, the IQ test has looked like psychology's biggest success—a genuinely useful scientific tool.

What is the vision that led to the excitement about IQ? At least in the West, people had always relied on intuitive assessments of how smart other people were. Now intelligence seemed to be quantifiable. Just as you could measure someone's actual or potential height, now, it seemed, you could measure someone's actual or potential intelligence. We had one dimension of mental ability along which we could array everyone.

The search for the perfect measure of intelligence has proceeded apace. Here, for example, are some quotations from an advertisement for one such test:

> *Need an individual test which quickly provides a stable and reliable estimate of intelligence in four or five minutes per form? Has three forms? Does not depend on verbal production or subjective scoring? Can be used with the severely physically handicapped (even paralyzed) if they can signal yes or no? Handles two-year-olds and superior adults with the same short series of items and the same format? Only $16.00 complete.*

Now, a single test that can do all that is quite a claim. American psychologist Arthur Jensen suggests that we could look at reaction time to assess intelligence: a set of lights go on; how quickly can the subject react? British psychologist Hans Eysenck recommends that investigators of intelligence look directly at brain waves. And with the advent of the gene chip, many look forward to the day when we can glance at the proper gene locus on the proper chromosome, read off someone's IQ, and confidently predict his or her life chances.

There are also, of course, more sophisticated versions of the IQ test. One of them is the SAT. Its name originally stood for Scholastic Aptitude Test, although with the passage of time, the meaning of the acronym has been changed—it became the Scholastic Assessment Test, and, more recently, it has been reduced to the plain old SAT—just the initials. The SAT purports to be a similar kind of measure, and if you add up a person's verbal and math scores,

as is often done, you can rate him or her along a single intellectual dimension. (Recently, writing and reasoning components have been added.) Programs for the gifted, for example, often use that kind of measure; if your IQ is in excess of 130, you're admitted to the program—if it's 129, "Sorry, no room at the inn."

Along with this one-dimensional view of how to assess people's minds comes a corresponding view of school, which I will call the "uniform view." A uniform school features a core curriculum—a set of facts that everyone should know—and very few electives. The better students, perhaps those with higher IQs, are allowed to take courses that call on critical reading, calculation, and thinking skills. In the uniform school, there are regular assessments, using paper and pencil instruments, of the IQ or SAT variety. These assessments yield reliable rankings of people; the best and the brightest get into the better colleges, and perhaps—but only perhaps— they will also get better rankings in life. There is no question that this approach works well for certain people—schools such as Harvard and Stanford are eloquent testimony to that. Since this measurement and selection system is clearly meritocratic in certain respects, it has something to recommend it.

The uniform school sounds fair—after all, everyone is treated in the same way. But some years ago it occurred to me that this supposed rationale was completely unfair. The uniform school picks out and is addressed to a certain kind of mind—we might call it provisionally the IQ or SAT mind. I sometimes call it the mind of the future law professor. The more your mind resembles that of the legendary law professor Dr. Charles W. Kingsfield Jr., played on-screen by John Houseman in *The Paper Chase*, the better you will do in school and the more readily you will handle IQ-SATtype measures. But to the extent that your mind works differently—and not that many of us are cut out to be law professors—school is certainly not fair to you.

I would like to present an alternative vision—one based on a radically different view of the mind, and one that yields a very different view of school. It is a pluralistic view of mind, recognizing many different and discrete facets of cognition, acknowledging that people have different cognitive strengths and contrasting cognitive styles. I introduce the concept of an individual-centered school that takes this multifaceted view of intelligence seriously. This model

for a school is based in part on findings from sciences that did not even exist in Binet's time: cognitive science (the study of the mind) and neuroscience (the study of the brain). One such approach I have called the theory of multiple intelligences. Let me tell you something about its sources and claims to lay the groundwork for the discussions on education in the chapters that follow.

I introduce this new point of view by asking you to suspend for a moment the usual judgment of what constitutes intelligence, and let your thoughts run freely over the capabilities of human beings—perhaps those that would be picked out by the proverbial visitor from Mars. Your mind may turn to the brilliant chess player, the world-class violinist, and the champion athlete; certainly, such outstanding performers deserve special consideration. Are the chess player, violinist, and athlete "intelligent" in these pursuits? If they are, then why do our tests of "intelligence" fail to identify them? If they are not intelligent, what allows them to achieve such astounding feats? In general, why does the contemporary construct of intelligence fail to take into account large areas of human endeavor?

To approach these questions I introduced the theory of multiple intelligences (MI) in the early 1980s. As the name indicates, I believe that human cognitive competence is better described in terms of a set of abilities, talents, or mental skills, which I call *intelligences*. All normal individuals possess each of these skills to some extent; individuals differ in the degree of skill and in the nature of their combination. I believe this theory of intelligence may be more humane and more veridical than alternative views of intelligence and that it more adequately reflects the data of human "intelligent" behavior. Such a theory has important educational implications.'

Lecture N° Twenty-One

III.1.1 Presenting the nine types of Intelligence

Howard Gardner's multiple intelligence theory (1993) proposes the idea that we all have various levels of intelligence across a range of intellectual areas. **Gardner**'s theory comes in part out of a concern that when intelligence is measured, the most commonly used tests (standard verbal and non-verbal reasoning tests) often do not allow those tested to demonstrate what they are

really good at or where their intelligence lies. **Gardner** gives us a set of different *intelligences* which, as individuals, we display more or less of, according to our particular intellectual make-up.

III.1.2. Multiple Intelligences Model for teaching literary texts

> *…as long as people are busy bashing teachers or saying that we can't try anything new because it might fail, then reform will be stifled as it has been in the past .*
> Howard Gardner

In an interview[28] posted on YouTube, Howard Gardner said : "We have this myth that the only way to learn something is read it in a textbook or hear a lecture on it, and the only way to show that we have understood something is to take a short-answer test or maybe occasionally with an essay question thrown in. Everything can be taught in more than one way, and anything that's understood can be shown in more than one way." This quote is characteristic of the multiple ways that many didactics-oriented scholars have repeatedly stressed, including Howard Gardner. He, however, highlights in particular the potential of drawing on the eight intelligences (plus a ninth one introduced in the subsequent developments of his model to ensure durable and effective learning). Similarly, as much as Lev Vygotsky stresses metacognition to bring to the students 'consciousness the multiple learning strategies so does Gardner, through suggesting his eight intelligences. Both scholars' theories attempted to free the academia of the shackles imposed by the psychometric measures of intelligence and Piaget's cognitive, yet individualistic, theory of learning[29].

Gardner, in *Frames of Mind*[30], laid the foundations for his Multiple Intelligences model by, first, distinguishing between the capacities and intelligences and then provided the criteria for selecting the intelligences that constitute the core of his work. He also supplied what he names innate 'proclivities' that signal every individual's natural inclinations with regard to the way he/she most naturally prefers learning. Elaborating on this idea,

[28] https://www.youtube.com/channel/UCdksaQxXH13BMeHo09MorBg
[29] *Vygotsky's Educational Theory in Cultural Context*. Edited by ALEX KOZULIN, BORIS GINDIS, VLADIMIR S. AGEYEV, and SUZANNE M. MILLER. 2003
[30] *Frames of Mind. The Theory of Multiple Intelligences* by HOWARD GARDNER, Published by Basic Books, 2011.

Armstrong Thomas, in his *Multiple intelligences in the classroom*[31], writes: "By the time children begin school, they have probably established ways of learning that run more along the lines of some intelligences than others". (P.32) Moreover, relaying Gardner's opinion concerning the ways and of identifying the types of intelligences, Armstrong writes: "I've often humorously suggested to teachers that one good way to identify students' most highly developed intelligences is to observe how they *misbehave* in class. The strongly linguistic student will be talking out of turn, the highly spatial student will be doodling and daydreaming, the interpersonally inclined student will be socializing, the bodily-kinesthetic student will be fidgeting, and the naturalistically engaged student might well bring an animal to class without permission! (….) "These intelligence-specific misbehaviors, then, are sort of a cry for help—a diagnostic indicator of how students want to be taught."(P.34)

Armstrong's advice, however, points to the, as yet, difficult task of ascribing to individuals their respective, innate intelligences; he also confirms the notion that every individual student possesses a highly developed intelligence, i.e., an overt intelligence, alongside other less developed ones, covert intelligences. The task of the instructor then lies either within what Armstrong suggests or in the diversification of the instructional input according to the number of intelligences that might possibly be available among the learners in his/her class. In this way, different learners' intelligences will be catered for.

[31] *Multiple intelligences in the classroom* by Thomas Armstrong. — 3rd ed. ASCD, USA, 2009.

Below is a list of Gardner's Intelligences, with examples pertaining to teaching activities, materials and strategies.

Table.2

Intelligences	**Teaching Activities (Examples)**	**Teaching Materials (examples)**	**Instructional Strategies**
Linguistic	Lectures, discussions, word games, storytelling, choral reading, journal writing	Books, tape recorders, typewriters, stamp sets, books on tape	Read about it, write about it, talk about it, listen to it
Logical-mathematical	Brainteasers, problem solving, science experiments, mental calculations, number games, critical thinking	Calculators, math manipulatives, science equipment, math games	Quantify it, think critically about it, put it in a logical framework, experiment with it
spatial	Visual presentations, art activities,	Graphs, maps, video, lego sets, art materials, optical illusions, cameras, picture library	See it, draw it, visualize it, color it, mind-map it
Bodily-kinesthetic	hands-on learning, drama, dance, sports that teach, tactile activities, relaxation exercises	building tools, clay, sports equipment, manipulatives, tactile learning resources	Build it, act it out, touch it, get a "gut feeling" of it, dance it
Musical	rhythmic learnings, rap ping, using songs that teach	tape recorder, tape collection, musical instruments	sing it, rap it, listen to it
Interpersonal	Cooperative learning, peer tutoring, community involvement, social gatherings, simulations	board games, party supplies, props for role-plays	teach it, collaborate on it, interact with respect to it
Intrapersonal	Individualized instruction, independent study, options in course of study, self-esteem building	self-checking materials, journals, materials for projects	connect it to your personal life, make choices with regard to it, refl ect on it
Naturalist	nature study, ecological awareness, care of animals	plants, animals, naturalists' tools (e.g., binoculars), gardening tools	connect it to living things and natural phenomena

As are presented in the table above, could be applied to diverse disciplinary contents. Instructors are thus offered an array of possibilities to draw on the innate capacities, or intelligences, to usher students to productively learn based on whatever intelligences they are born with.

III.1.3. Educational Implications.

There are certainly various educational implications in implementing Gardner's theory within educational systems. However, it would be safer to keep within Gardner's paradigm for it shows more clearly Gardner's own view of how his theory is applied and what the outcome could be. This is why is suggested below a five-page section taken from *Multiple Intelligences New Horizons*, mentioned earlier, to illustrate how Gardner limited the implications to three, that he qualified as key implications.

Three Key Educational Implications

Of the various educational themes in the MI world, three stand out in my own mind. They concern the individualization of teaching and assessment, the need to articulate educational goals, and the advantages of multiple representations of key concepts. I discuss each in turn.

Individual Centered Education

Most schools throughout history have been uniform schools: students are taught the same things in the same way and are assessed in equally similar manner. This approach is seen as fair—after all, everyone is being treated equal. Yet, as I have pointed out, this approach is fundamentally unfair. It privileges those who have strong linguistic and logical-mathematical intelligences, whereas it makes school difficult for the many among us who exhibit somewhat different intellectual profiles.

An individual-centered education is not one that is self-centered or narcissistic. Rather, it is an education that takes the differences among individuals very seriously. Educators attempt to learn as much as they can about the learning strengths and proclivities of each student. As far as possible, educators make use of this information to craft the optimal education for each child.

I have suggested three roles that could be used in individualized education. The job of the assessment specialist is to acquire as much information as possible about each child and present it to teachers, parents, and the child in ways that are readily grasped. There is no imperative to assess each child, however; when the child is thriving educationally, one should say a

prayer of thanks and move on to the next order of business. But when a child is having learning difficulties, it is important to understand his or her cognitive modes as accurately as possible.

The other two roles are brokering ones. The student-curriculum broker should match students with curricula (and, when possible, with appropriate assessments). When there are options—and I certainly favor some electives—the broker should recommend electives that might suit the child's intellectual profile. When there is a required curriculum—and I certainly favor some required courses—the broker should help the student find the best presentation of the curriculum. Everyone should study history and mathematics, but these topics need not be taught and assessed in a single way to all students.

The school community broker plays an analogous role outside the walls of the school. It is his or her job to expose the student (and the parents) to various vocational and a vocational options in the community that might appeal to a student with a given intellectual profile. Not everyone wants to be a law professor; and, indeed, not everyone can occupy any particular occupational niche. The chance for a child to explore options that might be congenial to his or her strengths and interests can spell the difference between a frustrating educational experience and one that has purpose.

Of course, most schools will not be in a position to hire individuals to fill these positions. That is why I refer to "roles" rather than "positions." It is up to teachers, parents, peers, and the broader community to see that these needs are met when it is not possible to hire people who are expert in these roles.

Now, Howard Gardner could write about individualized education for decades and it might have little impact. (That might not keep Howard Gardner from trying—he is a persistent fellow!) What *will* bring individualized education to the fore are powerful computer programs. Once it has been demonstrated that algebra can be taught three or even thirty ways, it will be malpractice to declare "Johnny could not learn algebra my way— bring me another child." With the patience and versatility of tomorrow's computers, many facets of these three roles will be within the grasp of educators everywhere.

The Priority of Educational Goals

When I travel, I am frequently greeted with the words, “I have an MI classroom,”or “We work in an MI school.” I am flattered by these words; wishing to be polite, I respond by smiling and saying, “That’s great. Thank you.” But what I am really thinking is something different.

MI theory is certainly relevant to education, but it is not in itself an educational rationale or goal. As I have noted earlier, the assertion that we as a species have a number of intelligences, and that individuals differ in their particular profiles, could lead to any number of educational practices, some of them actually contradicting others. A fact or a hypothesis about the human condition can never in itself dictate what to do on Monday morning or next year.

This point was brought home to me vividly in a conversation I had with Richard Herrnstein, senior author of *The Bell Curve* (1994), shortly before his death. We were discussing the implications of the claim in that book that psychometric IQ is difficult to change.Were that true, Herrnstein and I agreed, one could draw two diametrically opposed conclusions:

1. IQ is difficult to change, and so we should not bother.

2. IQ is difficult to change, and so we should devote all of our efforts to changing it. We might prove successful. Indeed, we might even discover a way to change it much more readily than anyone had anticipated.

It is no secret that Herrnstein and his coauthor Charles Murray were more sympathetic to the first conclusion and I to the second. But the important point is that we agreed that both inferences were possible. Indeed, in the late 1970s and early 1980s,Herrnstein himself joined a project called Project Intelligence, whose declared aim was to raise the intelligence of the entire Venezuelan population. Paradoxically, in that particular instance, Herrnstein was the enthusiast and I was the skeptic.

The general point is this: One can never go from a scientific finding to an educational practice. Any finding has a multitude of implications, not all of them consistent with one another.

Instead, I argue, we need to proceed by stating as clearly as possible, what our educational goals are. There are many goals from which we could choose: critical thinking, creative thinking, civil individuals in a civil society, an orientation toward service, knowing the major facts and ideas in several

disciplines, thinking well within disciplines, interdisciplinary thinking, mastering technology, immersion in the arts and humanities, cultivating the right questions, building on the strengths of each individual, and the like. Once we go beyond vapid generalities—to use our minds well, to be culturally literate—realistic and attainable goals are not easy to articulate, as I have frequently discovered. It is easier and more tempting to argue about practice. Should we track? Should we have bilingual classes? Should we have eighty-minute rather than forty-minute periods?

Alas, too many schools claim that they are achieving all of the goals I listed above. That omnibus claim cannot be true. One has to prioritize, one has to make tough choices. Just as one should find out what a school wants to achieve, one should ask the tougher question: "What is *not* a priority? What are you *not* trying to achieve?" If one seeks to be all things to all persons, the chances are high that one will not serve anyone well.

Returning to the phenomenon of MI classes and schools, I much prefer an exchange where an educator says to me, "My educational goal is X. I will know that I have achieved it when my students can Y. And here is how I propose to use the concept/theory/hypothesis/claim of multiple intelligences to help achieve that goal."

Multiple Representations of Key Concepts

I earlier discuss the educational goal that I most prize today: the ability of students to exhibit genuine understanding in a number of key disciplines. Far more important than the attainment of cultural literacy or factual mastery, I crave evidence that the student can think of and critique a scientific experiment; that the student is able to analyze a current event in terms of historical precedents and non- or pseudo-precedents; that the student can confront a work of art and illuminate its power and its modes of operation.

Even when the goal of disciplinary understanding is given high priority, it is difficult to achieve; and no doubt there are many ways to approach this goal. My own belief is that disciplinary understanding is most likely to be realized if educators focus on a manageable number of key concepts and explore them in some depth. Only under those conditions are the concepts likely to be understood. And in the process of deeply understanding gravity in physics, or revolution in history, or the transformation of a theme in a classical

fugue, the student gains an invaluable asset—significant exposure to the ways in which experts in that discipline think.

Here is where the idea of multiple intelligences can be of genuine benefit to educators oriented toward the goal of disciplinary understanding. Mastery of a concept or theory requires repeated exposure to that material: one almost never achieves instant understanding. But it is a mistake to present the same content in the same way. Understanding is far more likely to be achieved if the student encounters the material in a variety of guises and contexts. And the best way to bring this about is to draw on all of the intelligences that are relevant to that topic in as many legitimate ways as possible.

(….) I focus on the attainment of disciplinary understanding of a few key concepts. At this point, it suffices to make three points. First, approaching topics in numerous legitimate ways ensures that one will reach more students. Some students will learn from linguistic entry points, others from artistic or personal or logical entry points; indeed, some will learn one subject best via one entry point, another subject via another entry point. Second, these multiple approaches to a topic convey to students what it is like to be a disciplinary expert—indeed, any kind of an expert. An expert is distinguished by the fact that he or she can think of his or her topic or skill in a variety of ways. Finally, through these multiple approaches, one activates different clusters of neural networks. To the extent that numerous neural networks are activated, and eventually connected, one obtains a solid and enduring mental representation of the topic in question.

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