Chapter II

MULTIPLE INTELLIGENCES AND SCIENCE INTEREST: A THEORETICAL OVERVIEW
Theoretical Overview

“Psychology undertakes to make a scientific study of the individual considered as a unit as he really is in his dealings with other individuals and with the world.”

(Woodworth, 1936)

Introduction

Psychology, throughout its history, has provided vital information for the design of schooling based on theory and research on human learning, development and motivation. Researches in psychology are relevant to education, particularly informative, during the past decades and promote our understanding of thinking, memory, cognitive and motivational processes; resulting improvements in teaching-learning and the whole enterprise of schooling. At the same time, educators concerned with the growing problems of school dropout, low levels of academic achievement, and other indicators of school failure are arguing for more learner-centered models of schooling. Such models attend to the diversity among students and use this diversity to enrich learning and to produce results within the context of current school reform.

The principles of psychology, which are consistent with more than a century of research on teaching and learning, are widely shared and implicitly recognized in many excellent programs found in today’s schools. They also integrate research and practice in various areas of psychology, including developmental, educational, experimental, social, clinical, organizational, community and school psychology. Besides, these principles reflect conventional and scientific wisdom. They comprise not only systematically researched and evolving learner-centered principles leading to effective schooling, but also principles that can lead to positive mental health and productivity of our nation’s children.

Educational Psychology

Educational psychology is considered to be a field that entails the study of psychological factors that influence the educational process, its development and application of psychological strategies in order to improve and solve problems aroused in the learning process. Like any scientific undertakings, educational
psychology has both descriptive and applied functions. It establishes ‘what is’; uses; its methods and procedures to bring about ‘what can be?’. Educational psychology is a potential discipline in improving the quality of education in general and enhancing the effectiveness of teaching in particular.

The nature of educational psychology is regarded as scientific because, it possesses a well organized, systematic and universally accepted body of facts.

The scope of educational psychology is both limited and extensive. It is limited in the sense that Educational Psychology must concern itself only with the study of the behaviour of the learner in the educational environment. Knowledge of educational psychology helps in:

- Knowing the learner
- Enabling the teacher to know him, strengths and limitations and to acquire essential teacher like traits.
- Selection and organization of proper learning experiences suited to the individuality and developmental stages of the learners.
- Suggesting suitable methods and techniques for providing the derived learning experiences and
- In arranging proper learning situations.

However, its scope may be considered extensive in the sense that it has, all that is needed for providing situations to the problems demands are unending and the process of education is dynamic, we cannot expect rigidity in terms of a strict delineation in the definition of the scope of educational psychology.

2.0 LEARNER CENTERED LEARNING

Learner-centered psychological principles provide a framework for developing and incorporating the components of new designs for schooling. The principles emphasize the active and reflective nature of learning and learners. From this perspective, educational practice will be most likely to improve when the educational system is redesigned with the primary focus on the learner. Psychologists, in collaboration with educators, can help to decide how best to apply sound psychological principles in the redesigning of schools.
2.1 THEORIES OF INTELLIGENCE

Intelligence is a concept which has been understood in different ways by different psychologists and has therefore, a wide variety of definitions. Wechsler (1944) tried to provide a comprehensive definition of intelligence, as “intelligence is the aggregate or global capacity of an individual to act purposefully, think rationally and deal effectively, with his environment”. The theories of intelligence propagated by psychologists from time to time have tried to uncover the components or elements of intelligence. These theories can be grouped under two categories namely, Factor Theories and Cognitive Theories.

2.1.1 Factor Theories of Intelligence

The Factor theories of intelligence tried to throw light on the structure of intelligence by pointing out the number of factors or constituents. Unitary theory or monarchic theory, the oldest theory in origin, holds that intelligence consists of one factor, a fund of intellectual competence, which is universal to all activities of the individual. Quite contrary to this, the Anarchic theory or Multifactor theory, propagated by Thorndike considers intelligence to be a combination of numerous separate elements or factors, each of which is a minute element of ability. Spearman’s (1904) two factor theory advocates the presence of two factors – General Intelligence ‘g’ and Specific intelligence ‘s’.

Thurston’s group factor theory postulates that all intellectual tasks can be categorized in definite groups. Each group has a unique common factor known as the Group factor. Thurston and associates had discovered nine such Group factors. The British psychologist Vernon’s (1950) hierarchical theory suggests a hierarchical structure for the organization of intelligence in the shape of ‘G’, an overall factor branching into two major group factors and various specific factors. Guilford’s (1961) theory lays down a three dimensional model of the intellect involving three interrelated and interacted basic parameter – Operations, Contents and Products for explaining the structure of human intelligence.

The theories discussed so far employ factor analysis technique for identification of factors or common abilities, which constitute one’s intelligence. These theories exhibit wide variations in terms of the number of factors that they
consider important. The range of such factor goes from 1 (monarchic theory) to 150 (Guilford’s intellect model). Each of the above theories of intelligence attempts to provide a structure of intelligence in terms of its constituents or factors.

2.1.2. Cognitive Theories of Intelligence

Cognitive theories of intelligence tried to analyse and describe intelligence in terms of certain fundamental cognitive processes. Cattell (1965) and Horn’s (1978) theories of intelligence state that intelligence is made up of two types of intelligence 1) Fluid intelligence (derived more from biological and genetic factors and relatively free from the influence of education and culture) and 2) Crystallized intelligence (Acquired fund of general information).

Jensen (1969) propounded the theory of mental functioning. According to this theory, the functioning of one’s mind depends upon the type and degree of intelligence one possess. Jenson describes one’s intelligence as being composed of two types of abilities namely associative abilities (related to biological maturation differing among social classes and races) and conceptual abilities (dependant on education and culture and responsible for observed differences in conceptual reasoning among social classes and races).

The American psychologists Brown & Campion (1986) developed theory of intelligence according to which one’s intelligence is composed of a two-part system. The first part is a biologically based architectural system and the second, an environmentally influenced executive system. While the former works as a base for one’s intellectual functioning incorporating such factors as memory capacity, information processing etc. the later is responsible for the higher order mental functioning. The American psychologist Sternberg (1985) has put the most recent acceptable theory of intelligence forward. Sternberg’s Information processing theory of intelligence makes use of the information processing approach for explaining the individual’s cognitive or problem solving behaviour. It outlines our mental functioning as definite steps explaining what we do with information from the time we perceive it till the time we finish using it to solve our problems.
2.2 HISTORY OF MULTIPLE INTELLIGENCES THEORY

For many years, intelligence has been equated with the ability to carry out abstract logical reasoning. The controversial discussion about intelligence as a singular or general factor or a number of favours led to the recognition of the idea that for certain purposes it will be more helpful to distinguish different forms of intelligence.

The term ‘intelligence’ had not been popularly used until the classical work of Binet and Simon (1905). They introduced first intelligence test in the world. The psychometric traditional approach to intelligence believed that intelligence is located within the individual. Psychometric traditional approaches were in tune with the concept of measurement of intelligence. These theories try to understand human intelligence in terms of way it is measured. This involves the examination of a matrix of inter correlations for a set of standardized test scores on mental ability to uncover common patterns of individual differences in the performances of these tests. The classical trend in the assessment of intelligence was to quantify the intelligence present in every individual to a simplified concept of IQ (Intelligent Quotient).

2.2.1 Basis for Multiple Intelligences

Gardner (1985) approached the concept of intelligence through the theory of Multiple Intelligences. Out of an analysis of psychological, philosophical and the literary comments on the concept of intelligence, he suggested that it was necessary to distinguish at least seven distinct and independent aspects of human intelligence. Very recently three more Intelligences are also added.

Gardner argues that there are biological and cultural basis for the Multiple Intelligences. Neurobiological research indicates that learning is an outcome of the modification in the synaptic connections between cells. Primary elements of different types of learning are found in particular areas of the brain where corresponding transformations have occurred. Thus, various types of learning result in synaptic connections in different areas of the brain. For example, injury to the Broca’s area of the brain will result in the loss of one’s ability to verbal
communication using proper syntax. Nevertheless, this injury will not remove the patient’s understanding of correct grammar and word usage.

A small set of human intellectual potentials is excluded in Multiple Intelligences theory. Intelligence is a connected interaction of two factors—Heredity and Environment. Some will develop certain kinds of intelligence more efficiently than others, but every normal individual develops each set of Intelligences to some extent (Gardner, 1985). Many people look at the right intelligences – particularly Musical, Spatial and Bodily-Kinaesthetic – and wonder why Gardner insists on calling them intelligences and not talents or aptitudes. Gardner realized that people are used to heeling expressions like "He’s not very intelligent, but he has a wonderful aptitude for music”, thus, he was quite conscious of his use of the word intelligence to describe each category. He set up certain basic ‘tests’ that each set of Intelligences had to meet to be considered a fully fledged intelligence and not simply a talent skill or aptitude. The criteria he used include the following eight factors.

1. **Potential Isolation by Brain Damage**

In brain-damaged patients, skills entailed in music, spatial reasoning, object manipulation, and linguistic functioning prove to be quite independent of one another, that is, a performance in one area does not predict performance in intelligence.

2. **The Existence of Savants, Prodigies and other Exceptional Individuals**

Gardner suggests that in some people, we can see single intelligence operating at high levels, much like huge mountains rising up against the backdrop of a flat horizon. Savants are individuals who demonstrate superior abilities in one part of intelligence while their other Intelligences function at a low level. They seem to exist for each of the Ten Intelligences. For instance, in the movie Rain Man, Dustin Hoffman plays the role of Raymond, a Logical-Mathematical savant. Raymond calculates multi-digit numbers in his head and does other amazing mathematical feats, yet he has poor peer relationships, low language functioning, and lack of insight into his own life.
3. **A Distinctive Developmental History and a Definable Set of Expert “End-State” Performance**

Gardner suggests that Intelligences are galvanized by participation in some kind of culturally valued activity and that the individual’s growth in such an activity follows a developmental pattern. Each intelligence-based activity has its own identifiable set of stages of growth with a mastery level which exist an ‘End-State’ in human development.

4. **An Evolutionary History and Evolutionary Plausibility**

Evidences from Evolutionary biology suggest sources of human abilities and capabilities in earlier or less complex species.

5. **Support from Psychometric Findings**

The use of psychometric instruments to measure intelligence (such as IQ tests) has traditionally been used to measure only specific types of ability. However, these tests can be designed and used to support the theory of Multiple Intelligences. For example, the Wechsler Intelligence Scale for Children includes subtests that require Linguistic intelligence [e.g., information, vocabulary], Logical-Mathematical intelligence [e.g., arithmetic], Spatial intelligence [e.g., picture arrangement] and to a lesser extent Bodily-Kinesthetic intelligence [e.g., object assembly].

6. **Support from Experimental Psychological Tasks**

Gardner suggests that by looking at specific psychological studies, one witness Intelligences working in isolation from one another. For example, in studies where subjects master a specific skill, such as reading, but fail to transfer that ability to another area, such as mathematics, we can see the failure of linguistic ability to transfer to Logical-Mathematical intelligence and so on. In studies of cognitive abilities, such as memory, perception or attention, we can see evidence that individuals possess selective abilities. Each of these cognitive faculties, is intelligence specific, that is, people can demonstrate different levels of proficiency across the ten intelligences in each cognitive area.
7. **An Identifiable Core Operation or Set of Operations**

Each set of Intelligences has core operations that serve to drive the various activities indigenous to that intelligence. In Musical intelligence, for example, those components may include sensitivity to pitch or the ability to discriminate among various rhythmic structures. In Bodily-Kinesthetic intelligence, core operations may include the ability to imitate the physical movements of others or the capacity to master established fine motor routines for building a structure.

8. **Susceptibility to Encoding in a Symbol System**

One of the best indicators of intelligence behaviour, according to Gardner, is the capacity of human beings to use symbols. The ability to symbolize is one of the most important factors that separate humans from most other species. Each of the Ten Intelligences in the theory of Multiple Intelligences meets the criterion of being able to be symbolized. Each set of Intelligences has its own unique symbol or notational systems. For Linguistic intelligence, there are a number of spoken and written languages such as English, French and Spanish. Spatial intelligence includes a range of graphic languages used by Architects, Engineers, and Designers as well as certain ideographic language such as Chinese.

2.2.2 **Relevance of Multiple Intelligences Theory**

1. Drawing a picture, composing or listening to music, watching a performance – these activities can be a vital door to learning – as important as writing and mathematics. Studies show that many students who perform poorly on traditional tests are turned on to learning when classroom experiences incorporate artistic, athletic and musical activities.

2. Opportunities should be provided for authentic learning based on students’ needs interests and talents. The Multiple Intelligences classroom acts like the ‘real’ world: the author and the illustrator of a book are equally valuable creators. Students become more active and involved learners.

3. Parent and community involvement in the school may increase. This happens as the students demonstrate work before panels and audiences. Activities involving apprenticeship learning bring members of the community into the learning process.
4. Students will be able to demonstrate and share their strengths. Building strengths gives a student the motivation to be a ‘specialist’. This can in turn lead to increased self-esteem.

5. When teachers ‘teach for understanding’ students accumulate positive educational experiences and the capability for creating solutions to problems in life.

2.2.3 Myths and realities of Multiple Intelligences

Gardner (1995) through his article ‘Reflections on Multiple Intelligences: Myths and Messages’, discusses seven myths that have grown up about Multiple Intelligences and attempts to set the record straight by presenting seven complementary ‘realities’. Myths and realities of Multiple Intelligences are:

<table>
<thead>
<tr>
<th>MYTHS</th>
<th>REALITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The seven intelligences have been identified, one can and perhaps should – create seven tests and secure seven scores</td>
<td>Multiple Intelligences theory represents a critique of “psychometrics-as-usual”. A battery of Multiple Intelligences tests is inconsistent with the major tenets of the theory</td>
</tr>
<tr>
<td>Intelligence is the same as a domain or a discipline</td>
<td>An intelligence is a new kind of construct and it should not be confused with a domain or a discipline</td>
</tr>
<tr>
<td>Intelligence is the same as a ‘learning style’ or a ‘cognitive style’ or a ‘working style’.</td>
<td>The concept ‘style’ designates a general approach that an individual can apply equally to every conceivable content.</td>
</tr>
<tr>
<td>Multiple Intelligences theory is not empirical</td>
<td>Multiple Intelligences theory is based wholly on empirical evidence and can be revised on the basis of new empirical findings</td>
</tr>
<tr>
<td>Multiple Intelligences theory is incompatible with ‘g’ with hereditarian accounts of the nature and causes of intelligence</td>
<td>Multiple Intelligences theory questions not the existence but the province and explanatory power of ‘g’</td>
</tr>
<tr>
<td>Multiple Intelligences theory so broaden that the notion of intelligence that it includes all psychological constructs and thus vitiates the usefulness, as well as the usual connotation of the term.</td>
<td>This statement is simply wrong. It rejects the distinction between talent and intelligence.</td>
</tr>
<tr>
<td>There is an eighth intelligences</td>
<td>Multiple Intelligences</td>
</tr>
</tbody>
</table>
Messages about Multiple Intelligences in the classroom are:

i) The attempt to teach all concepts or subjects using all the Intelligences

ii) The belief that it suffices, in and of itself, just to go through the momentum of exercising certain intelligence

iii) The use of materials associated with an intelligence as background

iv) The use of intelligences primarily as mnemonic devices

v) The conflating of intelligences with other desiderata

vi) The direct evaluation of intelligences, without regard to text or content

The burgeoning of a community that takes Multiple Intelligences issues seriously is not only a source of pride to the author also the best guarantor that the theory will continue to live in the years to come.

2.2.4 Criticism on Multiple Intelligences Theory

Advocates of psychometric evaluation criticize Multiple Intelligences theory include Linda S. Gottfredson, Richard Lynn, Hans Eysenck and Charles Murray. Gottfredson, a sociologist by training, is currently professor of educational studies at the University of Delaware. She states that most mainstream psychologists have concluded that there is such a thing as ‘g’ or ‘general intelligence’. In other words, Gottfredson argues that all of us do differ in intelligence and this difference can be scrupulously measured critics of the theory say that:

- **It’s not new:** Critics of Multiple Intelligences theory maintain that Gardner’s work isn’t groundbreaking – that what he calls ‘Intelligences’ are primary abilities that educators and cognitive psychologists have always acknowledged.

- **It isn’t well defined:** Some critics wonder if the number of ‘Intelligences’ will continue to increase. These opposing theorists believe that notations such as Bodily-Kinaesthetic or Musical ability represent individual’s aptitude or talent rather than intelligence. Critics also believe that Multiple Intelligences theory lacks the rigor and precision of a real science. Gardner
claims that it would be possible to guarantee a definitive list of Intelligences.

- **It’s culturally embedded:** Multiple Intelligences theory states that one’s culture plays an important role in determining the strengths and weaknesses of one’s Intelligences. Critics counter that intelligence is revealed when an individual must confront an unfamiliar task in an unfamiliar environment.

- **It defeats national standards:** Widespread adoption of Multiple Intelligences pedagogy would make it difficult to compare and classify students’ skills and abilities across classrooms.

- **It is impractical:** Educations faced with overcrowded classrooms and lack of resources sees Multiple Intelligences theory as Utopian.

### 2.3 THREE FUNDAMENTAL PRINCIPLES OF GARDNER’S THEORY OF MULTIPLE INTELLIGENCES

**First Principle** is not a single thing; whether viewed unitarily or as comprising multiple abilities. Rather, there exist Multiple Intelligences; rather distinct from the others. In some ways, the distinction between positing one intelligence comprising multiple abilities and positing Multiple Intelligences are distinct from each other in subtle. But the positing of these Intelligences emphasizes the separateness of each set of skills and also emphasizes. Gardner’s view treat each set of intelligences is a system in its own right, rather than merely one aspect of a larger system, namely what we traditionally call ‘intelligence’.

**Second Principle** is that these Intelligences are independent of each other. In other words, a person’s abilities assessed under one intelligence should in theory; be unproductive of that person’s abilities. As assessed under intelligence obviously the claim of independence is a strong one; but Gardner believes that, it is justifiable by what we know about the mind.

**Third Principle** is that Intelligences interact. Although they are distinct from each other, no one could ever get anything done if their distinctness and independence meant that they couldn’t work together. In such an instance; a mathematical word problem requiring; the application of both Linguistic and
Logical-Mathematical intelligence would be insoluble. Rather, on Gardner’s view, the two Intelligences work together to produce a solution to the problem.

2.4 THE ORIGINAL TEN INTELLIGENCES

In *Frames of Mind* and *Intelligentsia Reframed*, Gardner proposed the existence of ten separate human intelligences. The first two- Linguistic and Logical-Mathematical – are the ones that have typically been valued in school. Linguistic intelligence involves sensitivity to spoken and written language, the ability to learn languages, and the capacity to use language to accomplish certain goals. Lawyers, speakers, writers, poets are among the people with high Linguistic Intelligence.

Logical-Mathematical Intelligence involves the capacity to analyze problems logically, carryout mathematical operations, and investigates issues scientifically. Mathematicians, logicians, and scientists exploit Logical-Mathematical Intelligence.

The next three components of Intelligences are particularly notable in the arts, though each can be put to many other uses. Musical Intelligence entails skill in the performance, composition, and appreciation of musical patterns. In his view, Musical Intelligence is almost structurally parallel to Linguistic intelligence, and it makes neither scientific nor Logical sense to call one (usually Linguistic) as intelligence and the other (usually Musical) a talent. Bodily-Kinesthetic Intelligence entails the potential of using one’s whole body or parts of the body (like the hand or the mouth) to solve problems or fashion products. Obviously, Dancers, Actors, and Athletes foreground Bodily-Kinesthetic Intelligence. However, this form of intelligence is also important for Crafts persons, Surgeons, Bench-top scientists, Mechanics, and many other technically oriented professional. Spatial Intelligence features the potential to recognize and manipulate the patterns of wide space (those used, for instance, by Navigators and Pilots) as well as the patterns of more confined areas (such as those of importance to Sculptors, Surgeons, Chess players, Graphic artists, or Architects). The wide ranging ways in which Spatial Intelligence is deployed in different cultures clearly show how a biopsychological potential can be harnessed by domains that have evolved for a variety of purposes.
In the original list, the other two components of Intelligences, which he called the Personal Intelligences, raised most eyebrows. Interpersonal Intelligence denotes a person’s capacity to understand the intentions, motivations and desires of other people and, consequently, to work effectively with others. Salespeople, Teachers, Clinicians, Religious leaders, Political leaders, and Actors all need acute Interpersonal Intelligence. Finally, Intrapersonal Intelligence involves the capacity to understand oneself, to have an effective working model of one self – including one’s own desires, fears, and capacities – and to use such information effectively in regulating one’s own life.

In the list the other three Intelligences are notable in another aspect, though each can be put to many other uses. Naturalistic Intelligence entails skill in the performance, composition, and appreciation of naturalistic patterns. This intelligence involves the ability to recognize and classify plants, minerals and animals, including rocks, grass and all variety of flora and fauna. It also includes the ability to recognize cultural artefacts like cars, sneakers etc. This intelligence can be seen in such people as Farmers, Hunters, Zookeepers, Gardeners, Cooks, Veterinarians, Nature guide and Forest rangers. Existential Intelligence involves the ability to perceive, envision and be a thinker of the big picture. This type of intelligence can be seen in such people as Visionary leaders, Prophets etc. Moral/Spiritual Intelligence, this means the achievement of a state of being a sense of purpose, which has a spiritual/moral effect of others. This type of intelligence can be seen in Priests, Saints, and Ministers.

### 2.5 STEPS FOR ESTABLISHING A MULTIPLE INTELLIGENCES ENVIRONMENT IN SCHOOLS

There are many ways to proceed from goal to strategy to evaluation, and none is inherently superior. Here are some practices that have been effective in probing deeper into Multiple Intelligences.

1. **Learn more about Multiple Intelligences theory and practices:** There is now a sizeable literature in English, plus a growing amount in other languages. The literature is theoretical and practical, visionary and realistic. There are also videos and CD-ROMs that illustrate Multiple Intelligences practices.
2. **From study groups:** Many people find it most comfortable to explore new ideas with others. A group that meets weekly or bi-weekly to reflect upon Multiple Intelligences related themes, with a particular eye to the needs of a certain school or of educational institutions in one locate often makes fairly rapid progress.

3. **Visit institutions that are implementing Multiple Intelligences ideas:** Interacting with teachers, staff, parents, and children at Multiple Intelligences site provides invaluable insights, raises questions, and triggers ideas one can implement locally.

4. **Attend conferences that feature Multiple Intelligences ideas:** In many countries now, those involved in Multiple Intelligences work hold workshops, symposia, and conferences. Project Zero, at the Harvard Graduate School of Education, holds an institute each summer; many graduates return, some serving as mentors to new attendees. At their best, these meetings demonstrate effective practices and introduce outstanding presenters. Even when the actual content of the meetings is less than stellar, one has the opportunity to meet and begin to network with people more than casually interested in Multiple Intelligences theory.

5. **Join a network of schools:** There are now explicit Multiple Intelligences networks – such as the one coordinated by New City School head Thomas Hoerr for the Association of Supervision and Curriculum Development – that provide up-to-date information and regular access to others devoted to exploring the educational implications of Multiple Intelligences theory.

6. **Plan and launch activities, practices, or programs that grow out of immersion in the world of Multiple Intelligences theory and approaches:** It is important to be courageous but reasonable and to build in time for reflection. Also, having indices of effectiveness for a new activity will be necessary for determining whether to continue it. Yet, because most experimentation does not work well at first, it is important to be flexible and, as appropriate, either continues for a while, even in the absence of firm results, or change course and rethink the work.
Theoretical Overview

- **Readiness:** It is important to launch process that builds awareness about the Multiple Intelligences ideas and how they might be implemented. Such processes could include a faculty seminar, a parent awareness night, or a visit to other Multiple Intelligences schools. This process of building awareness can be lengthy if the school does not already have beliefs and practices that are at least loosely aligned with the themes and spirit of Multiple Intelligences.

- **Culture:** Multiple Intelligences practices are most likely to emerge in setting that support diverse learners and encourage study, hard work.

- **Collaboration:** There should be ample opportunities for formal and informal exchanges, both within the school and with others who share experiences and concerns. These exchanges remain crucial once the processes of change have begun, because there are always problems to discuss and decision to make.

- **Choice:** The school should offer meaningful options for curriculum as well as for assessment of student growth and learning. The options should make sense both to the students and to the wider community. A Multiple Intelligences setting can be undone if the curriculum is too rigid or if there is but a single form of assessment (which all too often is a short-answer standardised test).

- **Tool:** Multiple Intelligences should be used as a means of fostering high-quality student work. In the last analysis, it is the students’ work and their understanding of it that is the hallmarks of good schooling. Multiple Intelligences approaches work best when integrally yoked to outcomes that everyone cares about strongly.

- **Arts:** A programme rich in the arts should assume a significant role in the school. Otherwise, it will be difficult to address the range of Intelligences exhibited by students and teachers.
2.6. MULTIPLE INTELLIGENCES THEORY IN MODERN TEACHING APPROACH

Gardner of Harvard University has propounded a unique theory of intelligence called the “Theory of Multiple Intelligences”. He asserted that human intelligence or cognitive competence can be better described as a set of individual’s multiple abilities, talents and mental skills related to a multiple number of domains of knowledge in a particular culture setting. He concluded that there are seven independent types of intelligence that grow and develop differently in different people, depending upon their hereditary characteristics and environmental experiences. These different types of intelligence have been named by him as Linguistic, Logical-Mathematical, Spatial, Musical, Bodily-Kinesthetic, Intrapersonal and Interpersonal Intelligence.

The theory was extended by him in 1998-99; Gardner took a vacation and used part of that time to review evidence for the existence of new intelligence and concluded that there was ample evidence for Naturalistic Intelligence; and suggestive evidence as well as for a possible Existential Intelligence (the intelligence of big questions).

To begin with, there will efforts to propose new intelligence. In recent years, in addition to the explosion of interest in Emotional Intelligence, there have also been serious efforts to describe a Spiritual intelligence / Moral Intelligence.

Gardner (1983) says that our schools and culture focus most of their attention on Linguistic and Logical-Mathematical Intelligence. We esteem the highly articulate or logical people of our culture. However, Gardner says that we should also place equal attention on individual who show gifts in other Intelligences: the Artists, Architects, Musicians, Naturalists, Designers, Dancers, Therapists and others who enrich the world, in which we live. Unfortunately, many children who have these gifts don’t receive much reinforcement for them in schools. Many of these kids in fact end up being labelled learning disabled or simply underachievers, when a heavily Linguistic or Logical- Mathematical classroom doesn’t address their unique ways of thinking and learning. Based on his study of many people from any different walks of life in everyday circumstances and profession, Gardner developed the theory of Multiple Intelligences.
According to Gardner,

- All human beings possess all intelligences in varying amounts.
- Each person has a different intellectual composition.(Intelligentsia)
- We can improve education by addressing the Multiple Intelligences of our students.
- These Intelligences are located in different areas of the brain and can either work independently or together.
- These Intelligences may define the human species.

Gardner’s Multiple Intelligences theory challenged traditional beliefs in the field of education and cognitive science. According to a traditional definition, intelligence is a uniform cognitive capacity people are born with. This capacity can be easily measured by Objective type and short answer tests. Gardner defines intelligence as the capacity to solve problems or to fashion products that are valued in one or more cultural setting. Using biological as well as cultural research, he formulated a list of Ten Intelligences. This new outlook of Intelligence differs greatly from the traditional view, which usually recognizes only two intelligences – Verbal and Computational.

According to Gardner, intelligence is:

- The ability to create an effective product or offer a service that is valued in a culture.
- A set of skills that makes it possible for a person to solve problems in life.
- The potential for finding or creating solutions for problems, which involves gathering new knowledge.

According to Gardner, there are many not just one, different but autonomous intelligence capacities that result in many different ways of knowing, understanding and learning about our world. Elaborating his pluralistic view of intelligence concluded that, these are ten independent types of Intelligences that grow and develop difficulty in different people, depending upon their hereditary characteristics and environmental experiences.
By calling them independent, Gardner meant that each of the Intelligences is a relatively autonomous intellectual potential, which is capable of functioning independently of the others. He has named these different types of Intelligences:

1. Verbal-Linguistic intelligence
2. Logical-Mathematical intelligence
3. Visual-Spatial intelligence
4. Bodily-Kinesthetic intelligence
5. Musical-Rhythmic intelligence
6. Intrapersonal intelligence
7. Interpersonal intelligence
8. Naturalistic intelligence
9. Existential intelligence
10. Moral/Spiritual intelligence

1) Verbal-Linguistic intelligence

Verbal-Linguistic intelligence is the ability to use language effectively and creatively both orally and in writing. This type of human intelligence is responsible for all kinds of Linguistic competence – abilities, talents and skills, available in human beings. It can be best broken down into components like Syntax, Semantics and Pragmatics as well as more school-oriented skills such as written or oral expression and understanding. This type of intelligence is most visible in professionals like Lawyers, Lecturers, Writers, Lyricists and a number of other Professionals exploiting Linguistic intelligence.

Components of Verbal-Linguistic intelligence

1. Vocabulary and Grammar learning
2. Listening
3. Formal and informal speaking
4. Humour or jokes
5. Story telling
6. Reading
7. Writing
8. Creative writing
2) Logical-Mathematical intelligence

This type of intelligence is responsible for all types of abilities, talents and skills in areas related to Logic and Mathematics. It can be broken down into components like Deductive reasoning, Inductive reasoning, Scientific thinking including solving of logical puzzles, carrying out calculations and like professionals like Mathematicians, Philosophers, Physicists, Scientists, Computer programmers, Accountants, Lawyers and Bankers.

Components of Logical-Mathematical intelligence

1. Logic pattern games
2. Logical/sequential presentation
3. Number sequences/patterns
4. Problem solving
5. Forming relationship
6. Syllogisms

3) Spatial intelligence

This type of intelligence is concerned with the abilities, talents and skills involving the representation and manipulation of spatial configuration and relationship. Many of us as adults make use of this kind of intelligence in the sphere of our work. For example, Painters may be seen to demonstrate spatial intelligence through their use of space when applying pigments to canvas. This is also true of professionals like Land surveyors, Architects, Engineers, Mechanics, Navigators, Sculptures and Chess players who are found to rely upon the Spatial intelligence in their own way.

Components of Visual-Spatial intelligence

1. Visual aids making
2. Active imagination
3. Mind mapping
4. Environment arranging/decorating

4) Musical intelligence

This type of intelligence covers the abilities, talents and skills pertaining to the field of music. It may be well demonstrated through one’s capacity for pitch
discrimination, sensitivity to rhythm, texture and timbre, ability to hear themselves in music, and its most integrated forms, the production of music through performance or composition. This intelligence can be seen in Advertising professionals, Performance Musicians, Rock musicians, Dance bands and Composers.

Components of Musical intelligence

1. Music/song listening
2. Singing/humming
3. Musical instrument playing
4. Music composition/creation
5. Jazz chants/rapping
6. Vocal sounds/tones

5) Bodily-Kinaesthetic intelligence

This type of intelligence is concerned with the set of abilities, talents and skills involved in using one’s body or its various parts to perform skilful and purposeful movements. A child may be seen to demonstrate such intelligence in moving expressively, in response to different musical and verbal stimuli or bending different body parts in organized sports. Among Professionals, Dancers, Athletes and Surgeons, may be seen to demonstrate a high degree of Bodily-Kinaesthetic intelligence in their respective fields.

Components of Bodily-Kinaesthetic intelligence

1. Physical actions
2. Body language
3. Role Playing/Mime
4. Dramatic enactment
5. Sports/Games
6. Field trips

6) Intrapersonal Intelligence

This type of intelligence consists of an individual’s abilities to enable him to know himself. It includes knowledge and understanding of one’s own cognitive strengths, styles and mental functioning, as well as one’s feelings, range of
emotions and skills to utilize one’s fund of knowledge in practical situation. In brief, intrapersonal intelligence helps an individual to understand his own self by providing an insight into his total behaviour, what he feels, thinks or does. It is therefore said to be the most private of intelligence that a person possesses. On account of its secret and private nature, the access to this type of intelligence in an individual is available only through self-expression, i.e., language, music, visual, art and similar other forms of expression. In our practical life, this type of intelligence is demonstrated by Yogis, Saints, Philosophers, Psychiatrists, Spiritual counsellors and Cognitive pattern Researchers.

**Components of Intrapersonal intelligence**

1. Independent studies/projects
2. Journal/Logs/Diary Keeping
3. Focusing/Concentration Skills
4. Thinking Strategies

7) **Interpersonal intelligence**

The counterpart of Intrapersonal intelligence in one’s cognitive structure is Interpersonal intelligence. It consists of the abilities to understand individuals other than one’s self and one’s productivity, based on the understanding of others. The knowledge and understanding of others is the quality, which is needed for social interaction in one’s day-to-day life. In practical life, this type of intelligence is most visible among Psychotherapists, Teachers, Sales people, Politicians, Business executives and Religious leaders.

**Components of interpersonal intelligence**

1. Person to Person communication
2. Giving and receiving feedback
3. Co-operative learning strategies
4. Pair works and group projects
5. Jigsaw puzzle/strip story

8) **Naturalistic intelligence**

Naturalistic intelligence involves the ability to recognize and classify plants, minerals and animals, including rocks, grass and all variety of flora and
fauna. It also includes the ability to recognize cultural artefacts like cars, sneakers etc. This intelligence can be seen in such people as Farmers, Hunters, Zookeepers, Gardeners, Cooks, Veterinarians, Nature guide and Forest rangers.

**Components of Naturalistic intelligence**

1. Nature encounters/field trips
2. Species classification
3. Sensory stimulation exercise
4. Hands-on-labs- Performing experiments
5. Nature world simulations

**9) Existential intelligence**

Existential intelligence involves the ability to perceive, envision and be a thinker of the big picture. This type of intelligence can be seen in such people as Visionary leaders, Prophets etc.

**10) Moral/Spiritual intelligence**

This means the achievement of a state of being a sense of purpose, which has a Spiritual/Moral effect of others. This type of intelligence can be seen in Priests, Saints, and Ministers.

Gardner’s Multiple Intelligences theory touched off a wave of educational innovation not only in the United States, but also throughout the world. Educators recognize the diversity of the learners in the learning styles, learning potentials etc, and appreciate the development of learning strategies on the part of the learners. The theory of Multiple Intelligences has grabbed the attention of many educators around the country and hundreds of schools are currently using the philosophy to redesign the way to educates children.

**2.7. STRENGTHS OF GARDNER’S MULTIPLE INTELLIGENCES THEORY**

1) Helps to explain the variety of individual differences in different types of mental performance.
2) Based on developmental, clinical, case study and educational evidence.

It is very important to know how to use Multiple Intelligences theory in various kinds of schools or for various populations. Let us see different types of
intelligence and the core components of it, followed by the ways of improving various types of intelligence of the students by inculcating some aspects in teaching-learning process.

1) Verbal-Linguistic intelligence

The people with this intelligence learn best through language including Speaking, Writing, Reading and Listening. They are able to verbally or in writing, explain convince, and express them. They enjoy writing and creating new words. The core components of Linguistic Intelligence are sensitivity to sounds, rhythms and meanings of words, sensitivity to the different functions of language. They enjoy the researching, listening, reading and writing aspects of a research project.

Aspects to be inculcated in Teaching

1) Web development tools – sharing a poem, myth, legend, news article, Word processing (Word, Apple Works) – writing, rewriting, process writing, brainstorming, listing, review terms, writing definitions, listing ideas, writing a view script etc.
2) Story-creation software (poems, essays, letters)
3) Audio recorders and digitisers – recording oral histories and interviews
4) Video recording – text aspect
5) Storytelling, news program, interview, scripting, verbal reading, retelling
6) Speaking, debating, dramatising
7) Discussion lists and forums – discussing, debating

There are many ways to make learning more efficient (especially academic studies since they tend to be highly formalized). It is also possible to increase one’s reading speed and comprehension quite drastically. Teachers should develop the ability of using Syntax, Semantics and Pragmatics in the students. Students are asked to participate in various school-oriented skills such as a written or oral expression and understanding the concepts. All of them should participate in the various academic activities like quiz and essay writing competitions. As the proverb indicates ‘practice makes man perfect’, students are advised to practice or
exercise more in using the vocabulary and expression in order to develop their Linguistic intelligence.

2) Logical-Mathematical Intelligence

This type of intelligence is responsible for all types of abilities, talents and skills in areas related to Logic and Mathematics. The people with this intelligence learn best through numbers, reasoning, and problem solving. They are able to create and manipulate visuals and create mental pictures from many perspectives. They like to weigh, measure, calculate, and organize data. Give students opportunities to create or manipulate data they find on the internet. The core components of Logical-Mathematical intelligence are sensitivity to and capacity to discern, logical or numerical patterns, ability to handle long chains of reasoning. They enjoy collecting data, conducting experiments, and solving problems. Creating spreadsheets, databases, charts and other data organization and calculation projects would be their contribution to a group. They enjoy problem solving, measuring, sequencing, predicting, experimenting, and classifying and data collection aspects of a research project.

Aspects to be inculcated in Teaching

1. Organisational tools (database, calendars)
2. Calculation tools (spreadsheets)
3. Statistics
4. Online data collection
5. Problem-solving software
6. Computer-aided design – for problem solving
7. Strategy, logic, and critical thinking software

We always have to make decisions on uncertain, possibly biased information and incomplete understanding of how the world works. This makes it extra important both to find out more and to apply probabilistic reasoning to our decisions. Arithmetic and reasoning capacity of the students should be strengthened. For this, one should develop the Inductive and Deductive reasoning abilities and scientific thinking.
3) Visual/Spatial Intelligence

This type of intelligence is responsible for all types of abilities, talents, and skills involving the representation and manipulation of Spatial configuration and relationships. The people with this intelligence learn best visually and tend to organize their thinking spatially. They like to think and create pictures. They are also drawn to information that is presented in a visual form. Encourage students to combine visual elements such as editing photographs or enhancing line drawings. Encourage them to add other Intelligences such as written or oral descriptions or discussions. Ask them to make visual metaphors and stories. The core components of Spatial intelligence are capacities to perceive the Visual-Spatial world accurately and to perform transformation on one’s initial perceptions.

Aspects to be inculcated in Teaching

1. Photo sharing websites
2. CAD – Computer Aided Design
3. Puzzle building tools
4. Paint programs – Photoshop, Pain, Apple Works
5. Web development tools
6. Digital drawing pads
7. Scrap book, photo albums and slide shows: oral history projects
8. Visual information materials: photographs, clipart, charts, graphs, tables

4) Musical/Rhythmic Intelligence

This type of intelligence is responsible for all types of abilities, talents and skills pertaining to the field of Music. The people with this intelligence learn best through sounds including listening and making sound such as songs, rhythms, patterns, and other types of auditory expression. They are able to use Inductive and Deductive reasoning and identify relationships in data. Provide students with audio and video recorders to capture their musical expressions and ask them to choose appropriate music to go with a slide show, artwork or poem. They like to create
and record handmade instruments. Add other intelligences such as drawing patterns of music or writing about music and sounds. The core components of Musical intelligence are abilities to produce and appreciate rhythm, pitch and timbre, appreciation of the forms of musical expressiveness. They like to choose and compose music for multimedia presentations. They like to see and hear patterns, so they may be good at sequencing a presentation. They are good listeners; so ask them to look for things that might be missing after watching a videotape.

Aspects to be inculcated in Teaching

1. Pitch discrimination
2. Sensitivity to rhythm
3. Texture and timber
4. Ability to hear themes in music
5. Video and audio recorders – digitise singing, musical instruments
6. Sound and music files
7. Music clips
8. Music generation software
9. Music composition software
10. DVDs and CD-audios

5) Bodily-Kinaesthetic intelligence

This type of intelligence is responsible for all types of abilities, talents and skills involved in using one’s body or its various parts to perform skilful and purposeful movements. The core components of Body-Kinesthetic intelligence are abilities to control one’s body movements and to handle objects skillfully. The people with this intelligence learn best through physical activity such as dance, hands-on tasks, constructing models, and any kind of movement. They are able to manipulate and control objects, as well as express their ideas through movement. Give these students a video camera and let them record their movement such as a wood working activity or a skit. Add other intelligences such as taking still pictures and writing about the steps in the process.
Aspects to be inculcated in Teaching

1. Scientific probes and microscopes
2. Video production – skits, dances, sports, role-playing, demonstrations, animation – Macromedia Flash
3. Virtual Fieldtrip – using and creating
4. Digital still and video cameras – skits, plays, role-playing, demonstrations

6) Intraperisonal Intelligence

This type of intelligence consists of an individual’s abilities to enable him to know himself. The core components of Intraperisonal intelligence are access to one’s own feelings and the ability to discriminate among them and draw upon them to guide behaviour, knowledge of one’s own strengths, weaknesses, desires, and intelligence. It includes knowledge and understanding of one’s own cognitive strengths, styles and mental functioning as well as one’s feelings, range of emotions and skills to utilize one’s fund of knowledge in practical situations. The people with this intelligence learn best through meta-cognitive practices such as getting in touch with their feelings and self-motivation. They are able to concentrate and be mindful. Provide tools to help students ‘think about their thinking’ through writing or recording ideas. They are good at setting and pursuing goals and assessing work. They are good at working independently toward a group goal.

Aspects to be inculcated in Teaching

1. Problem solving software – self paced software
2. Internet research – self-paced
3. Word processing – brainstorming, diaries, journals
4. Video projects – record personal ideas

7) Interpersonal Intelligence

The counterpart of Intraperisonal intelligence in one’s cognitive structure is Interpersonal intelligence. It consists of the abilities to understand individuals’
other than one’s self and one’s relation to others. The knowledge and understanding of others is the quality that is needed for social interactions in one’s day-to-day life. The core components of Interpersonal intelligence are capacities to discern and respond appropriately to the moods, temperaments, motivation with other desires of other people. The people with this intelligence learn best through interaction with other people through discussions, cooperative work and social activities. They are able to create synergy in a room by being aware of the feelings and motives of others. They are good at rallying the group together and getting discussions going. They are good at teaching other members of the group and coordinating activities. In a group project, they are good at peer editing.

**Aspects to be inculcated in Teaching**

1. Chat
2. Word processing – chain writing, group editing, peer writing, brainstorming forums and discussions
3. Social networks
4. Video recording – sharing with others through skits, debates and role plays, games
5. Peer tutoring

8) **Naturalistic intelligence**

The eighth intelligence was proposed by Gardner in 1999 and he calls it as Naturalistic intelligence. This intelligence involves the ability to understand and work effectively in the natural world. This is exemplified by Biologists and Zoologists. The people with this intelligence learn best through the interactions with the environment including outdoor activities, fieldtrips and involvement with plants and animals. They see the subtle meanings and patterns in nature and the world around them. They are able to adapt. And also have the ability to discern patterns in nature like Darwin. They could enjoy fieldtrips that involve observation and recording the world around them.
Aspects to be inculcated in Teaching

1. Fieldtrips
2. Visiting zoo, parks etc.
3. Visiting botanical gardens
4. Identifying various plants
5. Identifying various animals
6. Describing nature

9) Existential intelligence

The ninth intelligence was proposed by Gardner in 1999 and he calls it as Existential intelligence. This intelligence involves the ability to perceive, envision and be a thinker of the big picture. The people with this intelligence learn best through the Question- answer method. They see the subtle meanings and patterns of questioning of existence, ideological philosophy and sense development. This type of intelligence can be seen in such people as Visionary leaders and Prophets.

Aspects to be inculcated in Teaching

1. Ideological based Education
2. Question- answer method

10) Moral/Spiritual intelligence

The tenth intelligence was proposed by Gardner in 1999 and he calls it as Moral intelligence. This intelligence involves the ability to understand the achievement of a state of being a sense of purpose, which has a Spiritual/ Moral effects of others. This type of intelligence can be seen in Priests, Saints and Ministers. They see the subtle meanings and patterns in Spiritual/Moral aspects, values, Religion, manners, spirit, discipline etc.

Aspects to be inculcated in Teaching

1. Value Based Education
2. Moral Education etc.
2.8. BARRIERS FOR THE IMPLEMENTATION OF MULTIPLE INTELLIGENCES IN THE SCHOOL

i) **Barriers relating to Teacher / Parents’ Culture**
   a. The conflicting benefits and practices associated with the different and competing subcultures within the school.
   b. Pervasive culture of teacher isolation common to the secondary school context.
   c. Parents not seeing the values of a Multiple Intelligences approach, not understanding how using Multiple Intelligences can help their children to be successful.

ii) **Barriers relating to Management Requirements**
   a. Stringent departmental requirements were found to promote curriculum-driven classroom programmes, and to discourage student-centred planning, curriculum innovation and teacher creativity generally.
   b. Financial constraints due to the limited resources in and around the classroom.
   c. Poor availability of Infrastructural Facilities.

iii) **Barriers relating to Time**
   a. The traditional timetabled system of 45 minute periods makes teacher difficulty in collaboration, encourages curriculum-centred practices and a superficial approach in teaching and learning and this can cause anxiety for some students.
   b. Lack of time due to the pressures of curriculum coverage and meeting assessment requirements.
   c. Extra time required to plan and implement Multiple Intelligences based multi-modal lessons.
   d. Regular interruptions to daily schedules due to school events.
e. Too many demands on teachers’ time, particularly those with management of extracurricular responsibilities.

iv) **Barriers relating to Personnel**

a. Need for supportive leadership of curriculum innovation

b. Teacher training may not adequately prepare teachers for implementing student-centered multi-modal classroom programmes, which make effective use of cooperative learning situations.

c. A change of personnel, particularly in a position of management, can potentially impact on implementation of innovations if the new staff member does not understand or support the initiative.

d. The use of relief teachers can break the continuity of learning for students and can work against curriculum innovations.

e. Less experienced teachers may be reluctant to implement activity-based lessons due to classroom management concerns.

f. Stresses in teachers’ personal lives can impact on their enthusiasm or energy for classroom innovations.

Thus, applying the theory of Multiple Intelligences in any learning environment enriches the lives of learners and teachers by widening the range of options for both. It offers opportunities for students, to take more responsibility for their own learning and for the teacher, to become a facilitator of learning rather than the sole provider of knowledge in the classroom. Teachers incorporating the theory of Multiple Intelligences into classroom instruction honours diverse learning style, students become involved learners rather than isolated learners; find new and creative ways to solve problems; expand skills in their areas of weakness to achieve success; demonstrate skills in their strengths to achieve success; bond more readily to school and other fellow students and become lifelong learners. These attitudes and behaviour later carry over to the workplace, making today’s better students tomorrow’s better workers.
FIGURE 2.1  Multiple Intelligences in Birds eye view

Later Gardner added Moral/Spiritual Intelligence along with other Multiple Intelligences (2001)
TABLE 2.1

Summary of the first Eight Intelligences

<table>
<thead>
<tr>
<th>Intelligence Area</th>
<th>Strengths</th>
<th>Preferences</th>
<th>Learns best through:</th>
<th>Needs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal / Linguistic</td>
<td>Writing, reading, memorizing dates, thinking in words, telling stories</td>
<td>Write, read, tell stories, talk, memorize, work at solving puzzles</td>
<td>Hearing and seeing words, speaking, reading, writing, discussing and debating</td>
<td>Books, tapes, paper diaries, writing tools, dialogue, discussion, debated, stories, etc.</td>
</tr>
<tr>
<td>Mathematical / Logical</td>
<td>Math, logic, problem-solving, reasoning, patterns</td>
<td>Question, work with numbers, experiment, solve problems</td>
<td>Working with relationships and patterns, classifying, categorizing, working with the abstract</td>
<td>Things to think about and explore, science materials, manipulative, trips to the planetarium and science museum, etc.</td>
</tr>
<tr>
<td>Visual / Spatial</td>
<td>Maps, reading charts, drawing, mazes, puzzles, imagining things, visualization</td>
<td>Draw, build, design, create, daydream, look at pictures</td>
<td>Working with pictures and colors, visualizing, using the mind's eye, drawing</td>
<td>Video, movies, slides, art, imagination games, mazes, puzzles, illustrated book, trips to art museums, etc.</td>
</tr>
<tr>
<td>Bodily / Kinaesthetic</td>
<td>Athletics, dancing, crafts, using tools, acting</td>
<td>Move around, touch and talk, body language</td>
<td>Touching, moving, knowledge through bodily sensations, processing</td>
<td>Role-play, drama, things to build, movement, sports and physical games, tactile experiences, hands-on learning, etc.</td>
</tr>
<tr>
<td>Musical</td>
<td>Picking up sounds, remembering melodies, rhythms, singing</td>
<td>Sing, play an instrument, listen to music, hum</td>
<td>Rhythm, singing, melody, listening to music and melodies</td>
<td>Sing-along time, trips to concerts, music playing at home and school, musical instruments, etc.</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Leading, organizing, understanding people, communicating, resolving conflicts, selling</td>
<td>Talk to people, have friends, join groups</td>
<td>Comparing, relating, sharing, interviewing, cooperating</td>
<td>Friends, group games, social gatherings, community events, clubs, mentors/apprenticeships, etc.</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>Recognizing strengths and weaknesses, setting goals, understanding self</td>
<td>Work alone, reflect pursue interests</td>
<td>Working alone, having space, reflecting, doing self-paced projects</td>
<td>Secret places, time alone, self-paced projects, choices, etc.</td>
</tr>
<tr>
<td>Naturalistic</td>
<td>Understanding nature, making distinctions, identifying flora and fauna</td>
<td>Be involved with nature, make distinctions</td>
<td>Working in nature, exploring living things, learning about plants and natural events</td>
<td>Order, same/different, connections to real life and science issues, patterns</td>
</tr>
</tbody>
</table>
2.9. MULTIPLE INTELLIGENCES THEORY AND THE TEACHER

Teachers are well aware of the fact that every classroom students are different from each other in many ways. Each student comes from a different social, economic and cultural background, each has different areas of interest, different ways of expressing themselves, different strengths and weaknesses and now the teacher is being asked to be aware of the fact that each student also has their own individual intelligence profile.

The traditional classroom tends to treat students as a homogenous group with the teacher presenting the same exercise to all students at the same time and expecting the same answers to be produced within similar time limits. Students are expected to absorb the knowledge presented by the teacher with a strong emphasis on the use of Language and Logical-Mathematical analysis. Most academic knowledge is presented for learning by means of an extremely limited methodology and the acquisition of that knowledge is evaluated by means of Note tests (pencil-paper tests), whereby the best grades are assigned to students who demonstrate the greatest ability for memorization.

Accepting Gardner’s theory of Multiple Intelligences has several implications for teachers in terms of classroom instruction. The theory states that all Intelligences are needed to productively function in a society. Teachers therefore think of all Intelligences as equally important. This is in great contrast to traditional educational systems, which typically place a strong emphasis on the development and use of Verbal and Mathematical intelligences. Thus the theory of Multiple Intelligences implies that educators should recognize and teach a broader range of talents and skills. Teachers should structure the presentation of material in a style that engages most or all of the intelligences. By activating a wide assortment of Intelligences, teaching in this manner can facilitate a deeper understanding of the subject material.

The theory of Multiple Intelligences was developed as an account of human cognition that could be subjected to empirical tasks. The Multiple Intelligences theory seems a harbor, a number of educational implications that are worthy of consideration. Armstrong (1994) has synthesized these ideas into four significant
points that are used by educators and this made the theory attractive. The four significant points are,

- Each one posses all Ten Intelligences.
- Intelligence can be developed.
- Intelligence work together in complex ways.
- There are many ways to become intelligent.

Gardner was not designed a curriculum or prepared a model to be used in schools with his Multiple Intelligences theory. Educators have taken the theory put it together in different ways and applied it to lesson planning and curriculum development.

Teachers have developed four ways of using Multiple Intelligence theory in the classroom. They are:

1. As a tool to help students to develop a better understanding and appreciation of their own strengths and learning preferences.

2. As a tool to develop a better understanding of learner’s intelligence. An understanding of Multiple Intelligence theory broader teacher’s awareness of their student’s knowledge and skills and enables them to look each student from the perspective of strengths and potential.

3. As a guide to provide a greater variety of ways for students to learn and to demonstrate their learning. Identification of personal strengths can make students more receptive to non-traditional learning activities and can give students a successful experience that builds their confidence as learners. With a Multiple Intelligence curriculum, students become aware that different people have different strengths and that each person has a substantive contribution to make.

4. As a guide to develop lesson plans that address the full range of learner’s needs.

2.9.1 Strategies for the application of Multiple Intelligence theory

There are four major strategies for the application of Multiple Intelligence theory. They are:
1. **Focusing on the uniqueness of the individual**

   An underlining assumption behind the practical application of the Multiple Intelligence theory is the realization that every middle level student is different. If in fact your adolescents are different, the teachers cannot teach these students as if they all are the same. Therefore, effective instruction cannot be enhanced through limited methodological approaches.

2. **Teaching to the intelligence**

   In order to vary instructional approaches, teachers who use Multiple Intelligences theory in the classroom plan activities in order to incorporate each of the ten Intelligences. Most school emphasizes the Linguistic and Logical-Mathematical intelligence. Educators, who advocate the application of Multiple Intelligence theory in the classroom, suggest all the other Intelligences should be incorporated into lessons to help students learn Linguistic and Logical-Mathematical concepts. In addition, these educators suggest there should be a balance of Intrapersonal and Interpersonal activities in the classroom.

3. **Planning Multiple Intelligences Lessons**

   It would not be practical to teach every concept through each of the Intelligences. Application of this theory does suggest, however, that teachers analyse their lesson plans to ascertain which Intelligences are being utilized with each activity. Teachers can evaluate whether a classroom activity is Linguistic, Logical/ Mathematical, Spatial, Musical etc. Teachers should keep a log (Intelligence Profile) of their activities in an attempt to determine if any of the Intelligences are over or under emphasized in their lesson plan. The significant point is that teachers should be aiming for balance in their plans by checking for overkill in some areas and omissions in other areas. Once teachers have taken stock regarding the level of use of the Intelligences in their planning then teachers have enough in their planning then teachers have enough information to revamp and adjust their plans in order to achieve the balance that they desire.

4. **Assessing the effectiveness of Multiple Intelligences lessons**

   Student performance on classroom assessments should be the criteria used to indicate the effectiveness of the lessons. The goal is to determine what the
students have learned. The application of Multiple Intelligences theory does not discourage testing as a primary source of classroom assessment. Instead, its primary focus should be to incorporate Intelligences into instructional practices in order to assist students to master difficult concepts. Therefore, the testing of those concepts is most appropriate.

In order to implement Multiple Intelligences theory successfully, teachers should attempt to learn as much about the application of it as possible. There are a number of sources for this information. Several educators have written books focusing on the application of Multiple Intelligence theory in the classroom. In addition to reading current literature about Multiple Intelligences theory, teachers must seek out workshops and in-service programs focusing on the application of theory. Another great source of information is other teachers. Teachers should be in dialogue with each other regarding the successes they have had in teaching the Intelligences.

2.10. RELATIONSHIP BETWEEN MULTIPLE INTELLIGENCES AND SCIENCE

Modern studies about intelligence are highly pertinent in science learning. Traditional teaching method has the notion that intelligence is innate and remains unchanged. Hence, there exists a thought that certain children are poor in rationality, arithmetic operations and analytical skill and they might be backward in learning science.

Science as considered an important subject in school curriculum as many professional and applied courses, directly or indirectly uses the knowledge to apply. Moreover, the present age is the era of science which is close to any nation’s health and strength for the well being of its people. Since science touches the lives of every individual and gives an essential background of knowledge for cultural development, it gives many opportunities to foster the scientific method of discipline. It trains the pupil to observe and think clearly and carefully. It stresses the need to appreciate the meaning of scientific life, spirit and endeavour – open mindedness, intellectual, honesty, self sacrifice and devotion – which ought to serve as ideals to the future citizen. It acquaints the pupil with knowledge of
chemical facts needed not only for many trades and professions, but also for many citizens, enabling them to lead happy, well-balanced and useful lives.

The exponential growth of the educational establishment, naturally led to a watering down of educational students in all subjects. Science education, consequently suffered most. The demand for science education in the state of Kerala has increased several folds in the course of the five decades following independence. Many five year plans of our country at different age’s earmarked fund required for bringing up thousands of highly qualified engineers, scientists, technologists and para-technical personnel. Since the basic qualification required for admission to various technical courses is the passing of pre-degree course (the 11th & 12th year of schooling attached to the institutions of higher education affiliated to the universities) in one of science streams (Physics, Chemistry and Mathematics / Physics, Chemistry and Biology) it has been found a steady increase in the enrolments in these course combinations.

Survey of the different published studies indicate that low achievement and under achievement in science subjects are often related to a number of psychological and sociological factors like intelligence, anxiety, achievement motivation, self concept, etc.

Our present educational system is heavily biased towards the Linguistic and Logical-Mathematical modes of instruction. Teachers traditionally teach science using two approaches – Linguistic approach and Logical-Mathematical approaches. These approaches benefit the students who are linguistically and mathematically talented. They could achieve high marks in science. But others will soon fall hopelessly behind and become discouraged. This situation not only will result in inefficient instruction but may easily become a fertile-breeding ground for discontent, loss of interest and possible disciplinary difficulties. If instruction is really effective, the subject matter must be selected and organized in such a way as to make it appropriate and suited to the age and intellectual development of the students. Since students do not learn with equal facility or at equal rates, there must be provision for differences in achievements.

Multiple Intelligences approach encourages teachers with regard intellectual ability more broadly. The theory of Multiple Intelligences implies that
all individuals are able to know the world through language, logical-mathematical analysis, spatial representation, musical thinking, the use of the body to solve problems, or to make things, and understanding of ourselves. Where individuals differ in their strength of those components of Intelligences and in the ways in which intelligence is invoked and combined to carry out different tasks, solve diverse problems and progress in various domains. Multiple Intelligence pedagogy insists to teach the subject by incorporating all the Ten components of Intelligence. This will help the teachers to identify, appreciate and reduce the Intelligences in all the students. The teacher could assess the intellectual strengths and weakness of each student. Thus the teacher could help the student to learn the subject through their well-developed intelligences. In the meanwhile, they could help the students to develop neglected intelligences as well as to activate under developed or paralyzed intelligence.

When the learning of the subject takes place through the preferred Intelligences of the students, they will have interest for learning. This will create a favourable attitude towards the subject as well as will help the learner to attain high marks in science. The learner will score more only when he/she has strong interest in science subjects. Knowing the components of Multiple Intelligences well, we can predict which element of intelligences fosters more for the development of science interest.

2.11. SCIENCE INTEREST

Interest is considered as a powerful ‘dictator’, ‘inspirer’ and ‘motivator’ in the learning process. Interest is the feeling that promotes us to spontaneous activity. Interest is something within the child.

According to Dewey (1909), “Genuine interest, in short, simply means that a person has identified himself with or has found himself in, a certain course of action”.

According to Crow and Crow (1976), Interest may refer to the motivating force that impulse us to attend to a person, a thing or an activity or it may be the effective experience that has been stimulated by the activity itself. In other words,
interests can be the cause of an activity and the result of participation in the activity.

Sawbery and Telford (1966) define interest as “favourable attitude towards objects”.

The learning forward of the body denotes interest. Harriman (1957) has defined it so “any preference displayed when choices are offered”. Strong (1927), developed a test for the measurement of interests by having the subjects choose among like indifference, and dislike for each of 420 items, the weighted scores furnishing a basis for comparisons with persons who are successful in various occupations.

According to Warren’s Dictionary of Psychology, interest is
1. A feeling which accompanies special attention to some content
2. An attitude characterized by focusing attention upon certain cognitive data.

2.11.1 Nature and Characteristics of Interests
1. Interests are closely linked with our instincts, basic needs, drives and motives.
2. Interests and attention are very much related to each other. Interest is a precondition to attention.

According to McDougall (1908), “interest is latent attention and attention is interest in action”.
3. Interests are innate as well as acquired dispositions.
4. Pursuit of one’s interest provides strength to an individual to resist fatigue.
5. Pursuit of one’s interest provides energy and a driving force.
6. Interests are sharpened by heredity and environment.
7. Interests are not fixed and permanent.
8. Interests of the individuals tend to become less varied with interesting age.
9. Interests of the individuals differ.
10. Learning becomes effective and efficient when interests of the children are satisfied.
2.12  **MOTIVATION AND INTEREST**

Motivation and interest have important role in learning. Motivation, as far as Indian schools are concerned, is provided by the factor of examinations. But often this leads to cramming. Permanent learning can be caused only by regular and planned work over a long period.

Armstrong (1994) quotes the view of Eliot, as “No one can really become educated without having persuaded some study in which he took no interest for it is a part of education to learn to interest ourselves in subjects for whom we have no aptitude”.

2.13  **THE TEACHER’S ROLE AND INTEREST**

It is interesting to examine the role of educator based on interest.

“The teacher concerned may

1. Promote desirable interest among students
2. Foster new interests with respect to science subjects
3. Discourage undesirable interests
4. By arousing interest, to develop increasing rapport between the teacher and the pupils
5. By arousing interest it will motivate pupils towards curriculum and
6. By provide better educational and vocational guidance with respect to their interest.

2.14  **MEASUREMENT OF INTEREST**

In many individuals, interests have been found to be sufficiently crystallized. Reliable measures should be taken for these interests when the individual is in elementary schools. There are several measures of interests.

The more prominent of these are,

1. **Strong Vocational Interest Blank**

This scale is available in separate forms, for men and women. It consists of 400 items grouped into 8 parts. The first 5 parts require a subject to indicate
whether he likes, dislikes or is indifferent to each item. The five parts deal with occupations, school subjects, amusement, miscellaneous activities and peculiarities of people. The other three groups of item require the subject to rank activities in his order of preference, compare his interests in pairs of items and rate his present abilities and various other characteristics. The test can be scored for 45 occupations for men and 25 for women. Strong (1927) has become famous in the development of this instrument and its validity is very great.

2. Kuder Preference Record- Vocational

This has been developed more recently and it enjoys considerable popularity. It contains 168 items; each of which lists 3 activities. The subject is asked to choose 2 of the 3 activities; the one he likes more to do and another he least likes. The items cover a great range of activity and are scored to yield a profile of interests, representing 10 areas - outdoor, mechanical, computational, scientific, persuasive, artistic, literary, musical, social service and clerical. The inventory can be self-scored and the scores in the ten areas are converted into percentile ranks. A score at or above the 75 percentile is considered high enough to be vocationally significant. Kuder vocational interest test (1966) can be standardized for high school and college students and adults.

2.15 INTEREST INVENTORY DEFINED

Attitudes and interests are both concerned with likes and dislikes. Both can be related to preferences for activities, social institutions or groups. Both involve personal feelings about something. It is the something that distinguishes attitudes from interests. An attitude is typically conceptualized for a group. An interest on the other hand, is conceptualized as being a feeling toward an activity.

Vernon (1949) says, Interests are very much the same as attitude, though their definition is also a matter of controversy. Their subject matter is usually more concrete. We are interested in or like athletics, music, model aeroplanes etc. Where as we have favourable or other attitude toward religion, foreigners etc.

Monroe (1909) says, Interest is essential as the starting point of the educative process, effort is essential as its outcome. The purpose of appealing to
the interest of child is to lead him to point where he will put forth effort to master the unsolved problem and understand relationship of his environment.

According to Super (1949), interest is not a separate psychological entity, but merely one of several aspect of behaviour.

Interest inventories typically contain a list of careers, topics or activities. The respondents indicate those in which he is interested. Interest inventories used in science educational research, fall into two broad categories: General and Specific. General inventories yield interest profile in a variety of areas, e.g.: Study of value test (Allport, Vernon and Lindzey, 1960) yields scores on six scales (theoretical, aesthetic, economic, social, political and religious) and has been used in science educational research by Blankenship (1965) and Murphy (1970).

Another type of vocational interest instrument is Kuder Preference record (1966), which has been used in research on career orientation. Its science scale has been employed by Butcher (1969) and Vitrogan (1969). Finally a lesson known Factorial Interest Bank Sandall (1960) has been used by Hanrahn (1972).

Some scales which are restricted purely to measure science interest include

1. The Science Activity Inventory Cooley and Reed, (1962).
2. Clarke Science Interest check list (1972)

There are various interest inventories. Out of these Singh (1986), has developed an interest inventory, to measure students interest in seven factors, for class X students, has validity in questions. The seven factors are

1) Mechanical interest.
2) Business interest
3) Scientific interest
4) Aesthetic interest
5) Social interest
6) Clerical interest and
7) Outdoor interest
According to William (1950), an interest inventory is an organized method of listening or inventorying a person like and dislikes (his interest). These interests are then related to those of other persons in specific groups of occupations or areas of activity.

According to Garrett (1977), the interest inventory is essentially a self-report or survey covering a person’s own interests, values preferences and feelings over a wide range of activities. In the schools knowledge of a student’s dominant interest is of real significance for the teacher. The printed interest inventory supplies systematic information about a student’s attitudes; feelings and personality trends which otherwise could be revealed only in a long interview, if at all.

An interest inventory is not likely to be faked or responded to adversely. Examinees find it impersonal, less prying and often interesting in itself. Hence their appraisals are usually honest. From an interest inventory, a counsellor may get too valuable clues as to a student’s personality trends- for example, his desire for security rather than passive roles, for people rather than books.

Interest inventories are relatively easy to administer. Some of them are difficult to score and must be handled by a trained person. Among the most widely used interest inventories are the following: Strong’s vocational interest Blank for Men (1927), Cleton’s Vocational Interest Inventory, Kuder’s Preference Record (1966) and Thurstone’s Vocational Interest Schedule.

An Interest inventory may be used in the determination of pupils’ interests in the various fields or their areas of preference while an attitude scale is useful in determining pupil opinions and beliefs or an issue or issues which may be controversial in nature.

Knowledge of an individual’s interests provides a sound basis for educational and vocational guidance. Interest inventory result may help the class room teacher to understand why a bright pupil is performing poorly. They can be give assistance to the students, if only to make them think more about their future. It is highly desirable that a number of interest tests-tests for measuring interest in
academic and professional areas- are developed within a short time of educational and vocational guidance and to take firm roots in Kerala.

2.16 CONCLUSION

While we all have these Intelligences, individuals differ from both genetic and experiential reasons in their respective profiles of intellectual strengths and weaknesses. There are many methods of improving our intelligence, and fortunately we have many proven cognitive tools such as mnemonics, problem solving heuristics, creativity techniques and decision-making tools. Put concretely, we can approach topics in a number of ways; we can make use of analogies and comparisons drawn from a range of domains; and we can express the key notions or concepts in a number of different symbolic forms. Well choreographed ‘design experiments’ can reveal the kinds of educational endeavours where a Multiple Intelligences perspective is appropriate and where it is not. By knowing all the Intelligences we can understand which component of Multiple Intelligences will foster Science Interest of an individual.