

## COGNITIVE THRESHOLDS AND ITS APPLICATION IN TESTING DIAGNOSIS

**Nsikak-Abasi Udofia**

Department of Educational Foundations, Guidance and Counselling,  
University of Uyo, Uyo,  
Nigeria

---

**ABSTRACT:** *The thresholds are the distinctive delimitation of concepts. It is applicable wherever and whenever a concept is defined. Phenomena, event, experiences, existence, and stimuli are subject to threshold laws. In this work the Threshold is classified into discrete, continuous, anecdotal, circumstantial, circumstantial, cooperate, transitional, or absolute forms. It has different categories and one of such is the Cognitive threshold which is the span or range within which any cognitive function can take place. The cognitive threshold can be affected by physical, biological, psychological, sociological, environmental factors. It is dynamic, is made up of factors and exists within range. It can be applied in Testing Diagnosis and in Learning.*

**KEYWORDS:** Cognitive Thresholds; Educational Measurement; Teaching; Learning

---

### INTRODUCTION

The thresholds are the limit within which events occur. They are Characteristics conditions under which an incident or the properties of a particular concept. Construct or law manifests. It is common in nature to recognize limits and recognize situations within which phenomena become overt. Such limits are the thresholds. This is so as there seems to be a universal law that things occur only under suitable conditions. Even life falls within a threshold of birth and death. One can literary cause any phenomenon to manifest if the thresholds are known. For instance, water is ice at 0 °C and steam at 100 °C if one heats water - a liquid to 100 °C; it will change its state to gas (steam). Laws controlling the manifestations of phenomenon hold as a function of the associated thresholds for such event. Events occur only when characteristically conditions are present; concepts are defined by properties which fall within some limits which if exceeded results in another concept.

The proponent of any law will provide the conditions under which the law holds. It is this condition that summarizes the concept of the threshold as the magnitude or intensity that must be exceeded for a certain reaction, phenomenon, result, or condition to occur or manifest. Differences between elements, variables, factors and constructs exist as results of the condition necessary for their manifestation. For instance, Isaac Newton in the theory of motion state that ‘every object persists in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed on it’ p 1 (Glen, 2016) . He propounded that if the force applied failed to meet the resultant force then the body will remain in the state of inertia. The resultant force necessarily to create motion is the threshold for motion to occur. On the other hand, Hooke’s law states that provided the elastic limit is not exceeded the extension produced is directly proportional to the Load added. This implies that Hooke’s law is applied within the elasticity limit which is the threshold. The threshold is the extent a particular event takes place under the available law or the limit which must be reached or present or exceeded before a particular phenomenon can take place. Einstein law of relativity

in particular shows that at certain thresholds matter is mass and at a certain threshold it is energy (Browne, 1999; Lubliner, 2008; Galili, & Tseitlin, 2003; Lewin, 1999; Woodhouse, 2003; Einstein, 1916; Will, 2010; Einstein, 1919).

The black law dictionary describe Threshold as Boundary or the Maximum or minimum value serving as a benchmark to compare and guide any breach that can cause a review of a situation in a system. The American heritage dictionary explain threshold as the point that must be exceeded to begin producing a given effect or result. Collin English dictionary regards it as any doorway or entrance, or the starting point of an experience, event, or venture or the strength at which a stimulus is just perceived. The random house English dictionary defined threshold as the point at which a stimulus is of sufficient intensity to begin to produce an effect for instance the threshold of consciousness or threshold of pain (Law Dictionary, 2016; American Heritage® 2011, Collins English Dictionary, 2014; Webster's College Dictionary, 2010; The American Heritage® Roget's Thesaurus, 2014; McGraw-Hill Dictionary, 2011; The American Heritage® Stedman's Medical, 2003)

Interestingly, in education threshold is not emphasized. Different learners come into the classroom with different thresholds for learning in addition to the threshold accounted for by the learning environment. For instance, there are many teaching methods which have been tested and found very efficient but the question is how efficacious are they in the face of individual differences varying circumstance and environmental variations? The individual differences in a class, is a function of the individual's threshold. Learners may change their behavior, but can only be measured or detected if appropriate threshold facilities are available. In other words, irrespective of the learning methods, if the threshold condition is not in compliance with the threshold of the learner there will be no measurable change in behavior. Any lesson makes sense if the change in behavior is measurable with the available instrument. With the threshold principle there is some form of learning anytime there is interaction in a classroom, but there must be adequate threshold in the learner to understand the lesson. Additionally the measuring instrument must meet the threshold to measure the new behavior.

Has a particular teaching method the capacity to change the behavior of all the learners? The teacher is always left with the option of obtaining feedback from a lesson using the measurement tool; it is however uncertain whether a particular measurement tool has the threshold capacity to measure all relevant change in the behavior of learners. Otherwise, whether all changes in behavior falls in line with the stated objective to facilitate the measurement tool. Or whether all behavioral changes are of measureable status that is to a value it can be measured? Or whether the instrument is free from biases?

The issue of threshold is real. It is very obvious in physical science but has very little application in psychology and related courses. They are mostly found in the function of the brain. For instance the brain will not detect all stimuli as pain. Before pain is felt the stimuli must exceed the threshold of pain. The Neurometrics have used various means to map the brain function. The study especially in BEAM shows that the brain responses differently under different circumstance. And that people react differently as a result of their threshold levels (Howard-Jones, 2010).

### **Threshold Characteristic**

The body exhibits perfect division of labor which exhibits functional threshold characteristics. Moreover under a particular function it also shows respect to the threshold of operation. For

instance, the eyes cannot facilitate hearing. Obviously, not all stimuli in the environment are detectable. This is because every stimulus has its threshold characteristics. The eye for instance, sees infinity but can only interpret information within a given range. Additionally, the eyes cannot see microscopic organism unless aided. Moreover, the eyes cannot see through opaque obstacle and cannot see in the dark. Certainly, the eye sees objects within a certain wavelength and certain sizes and at restricted distances.

The skin for instance, is made up of the epidermis, the dermis and the sub-coetaneous layer. However, the nerve ending which receives pains ends in the dermis. Pains is only felt when the nerve ending is stimulated with the sensation of pains. Hence, if the epidermis is pricked the fellow will not feel any pains. Pains is only felt when the threshold of pain is reached.

The ear is more dramatic. The human ear detects sound within about 20 to 20,000 hertz, above which or below which it will not. Note that the ear can hear audibly the tickling of a watch 20 meters away. If it were more sensitive than this, it will result in one hearing the sound of molecule colliding with ones ears. Any slight increase in the sensitivity of the ear will make life unbearable. This is because the fellow will not only hear various useless sounds but will also be hearing the sound of air moving. This will be so irritating that the fellow will have to completely close the ears or go mad.

The threshold is universal as it is the critical quantity that must be acquired before an event occurred or a concept is qualified. If a boy applies a force of 99.9 N on a body of mass 10kg and assuming acceleration due to gravity of  $10\text{ms}^{-2}$  if the force of friction and other restraining forces are negligible then the body cannot move and can only move when a force of 100 N is applied. Unless this critical force is applied the energy applied will fall into the threshold and will not create the objective motion. In effect, when the force applied is not up to the critical or threshold value no visible action will take place.

The sweetness of Sugar can be discerned when 1 teaspoon is dissolved in 2 gallons of water while the odor of a Perfume can be detected when one drop is present in a three room apartment and a bee's wing falling from a distance of 1 centimeter can be felt on a cheek (Galanler, 1962). If this is so in physical science then there must be a threshold for a particular learning to occur and for a particular individual to learn.

### **Classification of Threshold**

Threshold can be discrete, continuous, anecdotal, circumstantial, cooperate, transitional, or absolute. Threshold is said to be discrete when it does not have a related concept following immediately. It is so as no other related concept makes it continuous. It is constant when it is exceeded the objective behavior will manifest. Example is during chemical reactions. Threshold is Continuous when the minimum or maximum threshold of one concept is the maximum or minimum of another. Example is change of state of matter. Threshold is Anecdotal when accidental or incidental threshold are created. It does not exist on its own but is caused to exist because of the new behavior. It is receptive. A self-defenses against unwarranted attacked will be quite different between a street urchin and a school boy of the same age. The school boy will be seriously injured but the urchin may overcome the attacker. The ability to do this is from the experience gathered by the urchins in the street which of course the school boy lacks. The anecdotal threshold is born from experiences and in some occasion from instinct.

Circumstantial threshold exist due to circumstantial behavior. They are anecdotal in nature but are simulative. Cooperate threshold, in a cooperate entity in some situation; there is unification or synchronization of thresholds. This will result in a common reaction to a given situation. Transitional threshold - A transitional interval beyond which some new action or different state of affairs is likely to begin or occur. Absolute Threshold - The absolute threshold is the least amount of physical intensity of stimuli that must be present for manifestation. This is the smallest amount of any stimulus that must be present for it to be detectable. Hence any stimulus that has the capacity to influence the sense organ does that at a threshold level. This is because a careful study of the environment shows that the environment is full with activities, movement and various stimuli which if man could perceive all will be distracting. However, men live at equilibrium with the environment because it has it threshold of sensitivity. The major sense organs in the body operate within a certain threshold and can only be perceivable within this threshold (Feldman, 1987).

### **Cognitive threshold**

This defines the concept of threshold as applied to human mental behavior. Human cognitive process functions within a threshold. The threshold filters the sensory stimulation to be detected by the human system. The Cognitive threshold is the span or range within which any cognitive function can take place. The cognitive threshold can be affected by physical, biological, psychological, sociological, environmental factors. They include teaching methods, teaching strategies, teaching technique, the general Teaching/learning environment, hearing ability, listening ability, attention span, social distracters, height, complexion, size, love life, sickness, hunger, inferiority complex, nervousness, fatigue, psychological changes, differential hearing, understanding, experience, language, dialectic issues, methods, strategies, techniques, evaluation, arrangement, This is the limits within which a particular cognitive process can take effect. Such ranges could be simple, associational, complex, compound or complicated.

During a particular learning experience the learner comes into the class with entrance threshold and leaves the class with the exit threshold. This implies that, the entrance threshold corresponds with the entry behavior. The exit threshold can be in any form. It is therefore left for the teacher to determine how much of the learning objectives had been accomplished after a lesson from the bulk of the exit threshold. The nature of the entrance threshold determines the efficiency of the lesson.

Cognitive threshold is simple when only one factor is used to determine the threshold. This is rarely the case. Many factors are always necessary in determining the threshold. Unfortunately, apart from proponent of multi- intelligence most researches tend to work as if only one factor is responsible for a particular activity or learning to occur. However, the threshold is simple when the dominant factors is significant as in experimental design the independent variable is treated as simple and others are treated as extraneous or intervening variable. They are to be controlled otherwise they will confound the result.

The threshold can always be associational, it is said to be associational when all the factors function either positively or negatively in determining the threshold. In other word all the contesting factors act in one direction. This is really the case in a situation which all the factors are in agreement in the functioning of that threshold. It will therefore means that the threshold from different factors tend to agree, and therefore act in such a way that they lose their individual identity and therefore act in one direction.

The cognitive threshold is complex when difference variables or difference factors come together to influence threshold some acting for and some acting against. This is common in a typical science class which gives rise to the concept of alternative conception, misconception and cognitive dissonance.

The threshold is in the compound form if the complex structure tends to maintain a systematic or sequence or edifying structure as they move from one level or stage to another. For instance, factors that were domineering kind of maintained that domineering locations while those who follow continue to follow.

Threshold is said to be complicated when a complex structure is influenced by varieties of factors as it changes from one level to another. In other words the threshold is just as in the complex form but different factors function at any given time to facilitate it.

### **Characteristic of Cognitive Threshold**

Cognitive threshold is made of different characteristics:-

1. It is dynamic in that it changes during experience including teaching and learning experiences. In other words, the learning must have the minimum threshold to articulate and stimulate the entrance threshold of the learner for the learning experience to occur. In the classroom, the learning must meet the absolute threshold for understanding to take place otherwise; the learning will not take place accordingly to the set objectives. At the end of the lesson if the learner leaves the class with different level of threshold suffix to say here, if the learner fails in capturing all that was taught that day he will experience change in the threshold but the learning will be scattered and will not be in line with the stated objective, in other word every experience brings about changes in the cognitive threshold either according to some stated objective or not.
2. Cognitive threshold is made up of factors already listed above but could be classified as: some factors are domineering, others are contributory some are recessive, others are dormant, retroactive and catalytic, and the domineering factors are proactive and are the most visible factors. Contributory factors follow the domineering factors competitively and in some cases may exchange places and become domineering. A factor is said to be recessive when they act on the background why encouraging the domineering factors to function. They are not out rightly expressive but are always present when a threshold is constituted. Dormant factors are only just present but do not contribute to formation of the threshold, in other words they appear insignificant. They are always present in the threshold but are not functional; in any threshold the dormant factors are always present. Retroactive factors act as interference present and absent at particular point in time in the formation of threshold and it will continue to act after the experience has been achieved. Collative factor, these are factors that have the capacity to change the nature of the threshold as a community. In order words, they act on the other factors causing them to affect others. Catalytic factors can increase or decrease the effect of other factors on the threshold usually on their own they remain unchanged. Such factors could influence any other factor either at instance or throughout the experience. Catalytic factors, this are factors act against the potency of other factors, what they do is to reduce the ability of other factors to function maximally and at the same time contradicts or confound the operation of threshold.

3. Threshold exists within range it has both upper and lower range and equally has real limits (real upper limit and real lower limit) for the continuous ones. If a teacher for instance goes to class he will meet different variety of students. Some that can understand what is taught easily and some that cannot. When the teacher goes on to teach those with high threshold capacity will understand easily those with low capacity will not. Several studies have shown that the individual difference can affect performance in the class.

### **Testing Diagnosis**

The diagnostic test is a form of Achievement test administered when the performance of the subject is poor. What the teacher does is to first administer a test. If at the end of the test the teacher observes poor performance the teacher will then proceed to analyze the test and find out which could be responsible for the poor performance. When such area is discovered the teacher then proceeds to administer a test based on such area and administered. From the result of the test the teacher proceeds to teach the problematic area and from there re-administered the diagnostic test to find out the effect of the treatment given. It is customary for the diagnostic test to be accompanied by a period of instruction.

Why the threshold is important here is because several factors are responsible for any observed performance. Method is only one of the factors. How can one be sure that only a change in the method of teaching can influence the performance of a candidate? There is need to find out what is really responsible for any poor performance if we really want to assist the learner. A diagnostic test is one but there is need to conduct a comprehensive diagnosis to be sure of the particular area of deficiency.

The basic look at it is that the diagnostic test is accompanied by instruction. The diagnostic test looks designed to identify areas in the curriculum not properly taught and is usually followed by remedial teaching. It is common knowledge that there are difficult areas in the curriculum. In extension there are difficult topics or perceived difficult areas in the curriculum. In effect anytime a teacher teaches such content the tendency is to suffer poor performance. And it is a reality that the learners are of different intelligent indices. This means that, the threshold of understanding varies in the class. Actually, some students are punished unjustly not really because of their inability to assimilate the lecture but because the lecture has not reached their threshold of assimilation. In effect, some factors not necessary the teaching method have resulted in the observed results. Actually, whatever teaching method, or technique, or strategy or combination of learning activity is used, they can only function at a certain threshold.

### **Case History**

In his days in the Nursery school Junior was among the best performing pupils. Unfortunately, Junior suddenly started and consistently performed poorly in the Primary school. It became a big worry to the family. The intelligent level of Junior was not determined but those who were closed to Junior described Junior as 'sharp'. The Teacher decided to administered diagnostic test to see how to alleviate the situation. Junior was taught and re-taught but to no avail. The home teacher was changed and another was hired to teach Junior, it could only make sure that Junior was promoted to the next class. A counselor was added to assist. Yet there was no significant change in the result.

The mother came to a stage of believing that it was a spiritual attack and had to visit any powerful pastors in the area and beyond to see how to alleviate the problem. Junior was subjected to series of test which were not classroom based. He was later tried on assignment in the lower class and observed that the reading load had increased seriously for Junior in this class. The capacity of Junior's vocabulary (Number and meaning of words known and use by a certain person) was seriously tasked by the demand of the new class.

To a casual observer Junior was deficient in Reading. A careful study showed that Junior could only recognize some words and will read those ones well. What Junior did was to read jumping words. He could make sense in some passages but was able to follow others. For the two letter words which he was introduced in the Nursery, Junior was rich enough and had the demand of the class under control. These classes introduced so many new words to the children. Some children were unable to cope up because they lack the necessary threshold to assimilate the lessons. Many students are unduly misdirected by the available learning and teaching theories to develop complexes in themselves as a result of being unduly blamed on not understanding a certain concept when the real issue is that the necessary threshold to uphold the concept has not first been ascertain by the teacher.

Whatever theory is applied begins at a certain threshold and ends in a new threshold. Any performance is as a result of the attainment of a threshold from a threshold. No learning works unless it the threshold for its actualizations is attained. What happened was for the class teacher to reduce the reading load of Junior and Junior read. Junior did not automatically translated his experiences in mastery of the two letter word to formation of three letters words and more complex words formation. The teacher decided to increase his vocabulary at least to the extent of what was required in the new class. This was done. The teacher cunningly introduced a plan form of it. It was beneficial to those who he had already listed as poor achievers. It might interest us that the teacher had such a highly competitive third term result that the school wondered why. By the third year, those who still remained in the school where among the first 30 students in a class of 89 students.

### **Learning And Threshold**

Learning is a relatively permanent change in behavior brought about by experience. Learning is therefore a result of inherited cognitive process, maturation and experience. Learning is not actually performance. Ever since Pavlov recognized the issue of learning through classical conditioning learning has been viewed from different perspectives. The advent of the cognitive theorist and the constructivists has made learning particularly interesting (Sugar man, 1988; Bernstein & Cowan, 1985)

Learning theories are conceptual frameworks describing how information are absorbed, processed, and retained during learning. Cognitive, emotional, and environmental influences, as well as prior experience, all play parts learning (Atkinson & Shiffrin, 1968). The Behaviorists look at learning as an aspect of conditioning and will advocate a system of rewards and targets in education. Educators who embrace cognitive theory believe that the definition of learning as a change in behavior is too narrow and prefer to study the learner rather than their environment and in particular the complexities of human memory (Brown, & Ryoo, 2008; Bodner, Klobuchar, & Geelan, 2001; Bredo, 1994; Bourne, Dominowski, Loftus, & Healy, 1986)

The constructivism believe that a learner's ability to learn relies to a large extent on what he already knows and understands, and the acquisition of knowledge should be an individually tailored process of construction. Transformative learning theory focuses upon the often-necessary change that is required in a learner's preconceptions and world view (Tomlinson – keasey, Gsert, Kahle, Hardy-Brown, & Keasey, 1979; Astington, Haras, & Asun,1988; Gboleon, & Roserthal,1984)

Whatever learning theory is applied , there no effect if the learning threshold is not met. In other words learning occurs when the teacher is able to breach the learning threshold of the learner. It is the attempt to reach such threshold where the learning methods are applicable. Incidentally, the learning threshold varies randomly. This is responsible for the identification of the entry behavior or the alternative conception or misconception or cognitive dissonance. Though they are present they only serve to alter or confound or distort the learning threshold (Adams, 1987). d. For instance, for a learner to understand a concept a teacher must first ascertain the learners' threshold of understanding that concept is reached. If not reached, understanding will not occur.

Understanding is only a first step in assimilation which must follow suite for any teaching to make impact and affect behavior for any teaching learning interaction and learning facilitation to occur. Learning is only effective if the change in behavior is according to the preset objectives. Teaching and learning occur when a new concept links up and affect and existing concept. It is the threshold that must be reached for the change in behavior to take place. A child who does not hare in the experience will not undergo the appropriate change in behavior.

A careful look as some of the theories of learning will reveal one very important fact that learning occurs under certain condition. It is this condition that amounts to the issue of threshold. For instance in the Piaget theory there are four dimensions namely the sensory-motor, preoperational, concrete operational, and formal stage. Each of these levels has task. In Piaget the developmental tasks are the behavior each person must acquire and exhibit proficiency during a particular growth or development period. Piaget has a list of periodic set task. Any individual must accomplish these task or related task before meeting the demand of the next level.

Many scholars have disagreed on the actual existence of set task. Other scholars argue against the discrete nature of Piaget grouping. Even though Piaget attempts to show continuity and gradual flow of development from one level to another. Dochler and backaro 1985 suggested that a better deception of how children cognition development could have task but were not in stages Bornstein and Sigmol 1986 disagreed with the ability of individual to perform some tasks. To them it was not common for children to exhibit the same experience hence the tasks are completed differently by different individual irrespective of the age .

Ginsburg and Opper 1988 and Gbolos and Rosethd 1984, who conducted studies supported Piaget theory even though it was based on some form of probability. Probably the work of Dore and Diemas 1987 which extended the work of theory to lower animals especially the primates added more issues to the application of Piaget laws. Interestingly Udofia(2005), who emphasized the domestication of task show that ., development processes whose back up by environmental situation, motivation, enhancement and facilitation to succeed in the next level. On addition there was need to develop structures to ensure readiness to resolve expression in the next stage. (Piaget, 1970; Piaget & Inhelder ,1988)



Even though Piaget has been so criticized two issues have been associated with Piaget, one is the ability to process information. Information processing is the way in which people take in use and store information. A close look at Piaget theory shown that it is not as dichotomously as some of the critics rather it is more of a threshold used. As individual develop the task changes accordingly in effect, it is the development of threshold that correspondingly brings about the development of structures that are necessary for to accomplished the developmental text of a particular period. In other word, it is not the age related issued that is most responsible for learning to take place but the availability of structures cable of facilitating understanding. That is responsible for learning to take place under a particular circumstance in effect learning does not take place base on the age of the individual but it take place base on the availability of the threshold factors, that is the cognitive structure which individual possess at the particular point in time.

## CONCLUSION

The thresholds are applicable wherever and whenever a concept is defined. What threshold does is to provide that distinction between concepts. It creates limits and delimits concepts and constructs. It shows boundaries and borders. It is universal and is applicable whenever there is need for recognition and differentiation. They believe system of a particular race affects the threshold of the inhabitant of the area. In other words the people are the product of their belief system. The limits of learning or acquiring any skills effectively are the cognitive threshold of that concept. These constitute the learning threshold for the learners in such environment. In other word, the ability to understand is a function of cognitive threshold of the individual and understanding it will go a long way to enrich the education system.

## REFERENCE

- Adams, S. M. J. (1987). Thinking Skills curricular, Their promise and progress. *Educational Psychologist* 24, 25- 27.
- American Heritage® *Dictionary of the English Language, Fifth Edition*. Copyright © 2011 by Houghton Mifflin Harcourt Publishing Company. Published by Houghton Mifflin Harcourt Publishing Company. All rights reserved
- Astington, J. W., Haras, P. L. & Asun D. E (1988) *Developing theories of mind*. Cambridge England, University Press.
- Atkinson, R.C. & Shiffrin, R.M. (1968). *K.W. Spence and J.T. Spence, ed. The psychology of learning and motivation (2 ed.)*. New York: Academic Press. pp. 89–125.
- Bernstein, P. & Cowan, E, P (Ed) (1985). *Child development. Psychological, Sociological and Biologocal factors*; Homewood 11 Dorsey.
- Binet, A. and Simon, T (1916). *The development of intelligence in children (the Binet – Simon scale)* Bathmore, Mo; Williams and Eilkins
- Bodner, G., Klobuchar, M., & Geelan, D. (2001). The many forms of constructivism. *Journal of Chemical Education*, 78, 1107-1134.
- Bourne, I. E. Dominowiski, R. L. Loftus, E. F. and Healy, A. F. (1986) *Cognitive process (2<sup>nd</sup> ed.)* Englewood cliffs Nj: prenfice Hall
- Bredo, E. (1994). Reconstructing educational psychology: Situated cognition and Deweyian pragmatism. *Educational Psychologist*, 29 (1), 23-35.

- Brown, B; Ryoo, K (2008). "Teaching Science as a Language: A "Content-First" Approach to Science Teaching". *Journal of Research in Science Teaching* **45** (5): 529–53.  
doi:10.1002/tea.20255.
- Browne, M. E. (July 1999). *Schaum's outline of theory and problems of physics for engineering and science* (Series: Schaum's Outline Series). McGraw-Hill Companies. p. 58. ISBN 978-0-07-008498-8.
- Collins English Dictionary – *Complete and Unabridged*, 12th Edition 2014 © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003, 2006, 2007, 2009, 2011, 2014
- Dictionary: *What is THRESHOLD? definition of THRESHOLD* (Black's Law Dictionary)
- Einstein, A. (1916), *Relativity: The Special and General Theory (Translation 1920)*, New York: H. Holt and Company
- Einstein, A. (November 28, 1919). "Time, Space, and Gravitation". The Times.
- Feldman R. S. (1987). *Understanding Psychology*. New York. McGraw Hill Publishing Co.
- Galanter, E (1962) *Contemporary Psycho – physics in a Brown. E Galanter, E. Hess and G, maroler (Eds) New directions in Psychology*. New York Holt 87 – 157.
- Galili, I.; Tseitlin, M. (2003). "Newton's First Law: Text, Translations, Interpretations and Physics Education". *Science & Education*. **12** (1): 45–73.  
Bibcode:2003Sc&Ed..12...45G. doi:10.1023/A:1022632600805.
- Gboleon, J. B. & Rosenthal, T. L. Eds (1984) *Application of cognitive development Theory*. New York Academic Press.
- Ginsberg, H. P. ,& Oppen, S. (1988). *Piaget Theory of intellectual development* (3<sup>rd</sup> Edt.) Baglewood cheff N. J. Practice Hall.
- Greene, Brian. "The Theory of Relativity, Then and Now". Retrieved 2015-09-26.
- Howard-Jones, Paul (2010). *Introducing Neuroeducational Research: Neuroscience, Education and the Brain from Contexts to Practice*. Taylor & Francis. p. 35. ISBN 978-0-415-47200-5.
- Lubliner, Jacob (2008). *Plasticity Theory (Revised Edition) (PDF)*. Dover Publications. ISBN 0-486-46290-0.
- McGraw-Hill *Dictionary of Scientific & Technical Terms*, 6E, Copyright © 2003 by The McGraw-Hill Companies, Inc.
- NMJ Woodhouse (2003). *Special relativity*. London/Berlin: Springer. p. 6. ISBN 1-85233-426-6.
- Piaget, J & Inhelder, B. (1988) *The Growth of logical thinking from childhood to adolescence*. Translated by A. Faison and S. S. Eagrin and judiciary.
- Piaget, J (1970) Piaget's theory. In P. H. Musen. (Ed.) *Carmmichaels manual of child psychology (vol. 1, 3<sup>rd</sup> Edt.)* New York John witey.
- Sugarman, S. (1988). *.Piaget's conduction of the child's reality cambade*, England, Cambridge University press.
- The American Heritage® *Roget's Thesaurus*. Copyright © 2013, 2014 by Houghton Mifflin Harcourt Publishing Company. Published by Houghton Mifflin Harcourt Publishing Company. All rights reserved
- The American Heritage® *Stedman's Medical Dictionary*  
Copyright © 2002, 2001, 1995 by Houghton Mifflin Company. Published by Houghton Mifflin Company
- Udofia, N. A. (2005). Mainstreaming – School Tasks into the Home for the four plus based the Neo-Piagetian theory. *Nigerian Academy of Education. 20<sup>th</sup> Annual Congress. Eds Prof. P. M.C Ogomaka, Prof. (Mrs) D. A Onyeyemesi. Owerri Nigeria Academy.*

- Walter Lewin (20 September 1999). *Newton's First, Second, and Third Laws. MIT Course 8.01: Classical Mechanics, Lecture 6. (ogg) (videotape)*. Cambridge, MA USA: MIT OCW. Event occurs at 0:00–6:53. Retrieved 23 December 2010.
- Wells, G. (2007). "Semiotic Mediation, Dialogue and the Construction of Knowledge". *Human Development* 50 (5): 244–74. doi:10.1159/000106414.
- Will, Clifford M (August 1, 2010). "*Fitzgerald–Lorentz contraction*". *Grolier Multimedia Encyclopedia*. Retrieved 2010-08-01.
- Will, Clifford M (August 1, 2010). "*Space-Time Continuum*". *Grolier Multimedia Encyclopedia*. Retrieved 2010-08-01.
- Willingham, D. T. (2009). *Why don't students like school?* San Francisco, CA: Jossey-Bass.
- Wilson, B. G., & Myers, K. M.( Web. 24 Mar. 2015). "*Situated Cognition in Theoretical and Practical context.*" *Theoretical Foundations of Learning Environments(1999): n. pag. Situated Cognition.*.
- Yount, William R. (1996). *Created to Learn*. Nashville: Broadman & Holman. p. 202.