CHAPTER - I

INTRODUCTION

There has always been an immense interest in the analysis of individual differences in educational psychology. Educational psychologists have understood for long time that an important key to facilitate student’s learning is to deal with individual differences in cognitive functions (Gustafsson and Undheim, 1995). Learning is the central theme of educational psychology and research because of the complexity and importance of this process for the evolution of society. Human beings are unique among all living organisms and their primary adaptive specialization lies in identification with the process of learning. Individual differences observed in the acquisition and process of information during learning results in style differences in learning (Heffler, 2001). The approach, to investigate on how students learn and seek the appropriate means of learning skills is needed for effective training and is absolutely necessary in the light of current trends in education. In this context, many steps and efforts have been taken to improve the educational system and classroom teaching (Khan, 2009). With the beginning of the cognitive styles movement in the late 1960’s, investigators have been studying the roles of stylistic variables in student’s academic achievement. Sometime, students do not know how to think and study properly and effectively. They must realize the importance and objectives of having knowledge, skills and attitudes which are significant in their future employment (Laguador, 2013). Traditionally, individual differences in abilities were used in explaining student’s success or failure in academic achievement. In recent years, researchers have become more interested in exploring the effects of stylistic variables on academic achievement. Ability measures account only for small proportion of individual differences in school performance, but construct of style as non ability measure has significant predictive power for student’s academic achievement. When various factors are examined, style has been considered as one of the important factors by researchers (Sharma, 2012). In the past 20 years, the study on learning and thinking styles, both theoretical and applied simultaneously sparked a strong interest.
The educationists, philosophers and psychologists have accepted that ‘learning’ and ‘thinking’ are the key processes. It is necessary to make the child learn and the whole education to be self-learning oriented. Teacher teaches in the classroom with the aim to provide maximum learning experiences to students, but in same class and same atmosphere, two students do not learn in the same way because many factors affect their process of learning. Learning style is one of the factors, and every student has his/her own learning style. Learning is a process of accumulation of knowledge, skills, attitudes and values through study, experience or teaching which causes a persistent, measurable change that is specific at a behavioural level. The way each human being processes, retains, integrates and begins to focus on new information and skills determine their preferred learning style (Kolb, 2005). Learning is related to thinking and as individual differences intervene, specific styles are used in learning and thinking processes. Thinking refers to the use of cognitive skills such as posing and answering questions, searching memory, processing information or evaluating potential solutions to the problem. Thinking styles refer to an individual’s preferred way of mentally processing information (Sternberg, 1999). It is important to generate knowledge about learning and thinking styles and consider all the students as individuals with their unique traits to cater the needs of students for promotion of learning and thinking. The effective adaptation to the situation, the use of student’s knowledge relative to the whole complex of factors that characterizes a particular context is possible by designing the main dimensions of the educational process, teaching learning and self evaluation based on quality standard issues related to learning and thinking styles (Atkin, 2006). The harmonious relationship between learning, thinking styles and teaching promotes class efficiency. Educational psychologists need to develop insights into the specific thinking and learning styles which are favoured by educational system. In the last many years, a number of educators have proposed that teaching will be more effective if faculty members take account of difference in students’ learning and thinking styles. The knowledge regarding styles of thinking can serve as an important tool in helping individual to improve the application of cognitive functioning and performance (Gakhar, 2007).
The main concern of all educational efforts is to see that the learner achieves academically. The over broadening spectrum of education and scientific development has raised the question of better learning and achievement for all. Academic achievement has always been crucial area and the main hub of educational research, as it plays an important and most significant role in shaping the career of an individual and planning for the future education. Achievement in a child is caused, promoted and affected by various variables such as variables arising out of person or self, variables arising out of teaching learning set-up, variables arising out of subject of study and so on. Each one of them is actually a cluster of variables which individually or on interaction with others have their influence on achievement (Padma, 1992). It is pertinent to mention that, of all the factors that influence an individual, his styles of learning and thinking plays a major role in determining academic performance (Vengopal and Mridula, 2007). Educating each individual in the classroom through individualized instruction is not a dream now a day. To meet the challenges arising from the fact that individuals differ remarkably in all aspects of their life space, various methods and techniques have been employed by several researchers, educationists and psychologists. Student’s learning and thinking style is used for providing individualized instruction.

1.1 Concept of learning style

Learning style simply refers to various approaches or ways of learning. It involves education methods, particular to an individual that are resumed to allow individual in learning at its best. It is commonly believed that most people favour some particular method of interacting with, taking in, and processing stimuli or information. Based on this concept, the idea of individualized ‘learning style’ originated in the 1970s, and has gained popularity in the recent years. It has been proposed that teachers should assess the learning styles of students and adapt specific methods to best fit each student’s learning styles. Many researchers, educationalists, psychologists have given meaning of learning style according to their own experience. Some of their ideas about learning style are given as:

- Kolb (1984) “Learning is a combination of experience, cognition, perception and behaviour, which lays the foundation of learning style models”.

• Felder and Silverman (1988) “Learning style is characterized as the preferences in process of an individual acquiring knowledge, holding and processing it”.

• Grasha (1996) “Learning style is collective experiences of learning during the process of gaining knowledge”.

• Ambasana (2004) “Students have different learning style; each learner has its particular learning style”.

• Donough (2005) “The approach to learning emphasizes the fact that individuals perceive and process information in very different ways. The learning style theory implies that how much individuals learn, has more to do with whether the educational experience is geared toward their particular style of learning”.

• Smith (2005) “People learn in many different ways and no two people learn in exactly the same ways. When people learn, they perceive and think, they also interact with resources, methods and environments. The tendencies and preferences that they get from their personal experience bring about own learning style”.

• Atkin (2006) “The different ways of learning and making meaning of information is called learning style. Learning styles refer to student’s preferences for some kinds of learning activities over others. A student’s learning styles have to do with the way he or she processes information in order to learn and apply it”.

To conclude, learning style is a relatively stable and consistent set of strategies that an individual prefers to use when engaged in learning. It refers to how someone likes to do something. These definitions reveal that learning styles are simply different approaches or ways of students’ preferences for some kinds of learning activities over others. These are characteristic approaches to learning and studying. Students who understand their own style are likely to be better learners, achieve higher grades, have more positive attitudes about their studies, feel greater self confidence and exhibit more skills in applying their knowledge in courses.
1.2 Learning style, multiple intelligence, learning strategy and learning ability

Learning style is different from multiple intelligence as multiple intelligence is bio-psychological potential to process information which are activated in a cultural setting to solve problems or create products that are of value in a culture (Gardner, 1999), while learning style is the way in which each person begins to concentrate on process, internalize and remember novel and difficult academic content. Multiple intelligence addresses what is taught (the product). Learning style addresses how it is taught (the process). Learning style research has evidenced that any content can be mastered when taught through student’s strengths. Multiple intelligence proponents advocate that by making changes in methodology used in the classroom the child learns best, while learning style advocates counsel teachers to use different instructional resources in a varied sequence in accord with how each learns best. Multiple intelligence do not differentiate kinesthetic and tactual learners. Learning style proponents do differentiate between two and advocate teaching them differently. Kinesthetic learners are those who learn through whole body activities and experiences, while tactual learners learn well with their hands. Learning style are different from learning strategies, as learning style is internally based on characteristics, often not consciously used by the learners, whereas learning strategies are external skills often used consciously by the learners to improve their learning (Reid, 1995). Being aware of their own learning style and constantly finding them effective in their learning process, learners will develop unconscious learning style into conscious strategies. Learning styles are so closely linked to strategies that a clear understanding of learner’s style will help teachers consciously develop learner’s potential in enhancing learning strategies and raise their chances for successful learning. Learning styles are different from learning ability as styles shows the way in which information is processed, while in learning ability, the information is being processed by how well a person is able to perform. Abilities are enabling variables which facilitate performance, while styles are more general determining principles which control and utilize abilities and strategies.
### 1.3 Factors affecting learning styles

Each of the factors that impacts learning styles subsumes a significant body of theoretical, conceptual and empirical research. Table 1.1 provides a list of some of the areas within each group. The field is replete with learning style theories based on one or more subject areas.

#### Table 1.1: Factors affecting learning styles

<table>
<thead>
<tr>
<th>Factor</th>
<th>Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental status</td>
<td>Genes, Gender, Educational experiences, Culture, Beliefs, Race, Prior content, Skills</td>
</tr>
<tr>
<td>Physiological</td>
<td>Perceptual (Visual, Auditory, Kinesthetic, Tactile), Mobility/Static, Time of day</td>
</tr>
<tr>
<td>Multiple intelligences</td>
<td>Logical/Mathematical, Linguistic, Musical, Spatial, Bodily/Kinesthetic, Interpersonal, Intrapersonal</td>
</tr>
<tr>
<td>Processing</td>
<td>Hemispheres, Cognitive/Behavioural</td>
</tr>
<tr>
<td>Emotional/psychological</td>
<td>Motivation, Persistence/Discipline, Responsibility, Safety/Comfort, Self esteem, Readiness to learn, Locus of control</td>
</tr>
<tr>
<td>Physical environment</td>
<td>Light, Sound, Temperature, Features, Mobility, Intake (Food and Liquid)</td>
</tr>
<tr>
<td>Sociological</td>
<td>Self, Pairs, Peers, Team, Group, Varied authority figure present</td>
</tr>
</tbody>
</table>

Some of the variables that are likely to affect the development of learning styles are:

1. **Genetically Inherited**: Learners preferences are influenced by genetic make up i.e. the genes one is born with. The particular learning style of parent of the
child is being adopted by the child in approaching a learning situation. As a result of hereditary factors, life experiences and demands of environment, students develop learning styles that emphasize certain learning abilities over others (Guild and Garger, 1985).

II. Schooling/Educational Background: The kind of schooling person gets also influences the preference of learning. Sometimes, the curriculum of the schools is like that it is mostly based on auditory or visual way. So, that particular learning style is a result of exposure to those stimuli over a long period of time. Cortazzi (1997) and Jordan (1997) also stated that the origin of learner style is often the student’s educational background, as well as their cultural background. Thus, learner’s surroundings and educational background definitely have an effect over their preference in learning.

III. Gender: Gender also plays an important role in the development of styles. Female learns best with social and independent/applied styles while males learning are finest with social/applied and social conceptual styles. Gender differences in verbal style of learning are also found, where females are having advantage over males. Female student tends to exhibit more characteristics of responsibility and a stronger preference for learning in various sociological environments than males, while male students have more competitive qualities and they would prefer to study hard independently, in order to win and stay competitive. In contrast, the female students are more dependent on their group members and characterized as collective learners, whereas male students partly viewed themselves as collective learners (Maubach and Morgan, 2001).

IV. Birth Order: Birth order has been studied for many years as a factor that plays an important part in influencing learning style of students. Birth order theory holds that children develop their behavioural pattern largely as a result of their position in the family. It means that first born children are more independent, dominant, and authoritarian than later born. It may be because of the reason that they are not dominated by their elder brother or sister and are free to take their own decisions (Sternberg, 1997).
1.4 Different learning style models

A very important contribution to progress in knowledge of learning style has been brought by classified studies/models in cognitive and constructive paradigms. They have allowed the development of highly prolific line of research that led to a better understanding of this concept. The preferred ways in which an individual approaches a task or learning situation is characterized in several different ways based on variety of theoretical models.

A) Model by Kolb (1984)

a) Theory:

Reviewing the previous work by John Dewey, Kurt Lewis, Jean Piaget, Carl Jung, Carl Rogers and others, Kolb (1984) developed a model of the experiential learning process called experiential learning theory (ELT). This unique theory on learning and development is built on six propositions of learning process models (Kolb, 1984): These are 1) Learning is best conceived as a process, not in terms of outcomes. 2) Learning is a continuous process grounded in experience. 3) The process of learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world. 4) Learning is a holistic process of adaptation to the world. 5) Learning involves transactions between the person and the environment. 6) Learning is the process of creating knowledge.

Kolb emphasized the need that the learner is taught differently and advocated personalized learning for individuals, based on the way they approach learning. Kolb, described learning as ‘the process whereby knowledge is created through the transformation of experience’. He proposed a theory of experiential learning that involves four key stages: 1) Concrete experiences; 2) Reflective observation; 3) Abstract conceptualization; and 4) Active experimentation. Each stage of the cycle requires different abilities and the learner must decide which one should apply in any particular situation. The concrete experiences and the abstract conceptualization are on one end of the scale and are opposite to the active experimentation, reflective observation on the other. Kolb’s learning theory sets out four distinct learning styles
as converging, assimilating, diverging and accommodating. Kolb classified styles according to four fold taxonomy as shown in the figure 1.1

![Diagram showing four learning styles: Converging, Assimilating, Diverging, Accommodating]

**Figure 1.1: Four learning styles based on Kolb’s model**

**b) Assessment of learning styles:**

To pertain the necessary information in discovering an individual’s style, Kolb designed a learning style inventory (LSI), a 12 item self assessment instrument to evaluate individual preferences for specific learning style. This framework identifies an individual’s learning style by plotting the individual’s choices on a quadrant graph and associating their choices to particular learning style. Validity for the LSI is established in number of fields including education, management, psychology, computer science, medicine. Internal reliability estimates are high in independent studies; test-retest reliability remained low. Veres, Sims and Locklear (1991) reported high test-retest reliability of 0.99.
B) Model by Honey and Mumford (1992)

a) Theory:

A more promising alternative to the learning style inventory is the measure created by Honey and Mumford. The learning style questionnaire measures the strength of preference for each style to give an indication of the degree to which any learning style is preferred to others. This psychometric evaluation adapts the learning style inventory by Kolb using the same bi-polar learning cycle. Honey and Mumford correlated activist with concrete experience; reflector with reflective observation; theorist with abstract conceptualization and pragmatist with active experimentation. According to Honey and Mumford (1992), individuals tend to rely on one of these approaches when they are engaged in learning.

b) Assessment of learning styles:

The questionnaire designed by Honey and Mumford, consists of 80 items with true/false answers taken from Kolb’s original concept of learning cycle of different learning styles. Honey and Mumford recognized fairly well validity of the instrument. The alpha coefficient for the four learning styles scales is quiet low, ranging from 0.31 for the pragmatist scale to 0.42 for the reflector scale.

C) Felder and Silverman Learning Style Model (1988, 1996)

a) Theory:

The Felder and Silverman learning style model is a learning model that is often used in technology-enhanced learning designed for traditional learning. This model focuses on individual learning tendencies, which account for individuals acting differently. The model has four dimensions, each specific to a learner and learner’s tendencies.

1. Active-Reflective: Active learners learn by trying things, working with others while reflective learners thoroughly think and work alone.

2. Sensing-Intuitive: Sensing learners are oriented towards facts and procedures while intuitive learners are more conceptual, innovative and focus on theories and meanings.
3. Visual-Verbal: Visual learners prefer visual representations of material such as pictures, diagrams and charts while verbal learners prefer written or spoken explanation.

4. Sequential-Global: Sequential learners are linear and orderly in their thinking and learn in small incremental steps while global learners are holistic thinkers who learn in large leaps.

b) Assessment of learning styles

Felder and Silverman originally developed a questionnaire for engineering students that has 44 questions focusing on four bipolar preferences for learning scales. Test-Retest reliability of this inventory is satisfactory and construct validity is also established for this inventory as cited by several studies.


(a) Theory:

The learning styles typology developed by Grasha and Reichmann is distinct from other three models and it is based on student’s responses to actual classroom activities rather than on a more general assessment of personal activity or cognitive traits. Grasha argues that this situation-specific approach is more likely to be reliable and valid. Grasha-Reichmann typology is designed to help the faculty identifying teaching techniques that addresses particular learning styles. Table 1.2 shows characteristics of Grasha-Reichmann learning styles categorized into six dimensions.

<table>
<thead>
<tr>
<th>Style</th>
<th>Characteristics</th>
<th>Classroom Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive</td>
<td>Compete with other students</td>
<td>Teacher-centered, class activities</td>
</tr>
<tr>
<td>Collaborative</td>
<td>Share ideas with others</td>
<td>Student-led small groups</td>
</tr>
<tr>
<td>Avoidant</td>
<td>Uninterested, non-participant</td>
<td>Anonymous environment</td>
</tr>
<tr>
<td>Participant</td>
<td>Eager to participate</td>
<td>Lectures with discussion</td>
</tr>
<tr>
<td>Dependent</td>
<td>Seek authority figure</td>
<td>Clear instructions, little ambiguity</td>
</tr>
<tr>
<td>Independent</td>
<td>Think for themselves</td>
<td>Independent study and projects</td>
</tr>
</tbody>
</table>
Table 1.3 shows teaching methods associated with cluster of teaching and learning styles.

**Table 1.3: Teaching methods associated with each cluster of teaching and learning styles**

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>Cluster 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary learning styles</strong>&lt;br&gt;(Dependent/Participant/Competitive)</td>
<td><strong>Primary learning styles</strong>&lt;br&gt;(Participant/Dependent/Competitive)</td>
</tr>
<tr>
<td><strong>Primary teaching styles</strong>&lt;br&gt;Expert/Formal Authority</td>
<td><strong>Primary teaching styles</strong>&lt;br&gt;Personal Model/Expert/Formal Authority</td>
</tr>
<tr>
<td>- Exams/Grades emphasized</td>
<td>- Role modelling by illustration</td>
</tr>
<tr>
<td>- Lectures</td>
<td>- Sharing thought processes</td>
</tr>
<tr>
<td>- Mini Lectures + Triggers</td>
<td>- Sharing personal experiences</td>
</tr>
<tr>
<td>- Teacher-centered questioning</td>
<td>- Role modelling by direct examples</td>
</tr>
<tr>
<td>- Term papers</td>
<td>- Demonstrating ways of doing</td>
</tr>
<tr>
<td>- Technology-based presentation</td>
<td>- Teacher/Coaching/Guiding students</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary learning styles</strong>&lt;br&gt;(Collaborative/Participant/Independent)</td>
<td><strong>Primary learning styles</strong>&lt;br&gt;(Independent/Collaborative/Participant)</td>
</tr>
<tr>
<td><strong>Primary teaching styles</strong>&lt;br&gt;Facilitator/Personal Model/Expert</td>
<td><strong>Primary teaching styles</strong>&lt;br&gt;Delegator/Facilitator/Expert</td>
</tr>
<tr>
<td>- Case studies</td>
<td>- Helping trios</td>
</tr>
<tr>
<td>- Guided readings</td>
<td>- Independent study/Research</td>
</tr>
<tr>
<td>- Key statement discussions</td>
<td>- Jigsaw groups</td>
</tr>
<tr>
<td>- Laboratory projects</td>
<td>- Learning pairs</td>
</tr>
<tr>
<td>- Problem based learning&lt;br&gt;- Group inquiry</td>
<td>- Practical</td>
</tr>
<tr>
<td>- Guided design</td>
<td>- Small group work teams</td>
</tr>
<tr>
<td>- Problem based tutorials</td>
<td>- Student journals</td>
</tr>
<tr>
<td>- Role plays/Simulations</td>
<td></td>
</tr>
</tbody>
</table>
b) **Assessment of learning styles**: Grasha, in 1996 proposed 90 items self report inventory which measures the preferences of both high school and college students. It consists of six categories:

1. **Avoidant**: Takes little responsibility for learning.
2. **Participative**: Accepts responsibility for self learning and relates well to peers.
3. **Competitive**: Compete with peers.
4. **Collaborative**: Enjoys working harmoniously with peers.
5. **Dependent**: Becomes frustrated when facing new challenges not directly addressed in the classrooms.
6. **Independent**: Prefers to work alone and requires little directions.

Studies on this instrument’s validity are limited and lack in strictness and care for detail. Reliability of this scale is generally at medium level and construct validity is good.


a) **Theory**:

The author Dunn believes that if individuals have significantly different learning styles as they appear to have, it is unprofessional, irresponsible, and immoral to teach all students the same lesson in the same way without identifying their unique strengths and then providing responsive instructions. The Dunn’s learning style model is complex and encompasses five strands of 21 elements that affect each individual’s learning. Some of these elements are biological and others are developmental. Style changes over time. A summary of these elements is provided below and represented in the figure 1.2

- The Classroom Environment (sound, light, temperature, design)
- Emotionality (motivation, responsibility, task persistence, structure)
- Sociological Preferences (self, pairs, peers, team, adult, varied)
o Physiological Strengths (perceptual, intake, mobility, time of day)

o Psychological (analytic, global, reflective, impulsive)

![Learning Style Model by Dunn and Dunn](image)

**Figure 1.2: Learning style model by Dunn and Dunn**

**b) Assessment of learning styles:**

This instrument includes two parts: (a) Learning Style Inventory (LSI) designed for children of grades 3-12 containing 104 items and (b) Productivity Environmental Preference Survey (PEPS), an adult version of the LSI containing 100 items. The first part of the instrument is most suitable for the school aged children in the United States, and adult version has applications outside of the school setting. The LSI has established impressive reliability and face construct validity.

**1.5 Hemispheric preference in style of learning**

Styles of learning are influenced by hemispheric functions of the brain and students learning strategies based on the preference of brain area. This is because mind plays a flexible role in accomplishing variety of tasks. Hemisphericity is the cerebral dominance of an individual in retaining and processing modes of information on certain styles of learning and thinking. Table 1.4 highlights common left and right brain attributes.
Table 1.4: Common left and right-brain attributes

<table>
<thead>
<tr>
<th>Left Hemisphere</th>
<th>Right Hemisphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls movements of the right side of the body</td>
<td>Controls movements of the left side of the body</td>
</tr>
<tr>
<td>Receives sensory and tactile input from the right side of the body</td>
<td>Receives sensory and tactile input from the left side of the body</td>
</tr>
<tr>
<td>Process symbolic language: letters, numbers, words, language, ideas, concepts</td>
<td>Process sensory experience that is concrete: sights, sounds, or sensory impressions without words</td>
</tr>
<tr>
<td>Verbal communication</td>
<td>Nonverbal communication</td>
</tr>
<tr>
<td>Step-by step, linear, sequential order</td>
<td>Simultaneous, global, big picture</td>
</tr>
<tr>
<td>Temporal: Perceives time order</td>
<td>Non Temporal: not aware of time order</td>
</tr>
<tr>
<td>Analyzes by breaking down into parts</td>
<td>Synthesize by connecting parts into whole</td>
</tr>
<tr>
<td>Part to whole learning</td>
<td>Whole to part learning</td>
</tr>
<tr>
<td>Poor visual spatial relationships</td>
<td>Good visual spatial relationships</td>
</tr>
<tr>
<td>Listen more to words than emotional overtones</td>
<td>Perceives other’s emotions</td>
</tr>
<tr>
<td>Music: timing, sequential or linear aspects of music production, analyzing music</td>
<td>Music: playing by ear, holistic appreciation of music, synthesizing different sounds in to whole</td>
</tr>
<tr>
<td>Creative with existing material</td>
<td>Creative by thinking of that which does not yet exist, inventive, imaginative</td>
</tr>
</tbody>
</table>

As a whole, the brain consists of two cerebral hemispheres, the left and right, which are connected by a bundle of nerve fibres known as the corpus callosum. The corpus callosum has about 250 million nerve fibres and allows each side of the brain to exchange information more freely. In teaching and learning process, cognitive neuroscientists have noted that right brain dominant people prefer visual, spatial and analogical processing while left brain dominant people prefers verbal, logical, linear and sequential processing. Research endeavours conducted have shown that human
left cerebral hemisphere is to be specialized primarily for verbal, analytical, abstract, temporal and digital operations (Bogen, 1969 and Gazzaniga, 1970). The same investigation revealed that the right cerebral hemisphere is to be specialized primarily for non-verbal, holistic, concrete, creative, analogic and aesthetic functions. The exploration also signifies that differences in brain functions result in an individual difference in learning and thinking styles. Among all the factors that influence individual differences, styles of learning and thinking play a significant and pivotal role. Knowledge of the processing modes of two hemispheres serves as a useful starting point to consider the nature of mental processing in learning and thinking. The left and right hemispheric distinction provides a simple and convenient basis for helping the students in their learning and thinking strategies. Opportunities must be provided to the learners for expressing their learning and thinking approach in a variety of modes.

1.6 Thinking style

Thinking styles are frequently studied in educational concepts since thinking is the core component which shapes the learning environment. The way the individual thinks, leads to thoughts which is one of the main aspects of human being as stated by Cloninger (2008). Thinking style is at forefront of research. Thinking style profile is used in all areas where skill in communication and the need to understand how other people think and learn are critical to success.

1.6.1 Concept of thinking style: varied views

Some of the views about thinking styles are given as:

- Hermann (1996) “Thinking style preferences reflect the ways in which individual approach challenges and problems”.
- Sternberg (1997) “Thinking style is the way people govern their own lives in everyday living, just as the government does for the society”.
- Zhang & Sternberg (2000) “Thinking style refers to the way an individual prefers to process and manage the intellect and knowledge”.
Sofo (2004) “Thinking styles are particular ways of thinking or how we prefer to use our intelligence. While thinking is about ability, thinking style is about how we prefer to use our abilities and not the ability itself”.

Sternberg (2009) “Thinking style is person’s preferred way of thinking and using abilities”.

Zhang (2014) “Thinking style is defined as individual preference for a specific thinking process”.

1.7 Principles of thinking style

Various principles of thinking styles are:

i. **Styles are preferences in the use of abilities, not the abilities themselves:**
   Styles and abilities are different. The way the abilities are preferred forms styles. Thus, styles are preferences in the use of abilities.

ii. **A match between styles and abilities creates synergy that is more than the sum of its parts:** Match between style and abilities create good quality of learning while mismatch between these results in frustration. Thus, a synergy is created when there is match between styles and abilities. Styles should be understood because they are important to the quality of work one do, and to the enjoyment of this work, as are abilities.

iii. **Life choices need to fit styles as well as abilities:** If the kind of occupation one desires matched with the styles and abilities; it creates a good harmony in career satisfaction. When styles don’t match the life choices, it pays. People who enter an occupation not because it is a good match to their abilities and styles but because it is what society or their superego want them to do, often end up unhappy and unfulfilled. In contrast, those who enter an occupation because it is a good match to their abilities and styles can easily end up near or at the top of the scale in terms of career satisfaction.

iv. **People have profile of styles, not just a single style:** People have a profile of styles. A person who likes to be creative may be super organised or totally disorganised, and may be a loner or someone who likes to work with others. Similarly, organised people may or may not prefer to be with others.
v. **Styles are variables across tasks and situations:** Styles vary not only with tasks but situations also. Some styles applied in one task may be different in another task in different situations.

vi. **People differ in strengths of their preferences:** Some people prefer styles very strongly, other people have a slight preference, and they can take it or leave it. People differ not only in absolute strength of preference, but in how pervasive the preference is.

vii. **People differ in their stylistic flexibility:** Style flexibility helps in adjusting with variety of situations. The more flexible people are, better they are likely to adjust. Flexibility is valuable in almost all aspects of life in school, on the job, in intimate relations with other people, and even in dealing with self.

viii. **Styles are socialized:** Children observe role models, and often begin to internalize many of the attributes that they observe in their role models. Thus, children who observe authoritarian role models are particularly susceptible to become authoritarian; those who observe more flexible role models are likely to become flexible.

ix. **Styles can vary across the life span:** Styles do change across the life span, it is important to be cognizant of the fact that the way one think now may not be the way one think after 10 or even 5 years.

x. **Styles are measurable:** Measurement is equally important in education. Styles are measurable by variety of assessments devices.

xi. **Styles are teachable:** Styles can be taught by giving children or students tasks that require them to utilize the style they want to develop. A wide variety of instructional activities such as lectures, class discussions, small group exercises, exams, papers, homework assignments can be given.

xii. **Styles valued at one time may not be valued at another:** Different styles are required for different kinds of responsibility in an organization. Styles of thinking that are desired at the higher levels of management, may be different that are desired at the lower end.
xiii. **Styles valued in one place may not be valued in another:** The person who is valued in one organization is likely to be devalued in the second and vice versa. Person may feel comfortable with someone who is highly organized, whereas another person feels bored and cramped with this same highly organized person.

xiv. **Styles are not, on average, good or bad- it’s a question of fit:** A style that may fit well in one context may fit poorly or not at all in another. One cannot judge stylistic fit simply by generic name of a job. Thus styles are not, on an average, good or bad, it is a question of fit.

1.8 **Theories on thinking style**

i) **Sternberg’s theory of mental self government**

The basic idea of the theory of mental self government (1997) is that the forms of government we have in the world are not coincidental. The theory holds that styles can be understood in terms of constructs from human notions of government. According to this theory, people can be understood in terms of the functions, forms, levels, scopes and leanings of government. The theory of styles applies not only to education, but also to other domains of personal and professional life.

a) **Functions**

Just as there are three functions of government: legislative, executive and judicial, a student in this regard is viewed as:

- **Legislative:** The legislative student has a predilection for tasks, projects and situations that require creation, formulation, planning of ideas, strategies etc. This kind of student likes to decide what to do and how to do it, rather than to be told. Some of the preferred kinds of activities of a legislative style are writing creative papers, designing innovative projects, creating new business or educational system and inventing new things. Some of the kinds of occupations they prefer are creative writer, scientist, artist, sculptor, investment banker, policy maker and architect.

Legislative style is particularly conducive to creativity because creative people need not have the ability to come up with new ideas, but also the desire to.
Legislative people enjoy doing the things the way they desire to do. They prefer problems that are not prestructured, but rather they can structure themselves. These students tend to be critical of the schooling they receive, often justly so. They may not want to do things the way their teacher want them to do. It is important to remind them that no system can function without some rules and set procedures, even if rules and procedures are suboptimal. In a school where teachers give fixed assignments and may have a rigid idea of what constitutes a good performance on those assignments, the legislative student may come out looking either not very bright or possibly disruptive.

- **Executive:** The executive student does tasks, projects and situations that provide structure, procedure, or rules to work with, and can serve as guidelines to measure progress. The executive student often prefers to be told what to do, and will then give it their best shot at doing it well. They like to follow rules and prefer problems that are prestructured or prefabricated. Some of the kinds of activities preferred by executive students are solving given mathematical problems, applying rules to problems, giving talks or lessons based on other people’s ideas and enforcing rules. Some occupations that can be a good fit to executive thinkers are certain types of lawyers, police officer on patrol, builder of other people’s design, soldiers and administrative assistant. Basically people with executive style are implementers. They like to do, and generally prefer to be given guidance as to what to do or how to do. The executive style tends to be valued both in school and in business, because executive stylists do what they are told, and often do it cheerfully. Thus a gifted child with an executive style is likely to do well in school, whereas a gifted child with a legislative style is more likely to be viewed as nonconforming and even rebellious.

- **Judicial:** The judicial student has a predilection for tasks, projects and situations that require evaluation, analysis, comparison-contrast, and judgement of existing ideas, strategies, projects etc. The judicial person tends to be evaluative, commenting on other people’s ideas and assessing other’s strengths and weaknesses. A judicial person likes to judge both structure and content. Judicial stylist like activities such as writing critiques, giving opinions, judging
people, their work and evaluating programs. Some of their preferred kinds of occupations are judge, critic, program evaluator, consultant, admissions officer, grant and contract monitor and systems analyst.

b) Forms

Theory states just as four forms of government, students are characterized as:

- **Monarchic:** A monarchic student is someone who is single minded and driven. The monarchic pupil has a predilection for tasks, projects and situations that allow focusing fully on one thing or aspect at a time, and staying with that thing until it is complete. A monarchic student likes to do things in his own way and does not like to do things according to the other’s ways. Sometimes their interests are best served when a teacher brings whatever they are monarchic about to bear on other things they are doing. Monarchic people often attempts to solve problems with full speed ahead. If a monarchic person cannot see how something relates to a preferred issue, the person may find the thing lacking in interest. This means that their interests can often be grabbed if the problems are related to certain issue.

- **Hierarchic:** The hierarchic pupil has a predilection for tasks, projects and situations that allow creation of hierarchy of goals to fulfil. These students often make lists and sometimes even list of lists. A hierarchic student carefully sets priorities and then sticks to it. This person tends to be more accepting of complexity than is the monarchic person, and recognizes the need to view problems from a number of angles so as to set priorities correctly. Hierarchic individual tends to fit well into organizations because they recognize the need for priorities. Hierarchic people tend to be systematic and organized in their solutions to problems and decision making. Perhaps this organization is part of what puts them at a great advantage in school and in many other institutions. Most institutions place hierarchic people at an advantage, and schools are perhaps the most notable. Students study multiple subjects, so they have to set priorities for their time and their expenditures of effort. They tend to write in the hierarchic style preferred by teachers, and read in a way that distinguishes between more and less important points.
• **Oligarchic:** The oligarchic pupil has a preference for tasks, projects and situations that allow working with competing approaches, with multiple aspects or goals that are equally important. Such student likes to do multiple things within a given time frame, but has trouble setting priorities. The oligarchic person is like hierarchic person in having a desire to do more than one thing within the same time frame. But unlike hierarchic people, oligarchic people tend to be motivated by several, often competing goals of equal perceived importance. They are not always sure what to do first, or how much time to allot to each of the tasks they need to complete. However, given even minimal guidance as to the priorities of the organization in which they are involved, they can become an effective or even more effective than people with other styles.

Oligarchic students sometimes suffer because they have competing demands on their time, and if, for example, they have short term and long term projects, they may find themselves putting their time into one set of projects and neglecting the other. So, students with this kind of style need to be guided in setting of priorities.

• **Anarchic:** The anarchic student has a predilection for tasks, projects and situations that lend themselves to great flexibility of approaches, and to try anything when, where, and how he or she pleases. This style tends to be motivated by a wide assortment of needs and goals that are often difficult for others, as well as for themselves to sort out. They are likely to disdain the system in place, sometimes with good reasons, but other times for less clear reasons. In schools, anarchic students are at risk for antisocial behaviour. They don’t fit in, so they drop out, whether physically or psychologically. Even they are part of school they stick out like sore thumbs. They are the students who challenge teachers, not necessarily on principled grounds, but rather for the sake of challenging the teachers or tend to be unsuccessful, because they are no better at maintaining their own systems than at adhering to anyone else’s. Anarchic people tends to be simplifiers at times, and to have trouble setting priorities because they have no firm set of rules upon which to base these priorities. The anarchic student may have good potential for creativity because the individual
draws ideas from so many places, but the pupil needs to be disciplined and organized. They are wide ranging in scope of things to be considered and see solutions to problems that other overlook. The problem for the teacher, parent, or employer is to help the anarchic person harness this potential for creativity, and achieve the self discipline and organization that are necessary for any kind of a creative contribution.

c) Levels

As there are two levels of government, student’s style can be classified as:

- **Local**: The student with a local style has a preference tasks, projects and situations that require engagement with specific, concrete details. Students with this style tend to enjoy tasks that require them to keep track of details and to focus on concrete specifics of a situation. These individuals like concrete problems require working with details. They tend to be oriented towards the pragmatics of a situation, and are down to earth. They prefer to deal with details, sometimes minute ones and concrete issues.

- **Global**: The global pupil has a preference for tasks, projects and situations that require engagement with large, global, abstract ideas, but sometimes can lose touch with details. Global people prefer to deal with relatively larger and often abstract issues. They ignore or don’t like details, and prefer to see the forest rather than the trees. Extreme localists or globalists can get carried away, and start to lose sight either that the big issue exists, or that there are details that someone needs to attend to.

d) Scope

Just as scope of government, theory highlighted scope in two dimensions as:

- **Internal**: The internal student has a preference for tasks, projects and situations that allow him or her to work independently of others. This individual is typically introverted, task oriented, aloof and sometimes socially less aware and often uncomfortable in groups. Essentially, their preference is to apply their intelligence to things or ideas in isolation from other people.
• **External:** The external student has a preference for tasks, projects and situations that require activities which allow working with others in a group or interacting with others at different stages of progress. These types of students prefer collaborative and team work. They tend to be extrovert, outgoing and people oriented. They like working with people wherever possible.

e) **Leanings**

There are two types of leanings described in the theory of mental self government: liberal and conservative.

- **Liberal:** The student with a liberal style has a preference for tasks, projects and situations that involve unfamiliarity, going beyond existing rules or procedures, and maximization of change. They like new challenges, thrive on ambiguity and new techniques. They tend to go beyond existing rules and procedures, to maximize change and to seek situations that are somewhat ambiguous.

- **Conservative:** The conservative pupil has a predilection for tasks, projects and situations that require adherence to and observance of existing rules and procedures. Such individual likes to minimize change and avoid ambiguity. These people stick with familiar situations in work and professional life. They are happy in a structured and relatively predictable environment. When such structure does not exist, the individual may seek to create it.

Table 1.5 shows thinking style in Sternberg’s mental self government theory. In the theory of mental self government, Sternberg (1988, 1997) attempts to integrate various approaches to styles. According to Sternberg, the thinking style construct is a broad intellectual style construct. As such, this theory of mental self government applies to both academic and non academic settings. Since its publication in 1988, the theory has guided much research in academic settings in several cultures, including Hong Kong, Mainland China, India, Philippines and United States. Much empirical evidence has supported both internal and external validity of the theory when testing among populations in academic settings. However, in non-academic settings, only internal validity of theory has been obtained.
Table 1.5: Thinking styles in the Sternberg’s mental self government theory

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Thinking Style</th>
<th>Key Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions</td>
<td>Legislative</td>
<td>Prefers to work on tasks that require creative strategies; one prefers to choose one’s own activities.</td>
</tr>
<tr>
<td></td>
<td>Executive</td>
<td>Prefers to work on tasks with clear instructions and structures; and implement tasks with established guidelines.</td>
</tr>
<tr>
<td></td>
<td>Judicial</td>
<td>Prefers to work on tasks that allow for one’s evaluation; and to evaluate and judge the performance of other people.</td>
</tr>
<tr>
<td>Forms</td>
<td>Hierarchical</td>
<td>Prefers to distribute attention for several tasks that are prioritized according to one’s valuing of the tasks.</td>
</tr>
<tr>
<td></td>
<td>Monarchic</td>
<td>Prefers to work on tasks that allow complete focus on one thing at a time.</td>
</tr>
<tr>
<td></td>
<td>Oligarchic</td>
<td>Prefers to work on multiple tasks in the service of multiple objectives, without setting priorities.</td>
</tr>
<tr>
<td></td>
<td>Anarchic</td>
<td>Prefers to work on tasks that would allow flexibility as to what, where, when and how one works.</td>
</tr>
<tr>
<td>Levels</td>
<td>Local</td>
<td>Prefers to work on tasks that require working with concrete details.</td>
</tr>
<tr>
<td></td>
<td>Global</td>
<td>Prefers to pay more attention to the overall picture of an issue and to abstract ideas.</td>
</tr>
<tr>
<td>Scope</td>
<td>Internal</td>
<td>Prefers to work on tasks that allow one to work as an independent unit.</td>
</tr>
<tr>
<td></td>
<td>External</td>
<td>Prefers to work on tasks that allow for collaborative ventures with other people.</td>
</tr>
<tr>
<td>Leanings</td>
<td>Liberal</td>
<td>Prefers to work on tasks that involve novelty and ambiguity.</td>
</tr>
<tr>
<td></td>
<td>Conservative</td>
<td>Prefers to work on tasks that allow one to adhere to the existing rules and procedures in performing tasks.</td>
</tr>
</tbody>
</table>

Assessment of measurement: The Thinking style inventory (TSI) developed by Sternberg and Wagner (1992) consisting of 104 items on 13 styles with 8 items under each style, is used to measure thinking styles given by this theory. The internal consistency and reliabilities of the scales are generally satisfactory, ranging from low 0.50 to the high 0.80.
ii) The Herrmann brain dominance instrument tool (HBDI)

Based on the extensive research which spans 20 years, Hermann (1996) developed an assessment tool that quantifies the degree of the person’s preference for a specific thinking style. The Hermann brain dominance instrument (HBDI) in which student’s thinking styles are classified by assigning functions to each of the four brain areas. In each areas of the brain, the learning process occurs through a specific style. Table 1.6 shows the characteristics of each of the four areas and examples of careers suitable for each style.

Four divisions have been identified within the brain, each chamber with a certain learning style as follows:

1. The upper left quarter (QA) represents external learning which is logical, rational, realistic, analytical, critical, deducting, quantitative, and verbal. Learners with in this category learn through traditional methods of lecturing, textbook and the teacher who serves as the person to dispense knowledge and answer questions.

2. The lower left quarter (QB) refers to procedural learning in which learning is characterized as sequential, structured, planned, regulated, individualized and based on verification. The most preferable learning style is the procedural step by step approach in which practice, repetition, hands on activities, abstract cognition and common sense are most emphasized.

3. The lower right quarter (QC) describes the interactive learning in which interrelations and kinesthetic work are emphasized. Learners of this pattern are sensory, cooperative, emotional, intuitive and explorative. The learning context is created by experience, feedback, listening, physical experimentation and shared thinking.

4. The upper right quarter (QD) represents the internal learning which focuses on comprehensive, creative, imaginative, conceptual, and inductive ways of learning. The learning context is characterized by insightfulness, ideas construction, instant, total, comprehensive and intuitive concept apprehension.
Table 1.6: Areas of the brain based on Hermann model

<table>
<thead>
<tr>
<th>Quadrant 1 Processing (QA)</th>
<th>Quadrant 3 Processing (QD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Associated words</strong></td>
<td><strong>Associated words</strong></td>
</tr>
<tr>
<td>Analytical</td>
<td>Artistic</td>
</tr>
<tr>
<td>Mathematical</td>
<td>Conceptual</td>
</tr>
<tr>
<td>Problem solver</td>
<td>Holistic</td>
</tr>
<tr>
<td>Rational</td>
<td>Innovative</td>
</tr>
<tr>
<td>Technical</td>
<td>Intuitive</td>
</tr>
<tr>
<td><strong>Occupational types</strong></td>
<td><strong>Occupational types</strong></td>
</tr>
<tr>
<td>Engineers</td>
<td>Architect</td>
</tr>
<tr>
<td>System analysts</td>
<td>Artists</td>
</tr>
<tr>
<td>Technicians</td>
<td>Salesperson</td>
</tr>
<tr>
<td></td>
<td>Psychiatrists</td>
</tr>
<tr>
<td></td>
<td>Venture capitalists</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quadrant 2 Processing (QB)</th>
<th>Quadrant 4 Processing (QC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Associated words</strong></td>
<td><strong>Associated words</strong></td>
</tr>
<tr>
<td>Administration</td>
<td>Interpersonal</td>
</tr>
<tr>
<td>Conservative</td>
<td>Emotional</td>
</tr>
<tr>
<td>Organization</td>
<td>Musical</td>
</tr>
<tr>
<td>Planner</td>
<td>Spiritual</td>
</tr>
<tr>
<td>Structure</td>
<td>Talker</td>
</tr>
<tr>
<td><strong>Occupational types</strong></td>
<td><strong>Occupational types</strong></td>
</tr>
<tr>
<td>Accountant</td>
<td>Caregivers</td>
</tr>
<tr>
<td>Bureaucrat</td>
<td>Musicians</td>
</tr>
<tr>
<td>CEO</td>
<td>Nurses</td>
</tr>
<tr>
<td>Librarian</td>
<td>Politicians</td>
</tr>
<tr>
<td></td>
<td>Teachers</td>
</tr>
</tbody>
</table>
Assessment of measurement: Based on the model, Hermann developed a questionnaire with 120 items to measure the predominant learning and thinking styles of learners. Teachers who can assess the thinking styles of their students are better able to understand how the students learn, make decisions and solve problems. This model helps to understand mental diversity in students and serves as a tool for effective teaching learning activities in all four brain quadrants. Thus, the Hermann brain instrument is an assessment tool that quantifies the degree of a person’s preference for specific thinking based on the task-specialized functioning of the physical brain.

1.9 Factors affecting development of thinking styles

Some of the variables that are likely to affect the development of thinking styles are:

1. **Culture:** Some cultures are likely to be more rewarding of certain styles than of others. In some cultures, children are taught from an early age not to question certain religious tenets. In other societies, children are encouraged to question much of what they are taught. Some groups encourage the kind of legislative, liberal thinking styles that is likely to produce creative work and to eventuate in prizes for creative achievements. Although internals and externals styles are found in both kinds of cultures, the respective natures of the cultures suggest that internalism is highly valued by the individualistic culture, externalism by the collectivistic culture. Thus, culture affects the development of thinking styles.

2. **Gender:** Males are more typically described as adventurous, enterprising, individualistic, inventive, and progressive. Females are more often described as cautious, dependent, fault finding, shy and submissive. Style differences between men and women affect development of thinking styles. Traditionally, a legislative, liberal pattern of styles has been more acceptable in males than in females. Men are supposed to set the rules, and a woman has to follow them. But this tradition is already changing in many cultures.

3. **Age:** Legislative is generally found in primary stage, where child is encouraged to develop their creative powers in the relatively unstructured and open
environment of the preschool. For example, high school physics or history is usually largely executive, with students answering questions or solving problems that the teacher asks. But the physicist and historian are expected to be more of legislative.

4. **Parenting styles:** What the parent encourages with reward is likely to be reflected in the style of child. For example, children are more likely to develop legislative styles if their parents encourage the children to ask questions and where possible, to seek answers for themselves. Children are more likely to develop a judicial style if their parents tends to evaluate, compare and contrast, to analyze, to judge things, both with respect to the questions the children ask and with respect to the answers that are given.

5. **Schooling and occupation:** Different schools and occupations reward different styles. As individuals responds to reward system of their chosen life pursuit, various aspects of styles are more likely to be encouraged (Sternberg, 1997).

1.10 **Application of learning and thinking styles to classroom teaching**

The knowledge about learning and thinking styles suggests that it is important to regard all the students as individuals with unique traits and cater their needs to promote learning and thinking. The harmonious relationship between learning, thinking styles and teaching promotes class efficiency. Zou (2006) has given following steps which must be kept in mind before teaching.

**Step I:** **Learning and thinking styles diagnosis among students:** Classification of styles in terms of perceptual preference is very important and discussion of the style assessment results can be carried out in the class. During the discussions, students will be made more aware of their own preference. Diaries can be used as supplementary tool to diagnose student’s preferences and provide more potential chances to identify student’s styles. So, diagnosis is the prerequisite for the teacher to take further steps to promote efficiency in learning. Rao (2002) comments that bridging the gap between teaching and learning can only be achieved when teachers are aware of learner’s needs, capacities, potentials, learning and thinking styles preferences.
Step II: **Curriculum design:** Learners should be invited to direct inputs in the curriculum that teachers design for them. Their suggestions about curriculum design will be contributive if they speak out in their preferred thinking and learning styles and teacher take their expectation into account while designing curriculum. Ramburuth (1997) recommends that student’s contribution to curriculum design follow intensive class discussions and self evaluation of language levels, learning and thinking styles, needs and background.

Step III: **Classroom activities expansion:** Various classroom activities facilitate flexible learning and thinking context where students can maximize their learning achievement with preferred learning and thinking styles. Alternative instructions are provided to accommodate different needs and preferences of students for success of learning in the class. McLoughlin (1999) reported that instructional techniques should be more effective in accommodating a wider range of individual differences and in reaching all types of learners, thus improving an overall achievement.

Some specific activities are:

a) Discussions groups can be formed where students have access to different or same learning styles of others.

b) Another activity of role play for students to enjoy learning language can be done. Engagement in acting roles promotes student’s bodily or kinesthetic intelligence. Moreover, role plays enable students to learn and cooperate with partners and willing to communicate with others.

c) Activity of audiotapes played in the class can also be encouraged. It can be followed by various listening, speaking or even writing tasks. Students can be provided with tasks such as multiple choices, summary writing, note taking etc.

d) Writing tasks can be carried out in various forms. Writing the traditionally independent student work, can sometimes be done within cooperative groups. Writing can be a wonderful task if it involves group brainstorming, negotiating with group members and solving of disagreements.
The student centred classes created by such activities enable students to enjoy their own learning and thinking styles in the class. These classroom activities promote a harmony between teaching, learning and thinking styles.

1.11 Academic achievement

Academic achievement has always been a crucial area and the main hub of educational research, as it plays an important and most significant role in shaping the career and planning for the future education of an individual. Academic achievement is a very broad term which generally indicates the learning outcomes of pupil. Setting the stage for the achievement of the youth is thus a fundamental obligation of the educational system. The term ‘Academic’ has been derived from the word ‘academy’. The achievement means knowledge attained or skill developed by pupils usually in the school subjects measured by test scores or by marks assigned by teacher or both. Achievement signifies accomplishment or performance carried out successfully by an individual or a group on the completion of task whether it is academic, manual, personal or social. It generally refers to the degree or level of success or proficiency attained in some academic work. It is not a one-dimensional activity. It helps both students and teachers to know their stands. It also encourages the students to work hard and learn more. It also enables the teachers to know whether their teaching is effective or not and thus to bring about improvement accordingly.

Concept of academic achievement:


2. Merrian Webster’s Dictionary (2001) “Achievement is an important aspect of behaviour of students who are engaged in the process of education and depends on degree of effectiveness for maximum performance”.

3. Dictionary of Education (2002) “Academic achievement is a measure of knowledge gained through informal education, usually indicated by test scores, grade point average and degree”.
Academic achievement plays an important role in life of an individual, shaping the vocation, career, profession and planning for further education. In educational context, academic achievement is highly valued. The scientific advancement has also raised the question of better achievement for all in the highly competitive society of today. A good academic record of students is an index of an effective educational system. Student’s developmental process is a product of the interaction between choices and socialization experiences in academic disciplines. Therefore, researchers have been attempting long to investigate various factors determining academic achievement. It is of great importance to know if the styles influence pupil’s academic achievement or not, and from there to design possible means of intervention for promoting effective learning and achievement. In recent years, value of understanding student’s learning style for improving learning as well as academic achievement has been paid much attention by the educators, psychologists and researchers. The relationship between learning styles and academic achievement has received a great attention over the last two decades. Research endeavours have shown that certain learning styles could be used as notable predictors of student’s academic achievement and performance. Kinsley (2002) stated that teachers and educators should consider student’s learning style in their teaching, as it is an important area of personal academic competence. If teachers can responds to individuals learning style preferences, then the achievement rate is likely to rise and ‘learning to learn’ skills of students may provide the foundation for the lifelong learning concepts. Student’s learning style can influence the process of peer assessments and final scores are more consistent with the instructor’s assessments.

1.12 Justification of the study

The over broadening spectrum of education and scientific development has raised the need of better learning and achievement for learners. Each classroom consists of students having differences with regard to various abilities background characteristics, personality, traits etc. Researchers and educationists are now attempting a through work in the area of learning styles influencing the student’s learning. Research has shown that quality of learning material is enhanced if the material is designed by taking into account the individual learning style
The common practice of ranking or grouping children according to their scores on intelligence and achievement test provides only a partial picture but children vary qualitatively in the way they approach in learning i.e. their learning styles. Teachers, by being aware of such detailed patterns of individual learners can best build on individual differences. When an individual learning style is known, it increases effectiveness and offers an opportunity to teach by using a wide range of methods in effective ways. Learning style has an important place in lives of individuals. Knowing one’s learning style; an individual will integrate it in the process of learning and become effective problem solver. The goal is to realize learning and to encourage the students to acquire knowledge after eliminating any negative situations. Identifying individual student’s learning characteristics may help the educator to improve the course design and choose helpful and appropriate learning materials, modes of delivery and assessment (Butler 1988, Sangster, 1996). Knowledge of student’s learning preferences can guide faculty to alter their preparation and instruction methods accordingly. Several studies have emphasized the importance of learning style in teaching learning process. Rollins (1990) analyzed the theoretical relationship between learning style of students and their preferences for learning activities. Riding and Rayner (1998) conducted study on linking learning style to academic achievement. Seng and Yeo (2000) linked learning styles with hemispheric preference. Ford and Chen (2001) noted that learning in matched conditions is significantly more effective than learning in mismatched conditions. Werner (2003) studied the effect of self awareness about learning styles on the selection of learning strategies and the development of comprehension process. Rayneri and Gerber (2004) studied on classroom performance of gifted middle school students and preference for learning. Graf et al (2008) analyzed the interaction between student’s learning styles, achievement and behaviour in mismatched courses. Khan (2009) conducted a study on differences between learning style in professional courses at University level. Haider et al (2010) conducted an investigation on relationship between learning styles and performance of learners. Halstead et al (2010) conducted a study on learning styles as a tool for selecting students for group work.
Studies are available on relationship of learning styles and academic achievement. Matthews (1996) in a study on investigation of learning styles and perceived academic achievement for students showed that both are positively correlated. Burns et al (1998) conducted study on the differences between the learning style preferences of high academic achieving students. Geiser et al (2000) examined the effects of learning style awareness and responsive study strategies on achievement, incidence of study, and attitudes of suburban eighth-grade students. Moss et al (2007) studied effects of instructional strategies, in concern with learning styles on student’s achievement. Malathi et al (2006) studied learning style of higher secondary students of Tamilnadu. Aripin et al (2008) conducted study on student’s learning styles and academic performance. Elizabeth et al (2009) studied learning styles of high and low academic achieving teacher education students. A perusal of studies on styles of learning and academic achievement shows that although there has been a proliferation of research on achievement, yet there is growing need for further investigations as majority of research are conducted in foreign countries.

Studies on importance of thinking styles are well documented in literature. Many research findings by Sternberg and Zhang have focussed on the academic and educational applications of thinking styles to explore their benefits in the field of education. Zhang (2000) investigated the relationship between thinking styles and personality types with Sternberg’s inventory of thinking styles. Zhang (2001) examined the relationship between teaching approaches and thinking styles in teaching. Kaufman (2001) studied relationship between thinking style and vocational subjects. Abdullah et al (2002) conducted a study to determine which thinking modes were the most or least preferable among groups of students. Balkis and Isiker (2005) conducted a study on a sample of undergraduate students to investigate the relation between thinking styles and personality types. Zhang (2008) examined the teacher’s thinking style and the consistency between thinking styles and teaching styles and concluded that the teaching styles can be predicted due to the thinking styles of the teachers. Another study by Zhang (2008) investigated relationship between emotions and thinking styles of students.

Studies are also available on relationship between thinking styles and academic achievement. Sternberg and Grigorenko (1993) examined the relationship between

Increasingly, research in the area of learning and thinking styles is being conducted in domains of medical and health care training, management, individual vocational training and a vast range of settings in different fields of education. It is of little wonder that applications of these concepts are so wide ranging given the centrality of learning and how best to do it to almost every aspect of life.

There are many studies that correlate intelligence with learning in a general way, but there is little research on the interrelationship of thinking and learning styles. Most of the researches have been conducted in foreign countries, hence empirical work and more evidences are still required in India. In Indian context, very little research has been conducted in the area of learning and thinking styles. It would be expedient attempt to study learning and thinking styles as correlate of academic achievement. Without doubt, this void deserves the necessary attentions of researchers.

This scarcity of studies also manifests itself in the area of relationships between learning and thinking styles. In the light of above mentioned facts, it would be worthwhile to undertake integration of studies on learning and thinking styles and their influence on academic achievement. Hence, present venture is an attempt by investigator to study “Interrelationship and Influence of Learning and Thinking Styles on the Academic Achievement of High School Students”.

1.13 Statement of the problem

“Interrelationship and Influence of Learning and Thinking Styles on the Academic Achievement of High School Students”
1.14 Operational definitions of the key words

Learning style

Learning style is a relatively stable and consistent set of strategies that an individual prefers to use when engaged in learning. These strategies include taking information through sensory organs, selecting as well as retrieving information for further processing and making sense of information to create new meanings, ideas, values, skills, strategies to solve problems and make decisions. Furthermore, learning style refers to how someone likes to do something.

Kolb defined four learning styles as convergers, assimilator, divergers and accommodators. Honey and Mumford (1992) classified learning styles as activists, reflectors, theorists and pragmatists which correspond to Kolb’s active experimentation, reflective observation, abstract conceptualization and concrete experience. Grasha (1996) categorized different learners based on various classroom activities as independent, dependent, collaborative, avoidant, participant, competitive. Neil Fleming (1999) classified learners into three broad categories as visual, auditory and kinesthetic learners.

In the present context, learning style in different preferences such as visual, auditory, kinesthetic, independent, dependent, competitive, collaborative, avoidant, participant are taken.

- **Visual Learners** learn effectively through activity or tasks that involve visual approach such as reading notes, books, looking at wall displays, reading lists to organize thoughts etc.

- **Auditory Learners** prefer teacher to provide verbal instructions in order to gain information in the classrooms during the teaching and learning process.

- **Kinesthetic Learners** learn best by doing or when learning involves their hands or other parts of body.

- **Independent Learners** prefers independent study; self paced instruction and would prefer to work alone on course projects than with other students.
• **Dependent Learners** look to the teacher, peers as a source of guidance and prefer authority figure to tell them what to do.

• **Competitive Learners** learn in order to perform better than their peers do and receive recognition for their academic accomplishment.

• **Collaborative Learners** acquire information by sharing, cooperating with teachers and peers.

• **Avoidant Learners** are not enthused about attending class or acquiring class content. They are typically uninterested and are sometimes overwhelmed by class activities.

• **Participant Learners** are interested in class activities, discussions and are eager to do as much class work as possible. They are eager to participate and can relate well to peers.

**Thinking style**

Thinking style refers to the way people processes information and use strategies to respond to different tasks. Sternberg (1997, 1999) described thinking styles as preferred ways of processing information; they are not fixed but rather modes of thinking that an individual is characteristically tend to use.

Sternberg (1988, 1997, 1999) also proposed the theory of mental self government representing the stylistic aspects of intellectual functioning. According to Sternberg’s mental self government, thinking style is the way people govern their own lives in their everyday living just as a government does for the society.

In the present study, thinking style is assessed on the basis of dimensions given by Sternberg who suggested 13 kinds under five types, namely function, form, level, scope and leaning.

• **Legislative** prefers to work on tasks that require creative strategies; one prefers to choose one’s own activities.

• **Executive** prefers to work on tasks with clear instructions and structures.

• **Judicial** prefers to work on tasks that allow for one’s evaluation.
• *Hierarchical* prefers to distribute attention to several tasks that are prioritized according to one’s valuing of the tasks.

• *Monarchic* prefers to work on tasks that allow complete focus on one thing at a time.

• *Oligarchic* prefers to work on multiple tasks in the service of multiple objectives, without setting priorities.

• *Anarchic* prefers to work on tasks that would allow flexibility as to what, where, when and how one works.

• *Global* prefers to pay more attention to the overall picture of an issue and to abstract ideas.

• *Local* prefers to work on tasks that require working with concrete details.

• *Internal* prefers to work on tasks that allow one to work as an independent unit.

• *External* prefers to work on tasks that allow for collaborative ventures with other people.

• *Liberal* prefers to work on tasks that involve novelty and ambiguity.

• *Conservative* prefers to work on tasks that allow one to adhere to the existing rules and procedures in performing tasks.

**Academic achievement**

In the present venture, academic achievement has been assessed on the basis of student’s previous year’s average scores of two classes.

**High school students**

In the present study, students of class IX of high school represent high school students.

**1.15 Objectives of the study**

1. To construct and standardize learning styles inventory.

2. To identify the learning styles (Visual, Auditory, Kinesthetic, Independent, Dependent, Competitive, Collaborative, Avoidant and Participant) of students.
3. To assess the thinking styles (Legislative, Executive, Judicial, Hierarchical, Monarchic, Oligarchic, Anarchic, Global, Local, Internal, External, Liberal and Conservative) of students.

4. To analyze the interrelationship of learning and thinking styles of students.

5. To study the interrelationship of learning and thinking styles of low, average and high achieving students.

6. To assess the difference in learning styles of male and female students.

7. To examine the difference in learning styles of low, average and high achiever male and female students.

8. To analyze the difference in learning styles of first born (oldest one) and later born (youngest one) students.

9. To analyze the difference in thinking styles of male and female students.

10. To study the difference in thinking styles of low, average, high achiever male and female students.

11. To study the difference in thinking styles of first born and later born students.

12. To assess the difference in learning styles of low, average and high achieving students.

13. To examine the difference in thinking styles of low, average and high achieving students.

1.16 Delimitations of the study

The present study was delimited to:

- The state of Haryana.
- Panchkula, Rohtak, Ambala and Kurukshetra districts.
- Public schools.
- High school students.
- First and later born students.